

# KIC 005370431

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
005370431-01	OBS	No	0.781860	131.783803	10.8	5.471	8.4	1.8	1.45	7051	0.51	13492.79
005370431-02	OBS	No	96.227075	222.050583	2395.4	3.148	18.8	12.0	1.45	7051	8.36	22.04
005370431-03	OBS	No	32.784515	133.747890	1183.7	1.555	17.4	7.2	1.45	7051	5.46	92.62
005370431-04	OBS	No	19.539904	136.581723	146.8	0.581	15.7	0.4	1.45	7051	1.84	184.66
005370431-05	OBS	No	19.533730	136.876849	1023.5	2.075	18.2	9.7	1.45	7051	5.07	184.74
005370431-08	OBS	No	19.553301	143.887382	967.7	5.353	12.9	8.7	1.45	7051	8.41	184.49

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
005370431-01	OBS	FP	0.00	1	0	0	0	LPP_DV
005370431-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS
005370431-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_POS_ALT
005370431-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
005370431-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—HALO_GHOST
005370431-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

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

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

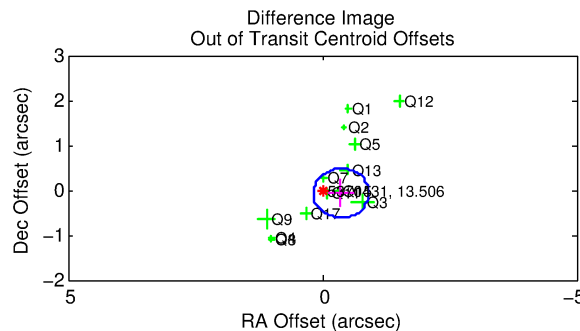
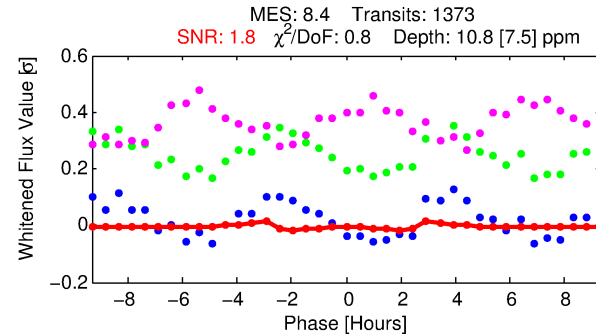
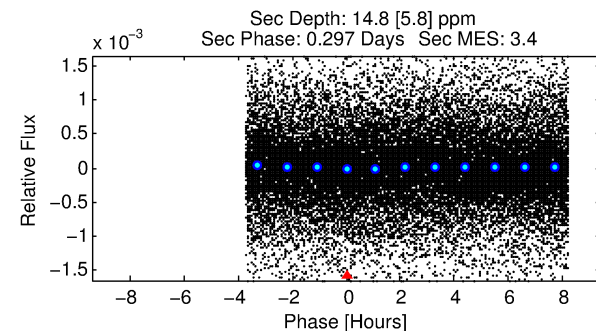
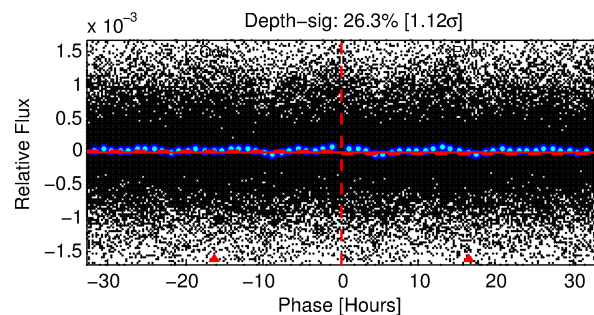
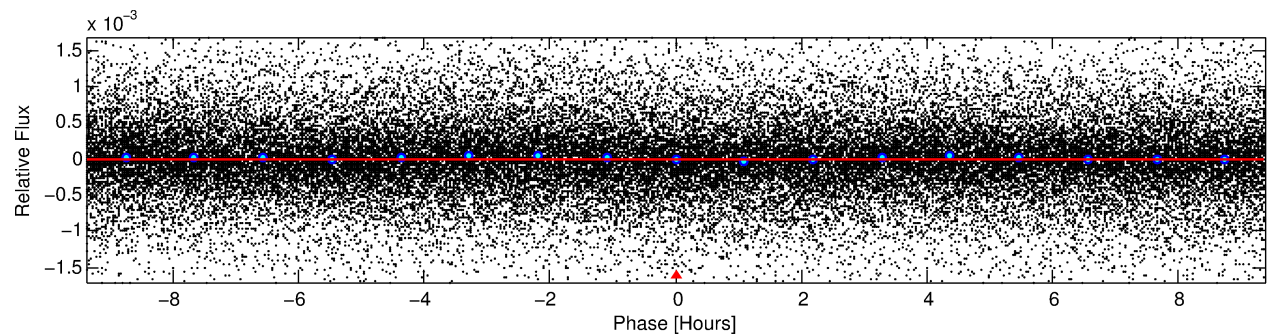
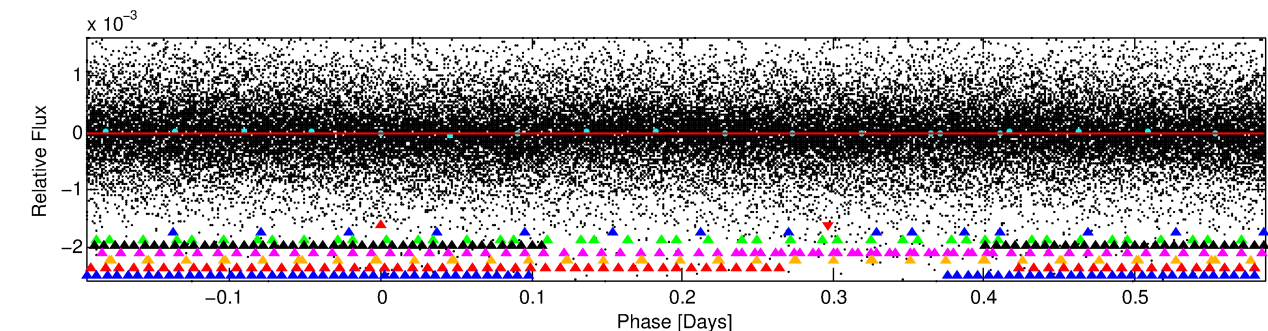
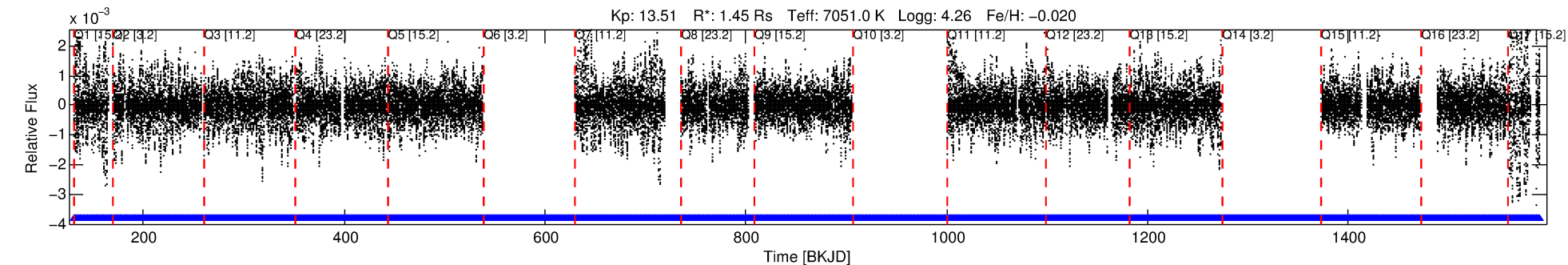
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 005370431-01

No Significant Match Found

# DV One-Page Summary

KIC: 5370431 Candidate: 1 of 8 Period: 0.782 d



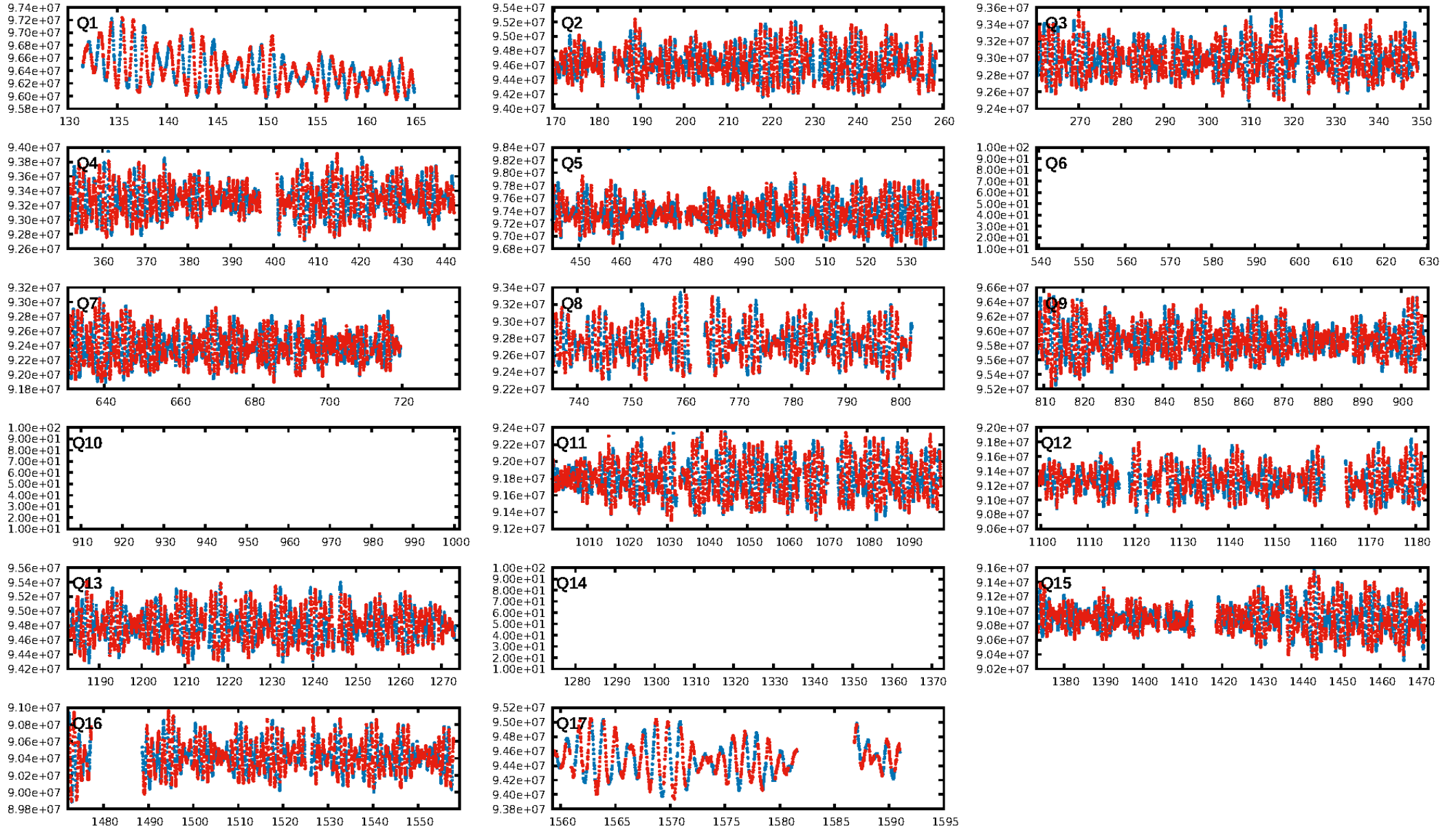
## DV Fit Results:

Period = 0.78186 [0.00006] d  
Epoch = 131.7838 [0.0095] BKJD  
Rp/R\* = 0.0032 [0.0032]  
a/R\* = 1.14 [1.56]  
b = 0.70 [4.22]  
Seff = 13492.79 [6058.88]  
Teq = 2748 [309] K  
Rp = 0.51 [0.54] Re  
a = 0.0186 [0.0055] AU  
Ag = 10.78 [22.21] [0.44 $\sigma$ ]  
Teffp = 7699 [3901] K [1.27 $\sigma$ ]

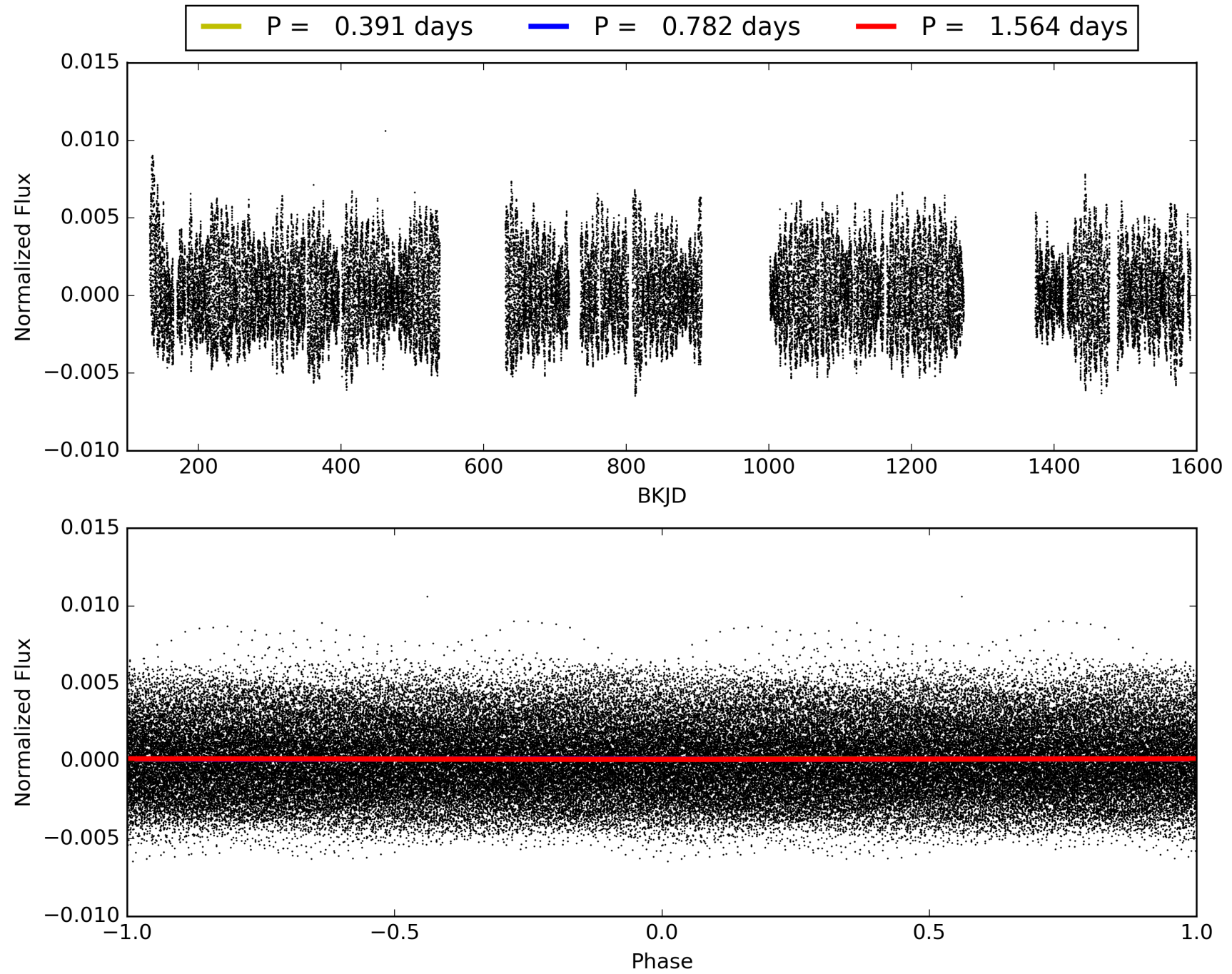
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [76.91 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
**Bootstrap-pfa: 9.24e-12**  
RollingBand-fgt: 1.00 [1295/1295]  
GhostDiagnostic-chr: -0.7068  
Centroid-sig: N/A  
Centroid-so: 2.770 arcsec [1.60 $\sigma$ ]  
OotOffset-rm: 0.372 arcsec [2.04 $\sigma$ ]  
KicOffset-rm: 0.424 arcsec [2.52 $\sigma$ ]  
OotOffset-st: 1/4/3/5 [13]  
KicOffset-st: 1/4/3/5 [13]  
DiffImageQuality-fgm: 0.69 [9/13]  
DiffImageOverlap-fno: 1.00 [14/14]

# TCE 005370431-01, PDC Light Curves



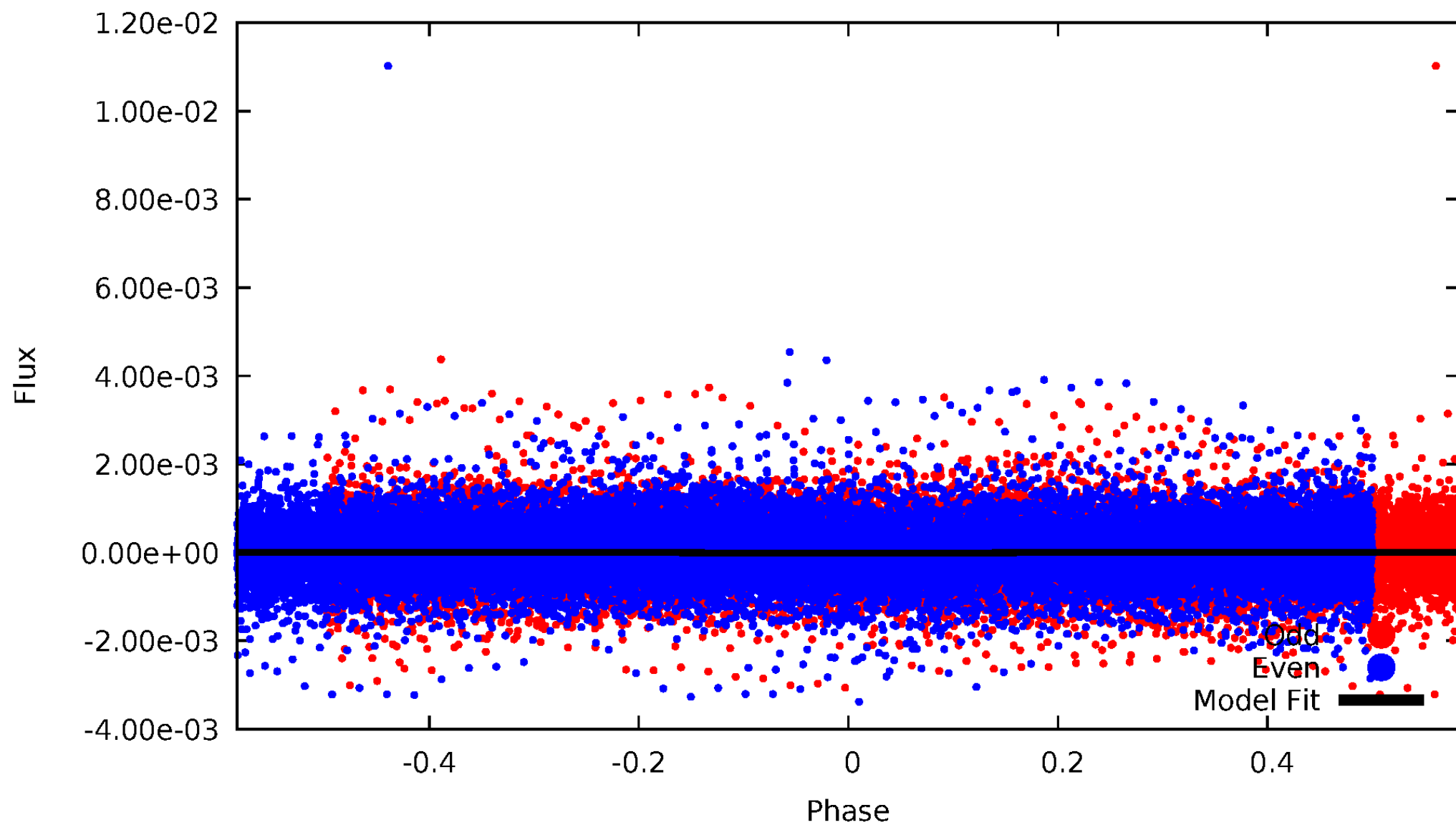
TCE 005370431-01





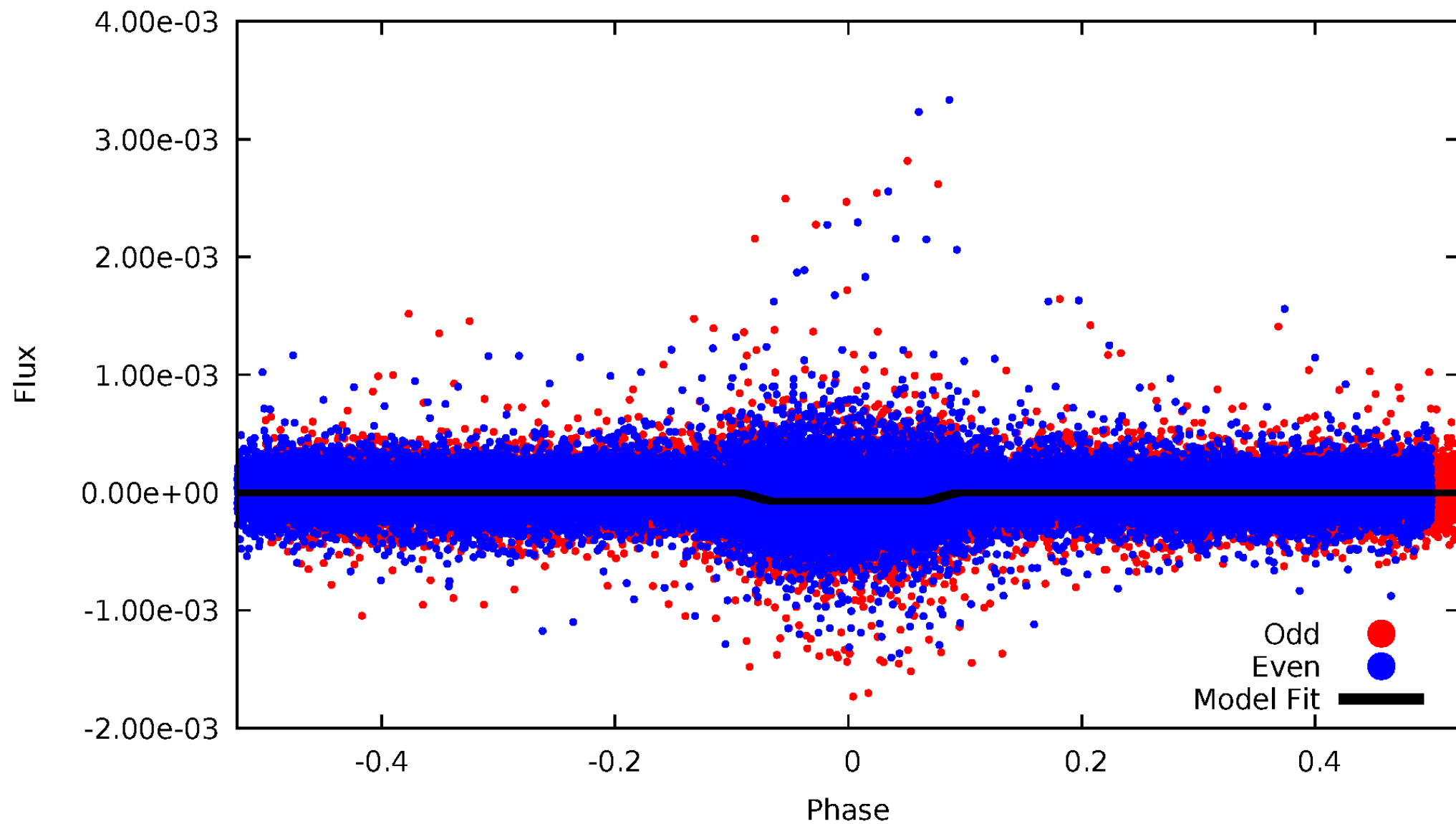
# DV Odd/Even

TCE 005370431-01



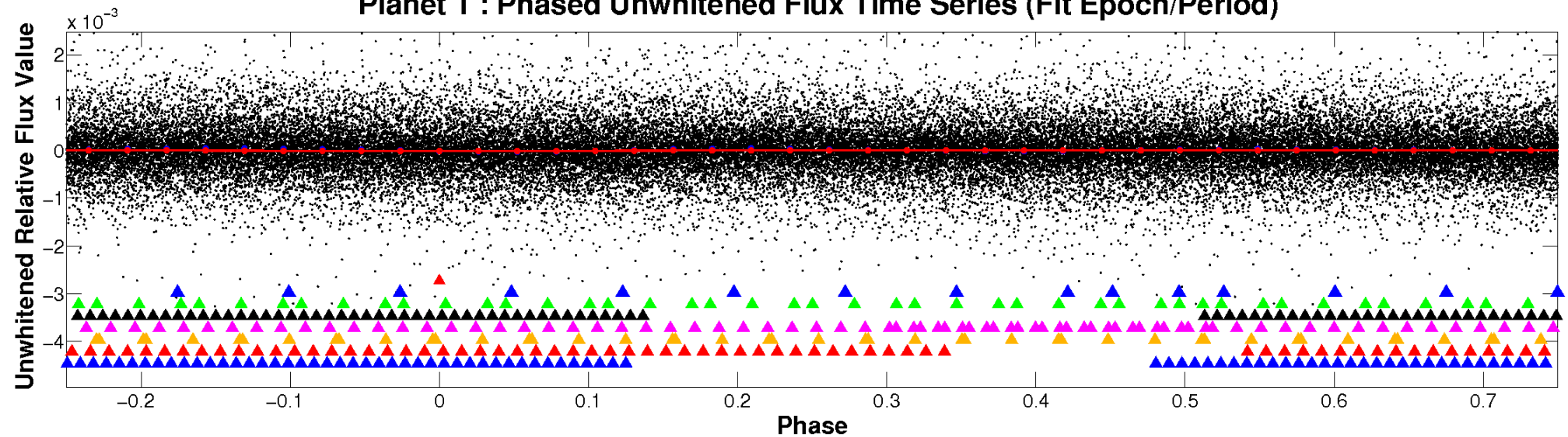
# ALT Odd/Even

TCE 005370431-01

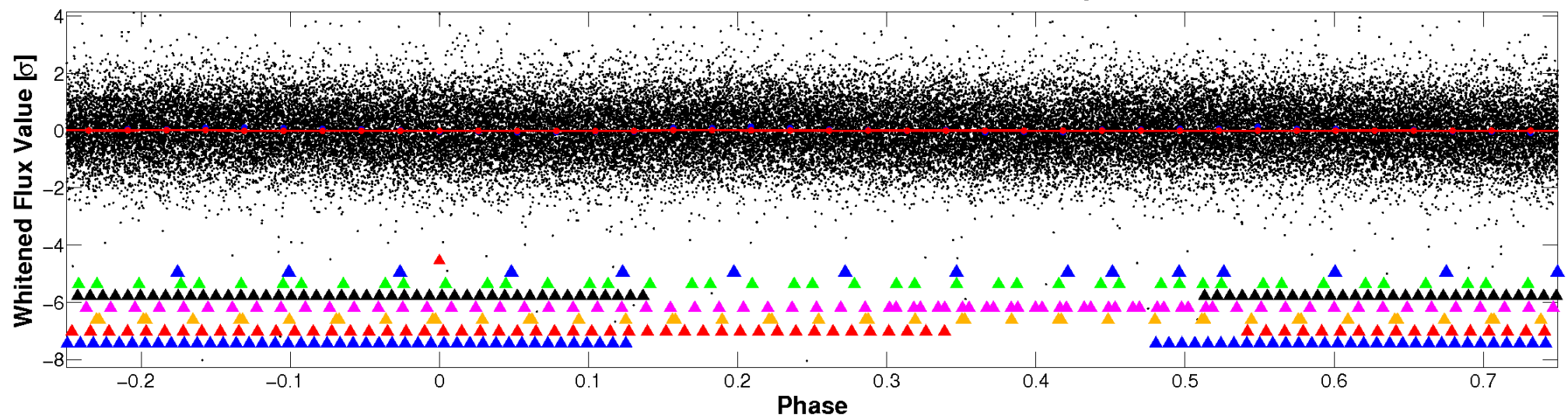


# Non-Whitened Vs. Whitened Light Curve

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

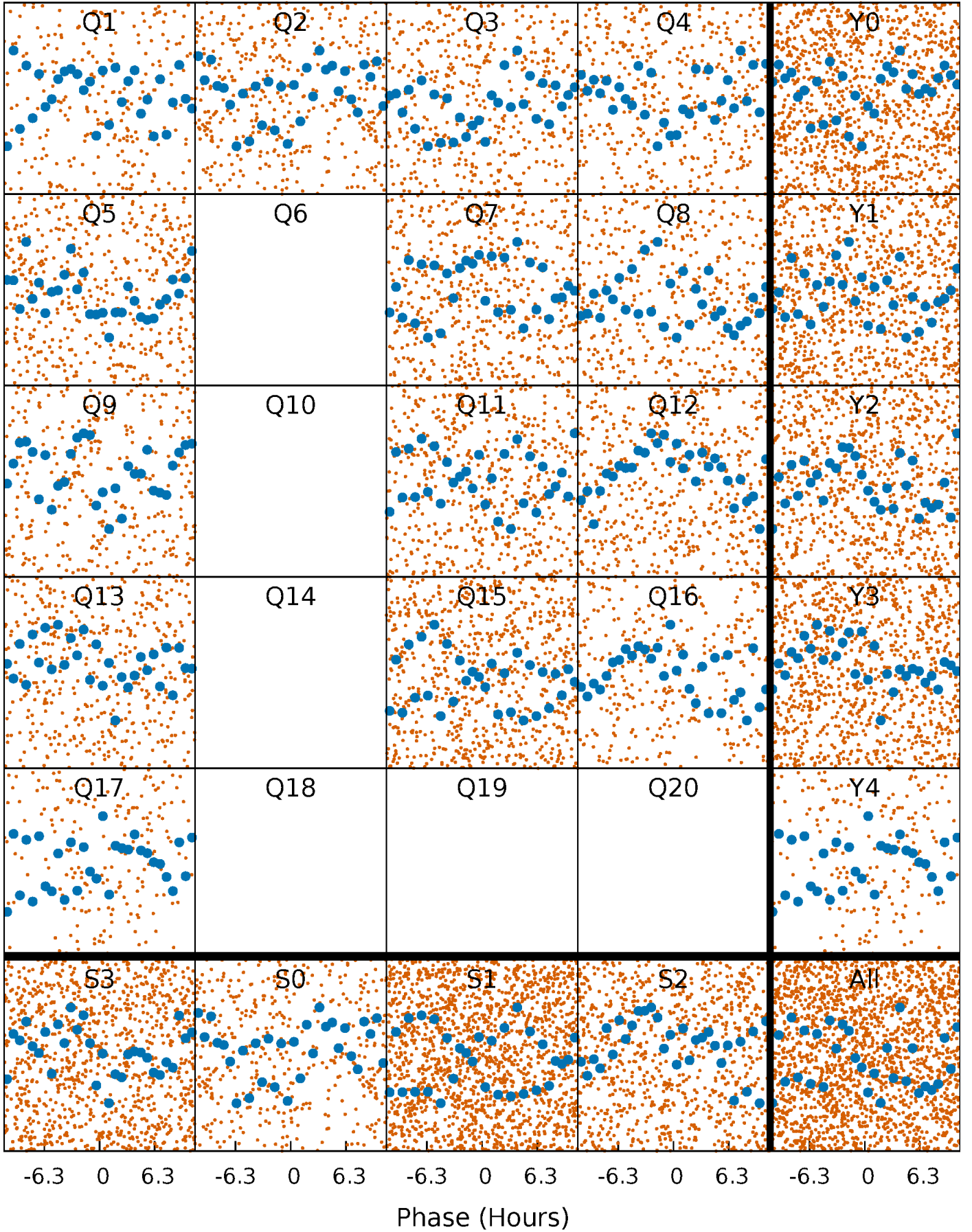


## Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

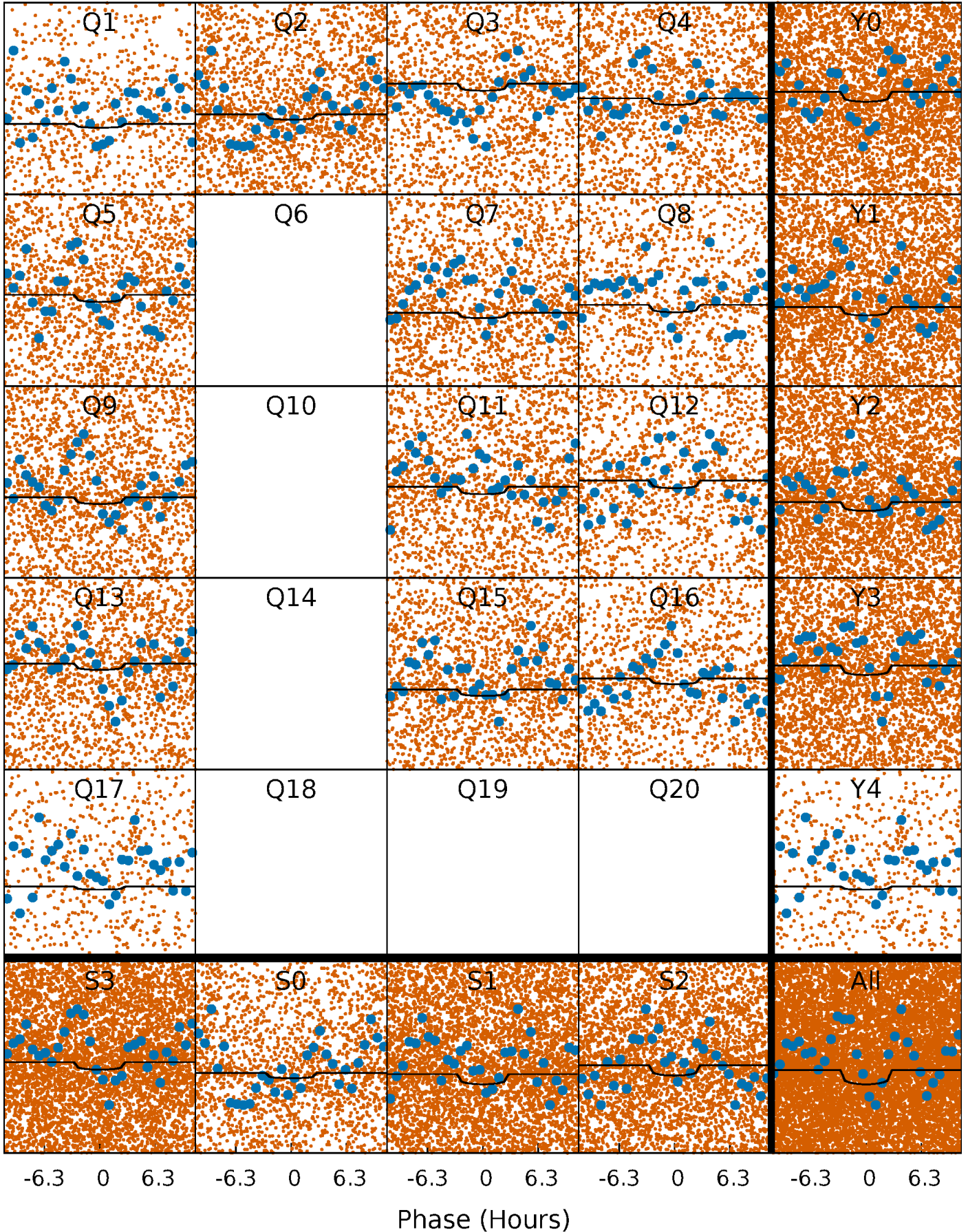
TCE 005370431-01   P= 0.781860 Days    $T_0=131.783803$  (BKJD)





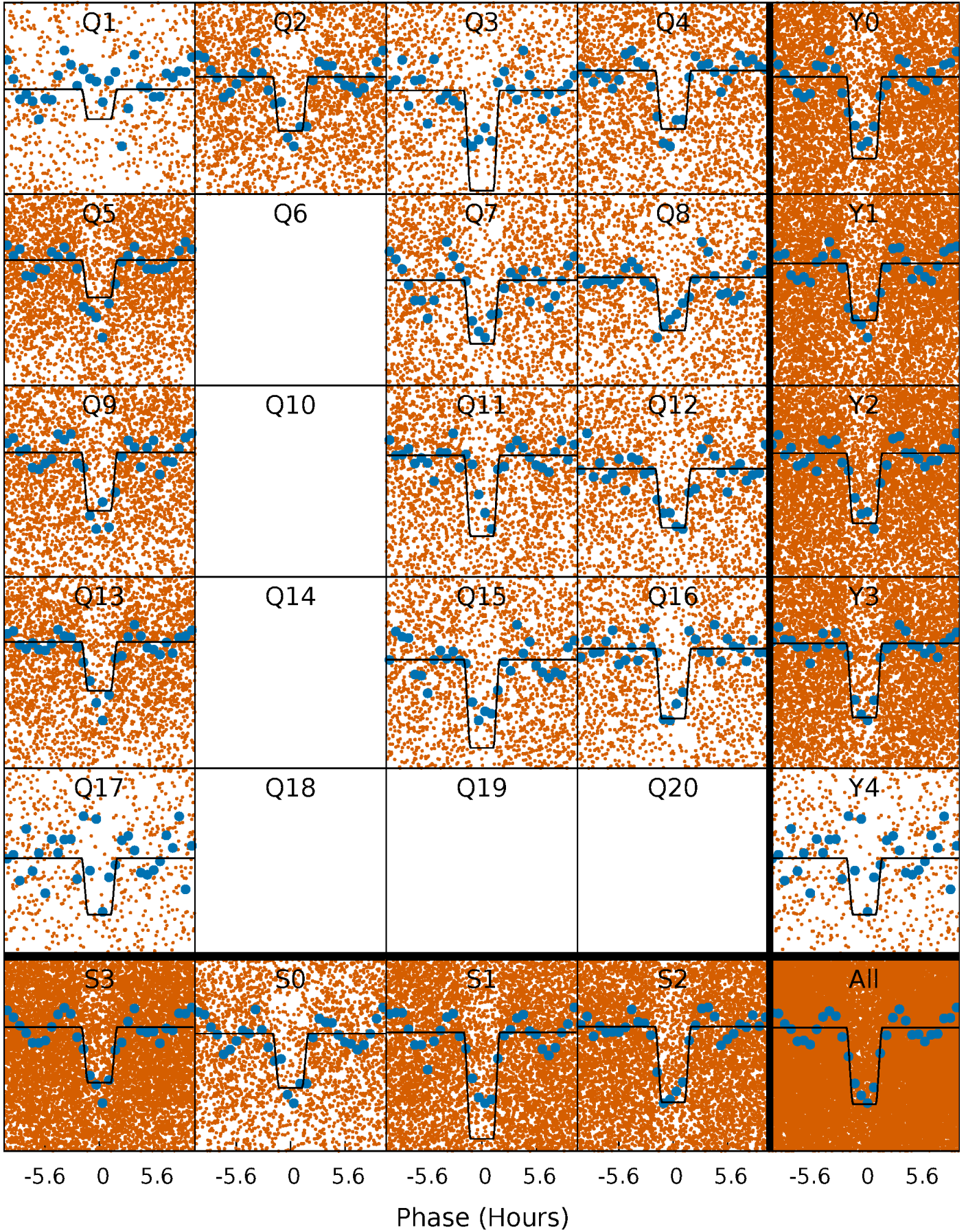
# DV Quarter-Phased Transit Curves

TCE 005370431-01 P= 0.781860 Days  $T_0=131.783803$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 005370431-01 P= 0.781908 Days  $T_0=131.780046$  (BKJD)

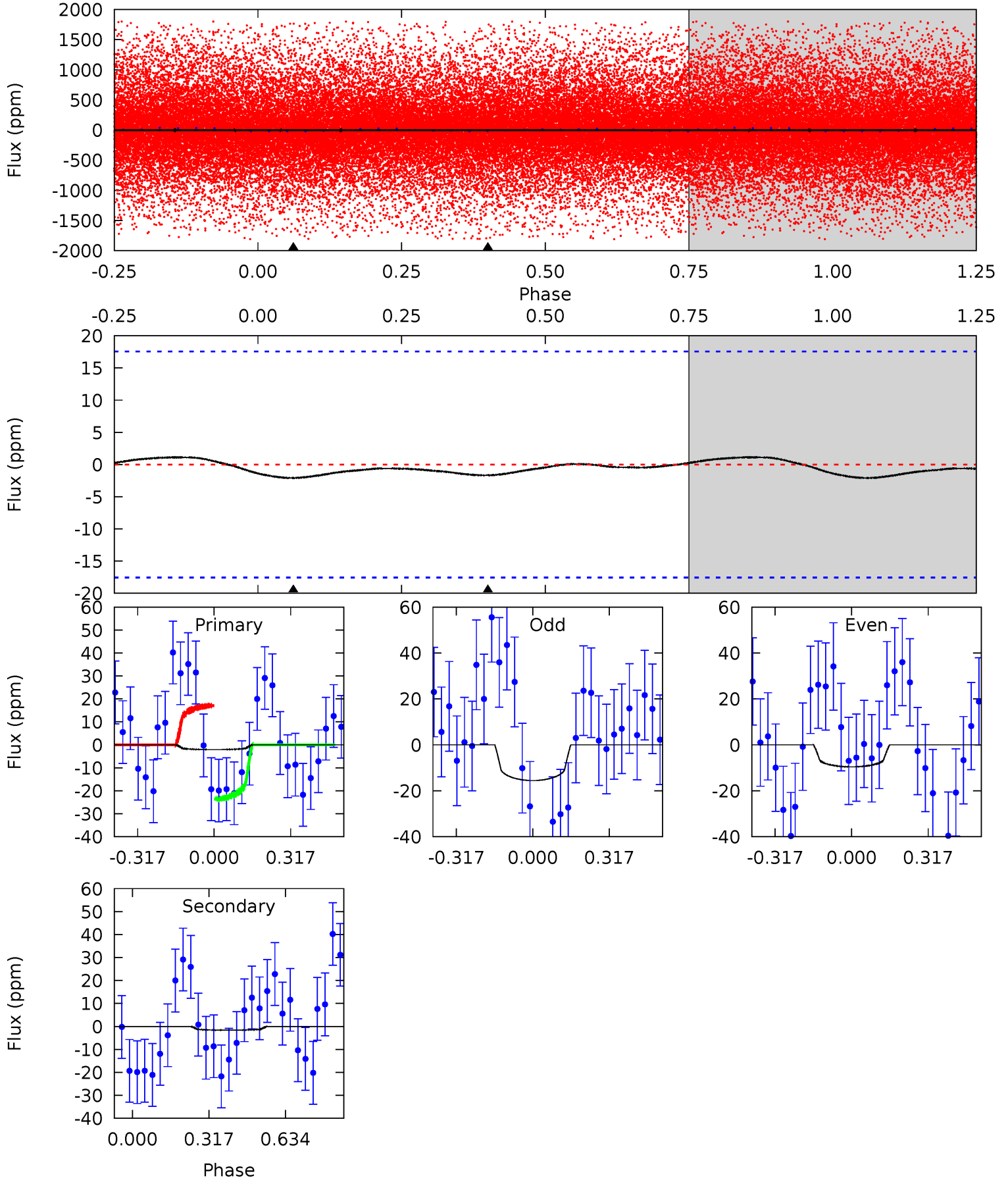




# DV Model-Shift Uniqueness Test

005370431-01, P = 0.781860 Days, E = 131.001943 Days

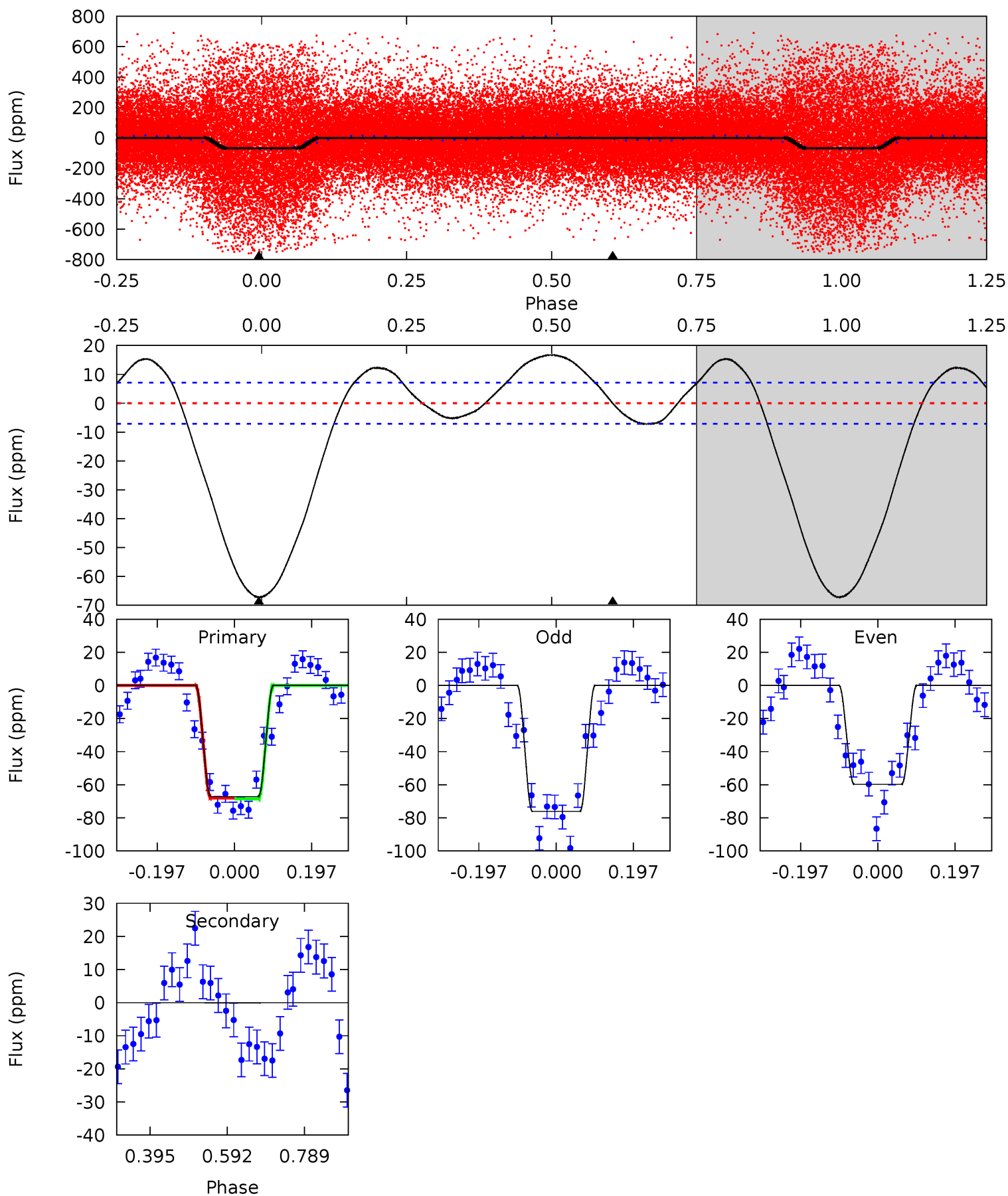
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
0.51	0.41	0	0	4.32	1.00	0.08	0.51	0.51	0.41	0.41	0.72	-0.21	0.35	0.80



# Alt Model-Shift Uniqueness Test

005370431-01, P = 0.781908 Days, E = 130.998138 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
41.8	0.02	0	0	4.42	1.29	3.69	41.8	41.8	0.02	0.02	5.08	0.96	0.20	0.16





### Stellar Parameters For KIC 005370431

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7051^{+194}_{-315}$	$4.262^{+0.073}_{-0.218}$	$-0.020^{+0.200}_{-0.350}$	$1.454^{+0.524}_{-0.225}$	$1.409^{+0.222}_{-0.202}$	$0.645^{+0.254}_{-0.347}$
	+3%/-4%	+2%/-5%	+1000%/-1750%	+36%/-15%	+16%/-14%	+39%/-54%
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 005370431-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-2\pm4$	$0.63^{+0.49}_{-0.37}$	$3929^{+307}_{-249}$	$3339^{+2951}_{-8222}$	$0.457^{+4.406}_{-1.557}$
Alt.	$-0\pm2$	$1.44^{+0.61}_{-0.52}$	$3908^{+313}_{-234}$	$-3627^{+516}_{-350}$	$0.003^{+0.176}_{-0.161}$

$T_{max}$  = 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

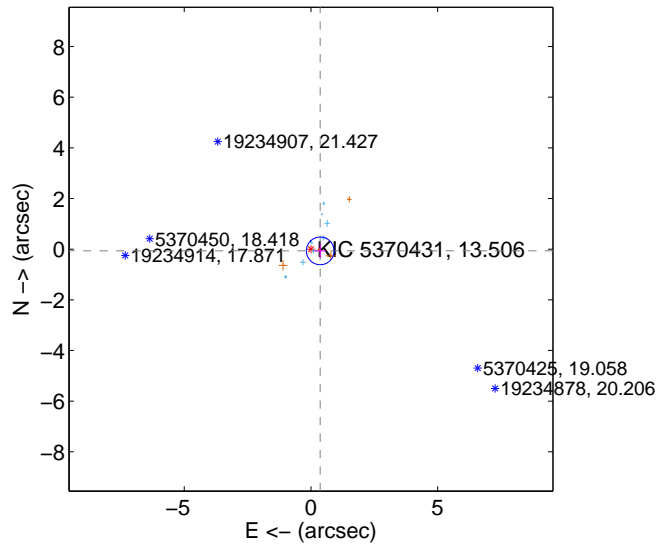
Supplemental centroid analysis for 005370431-01. Kepler magnitude: 13.51. Transit SNR 1.75

There are 9 quarters with good PRF difference image offsets

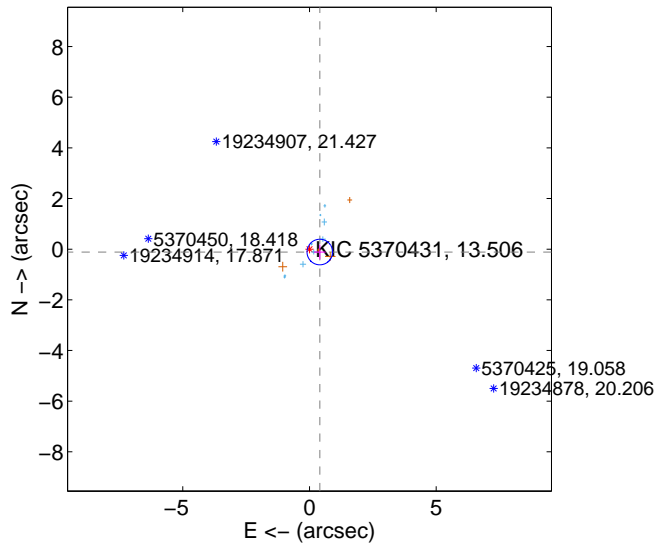
The direct PRF centroid is offset from the target star catalog position by about 0.10 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.372 \pm 0.182$	2.04	$-0.366 \pm 0.223$	$-0.068 \pm 0.283$
PRF-fit source offset from KIC position	$0.424 \pm 0.168$	2.52	$-0.408 \pm 0.233$	$-0.113 \pm 0.291$
photometric centroid source offset	$2.77 \pm 1.73$	1.60	$-2.11 \pm 1.77$	$-1.79 \pm 1.68$

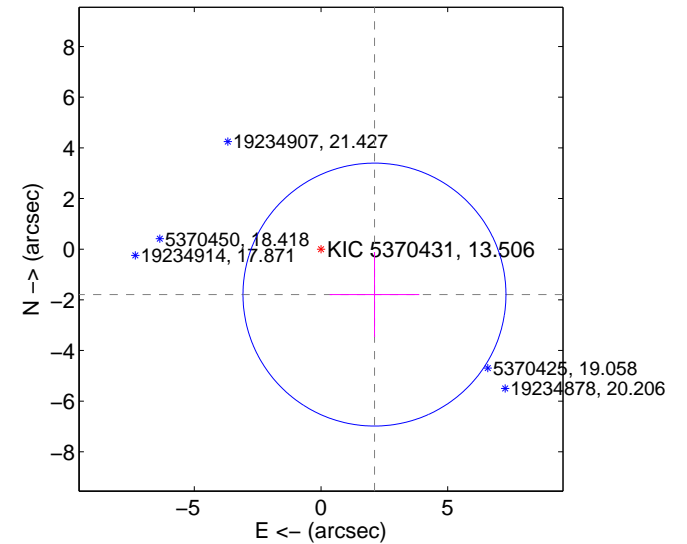
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

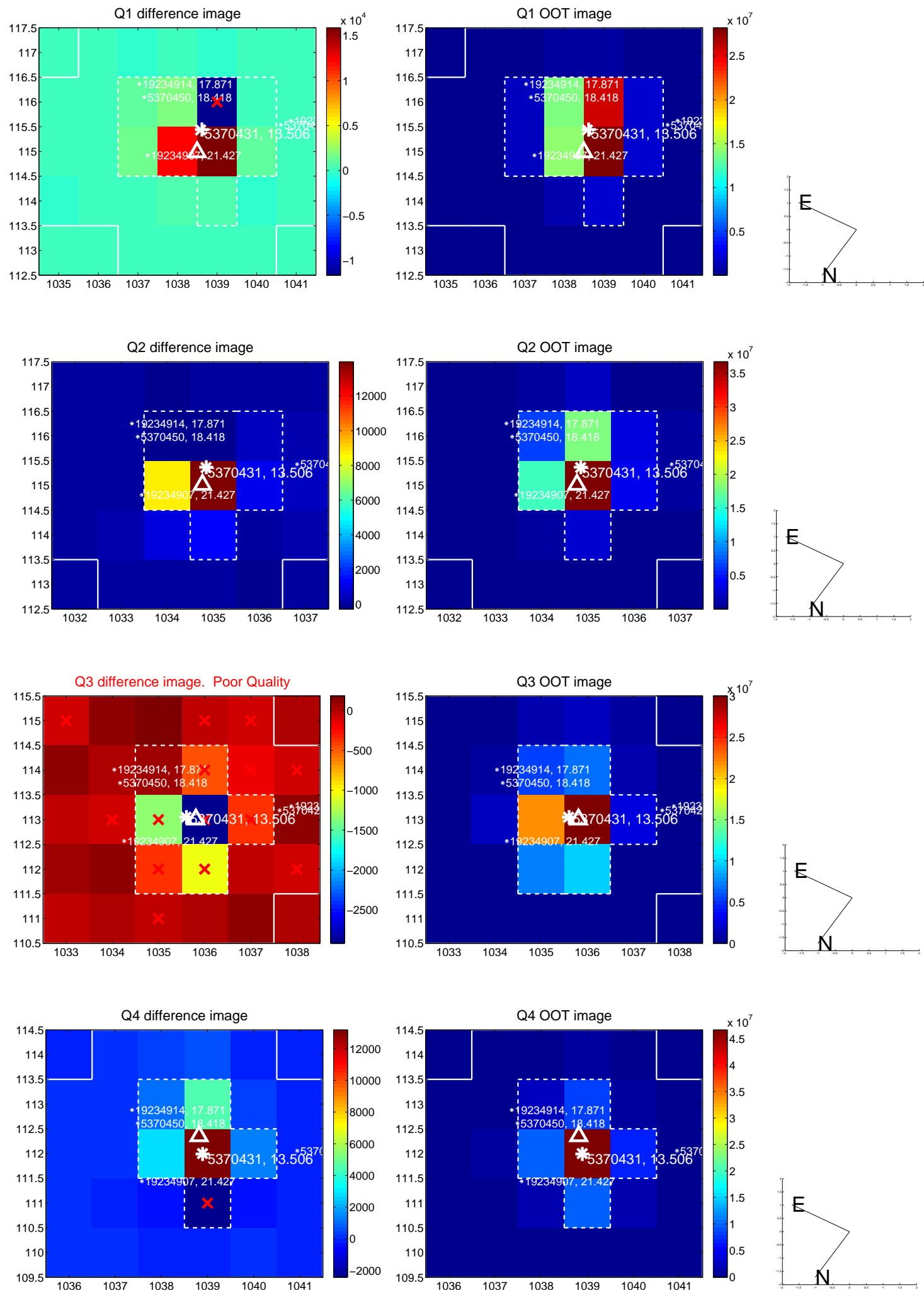


offset from photometric centroids

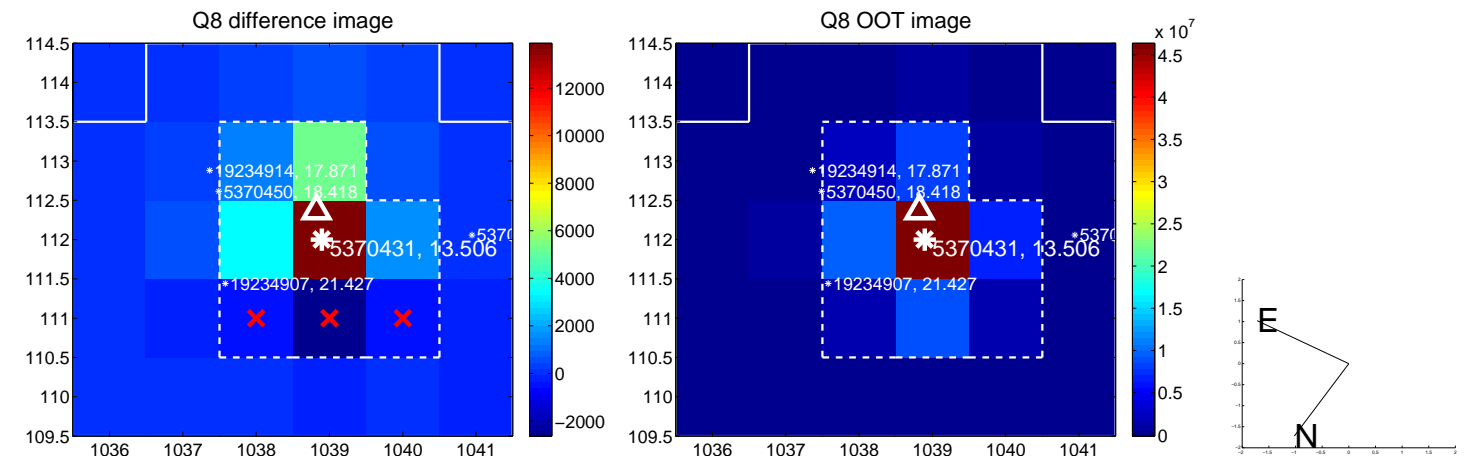
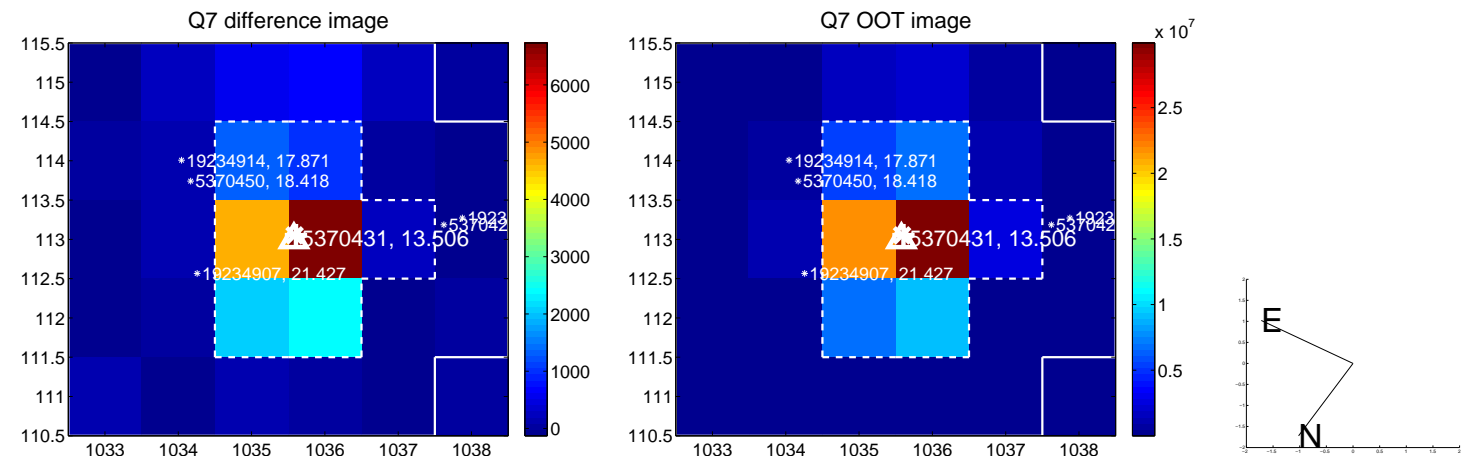
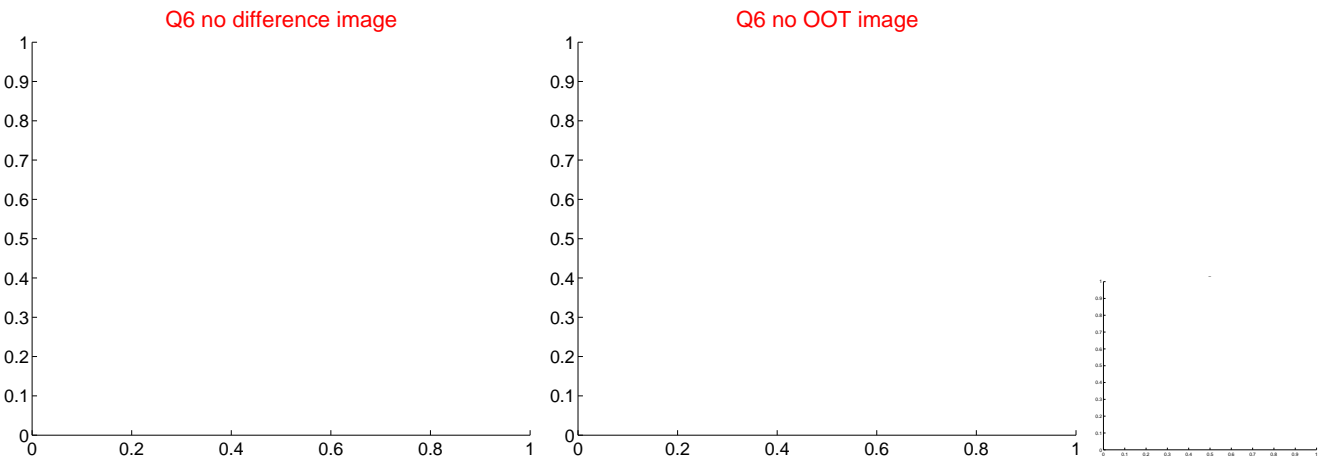
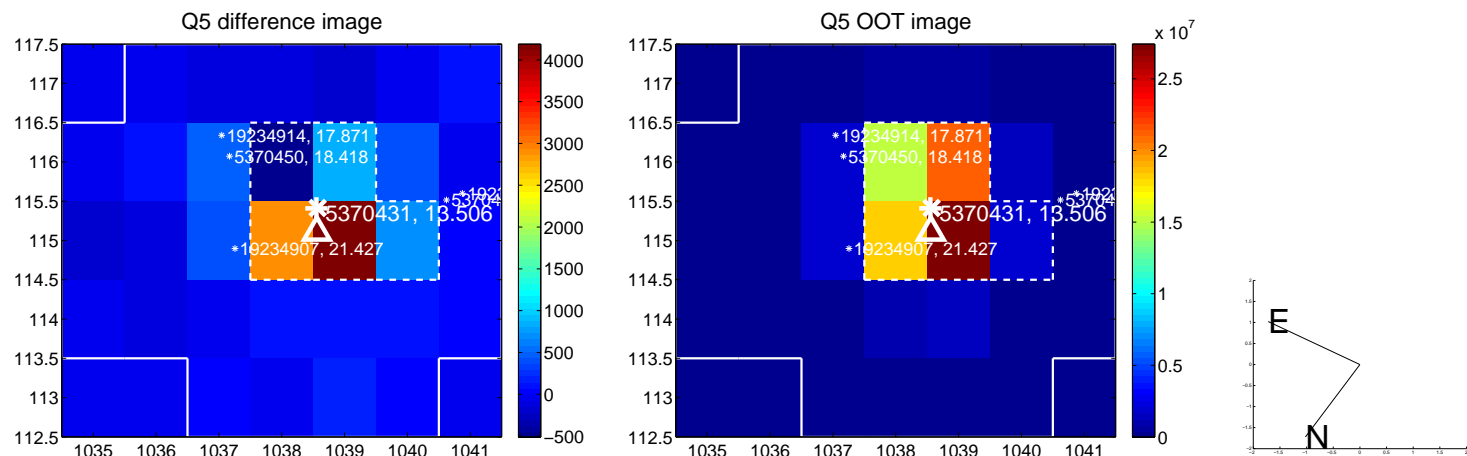


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

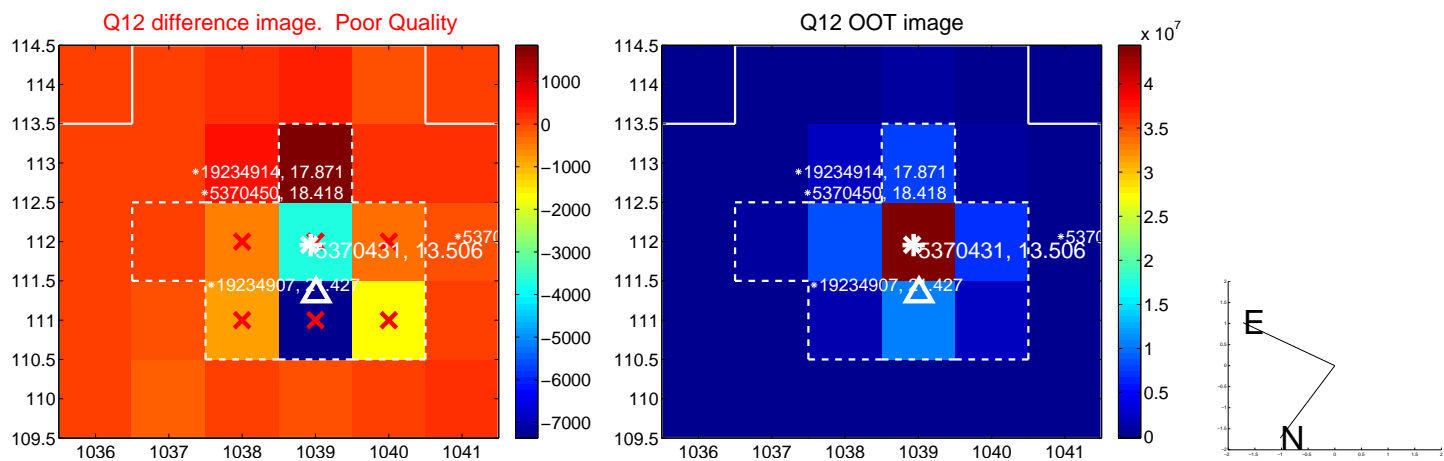
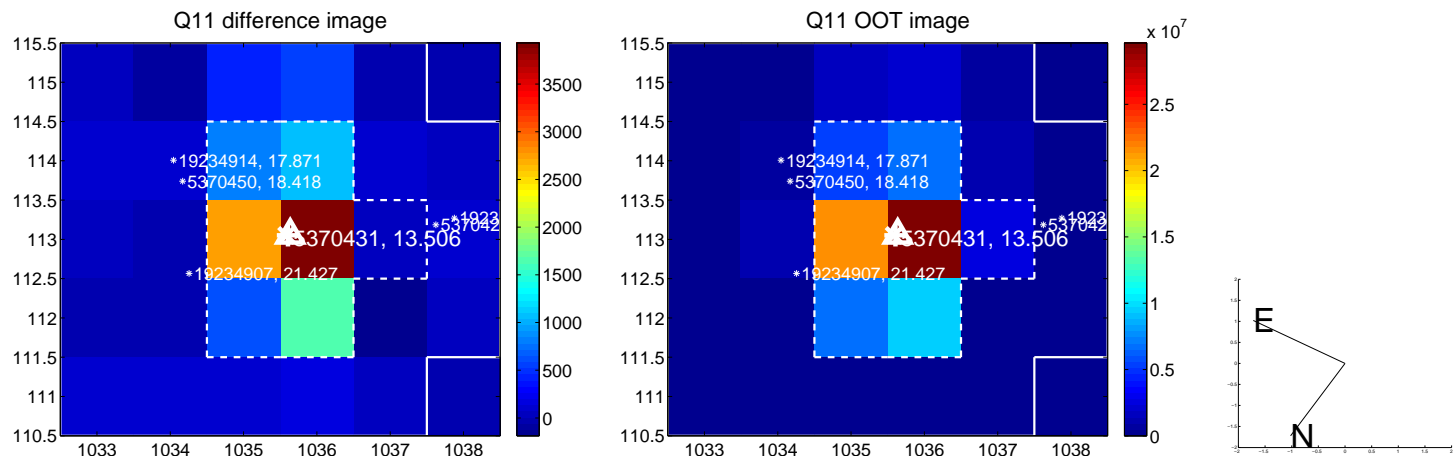
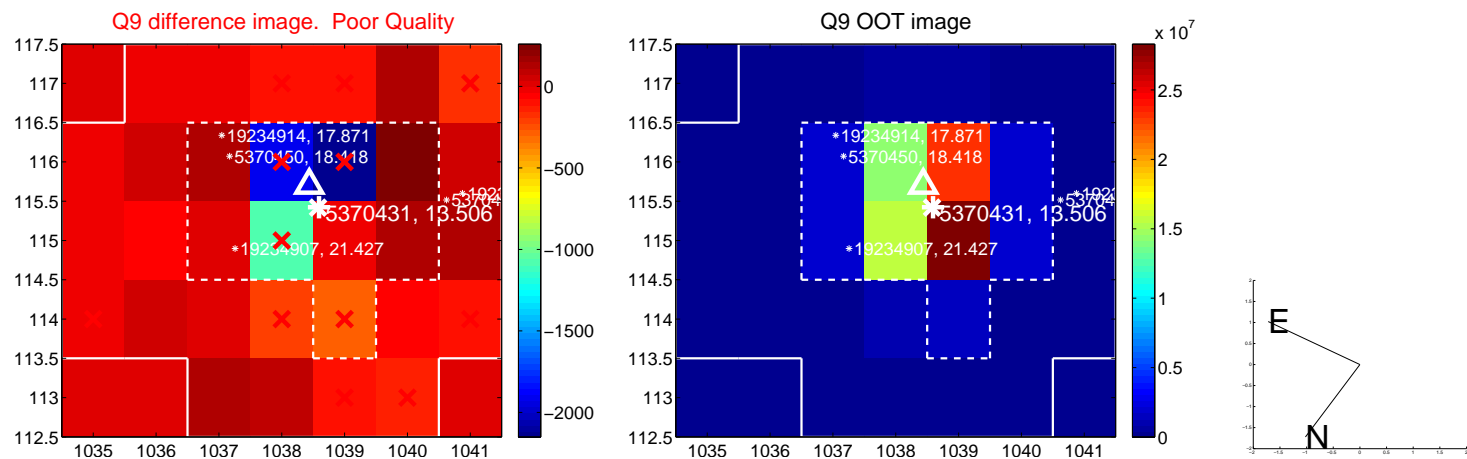


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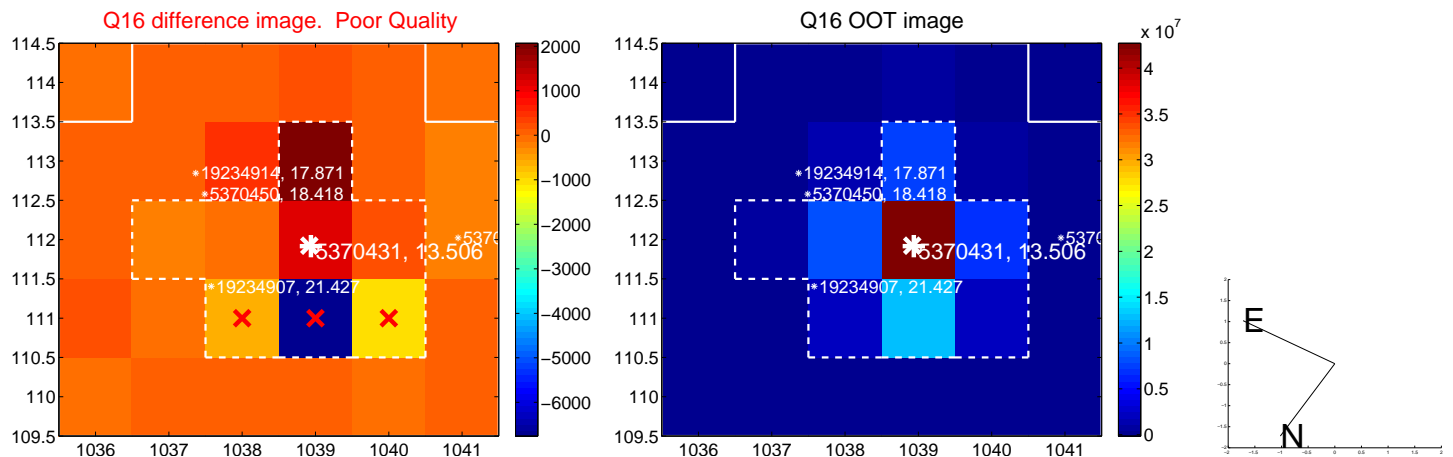
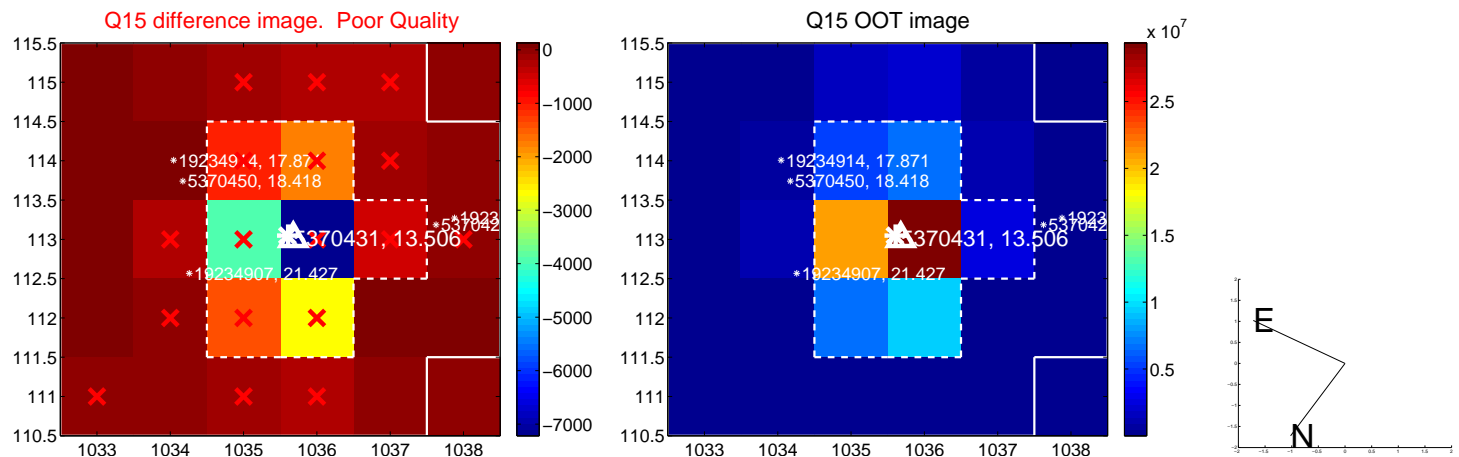
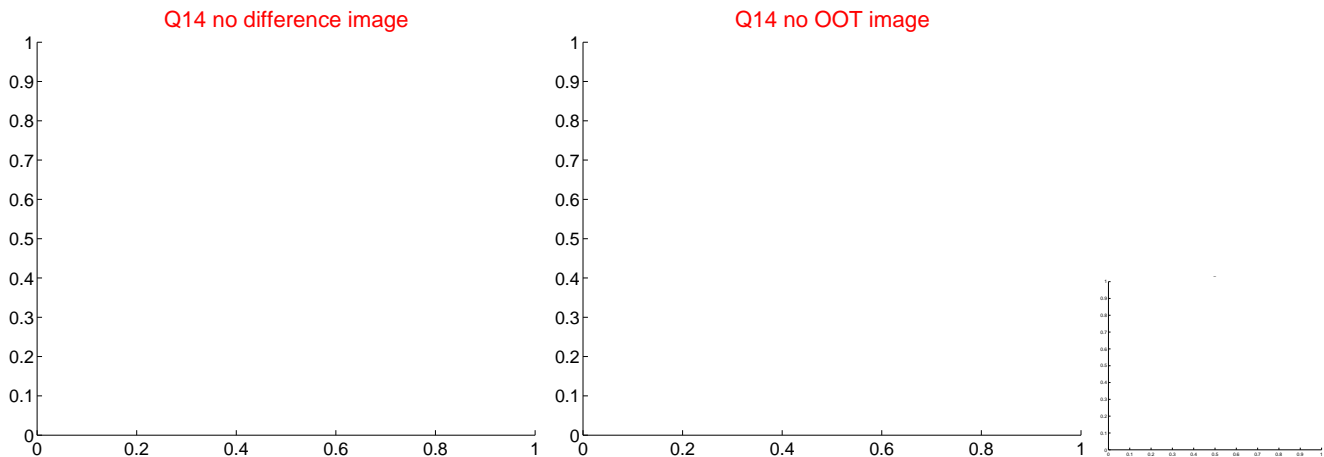
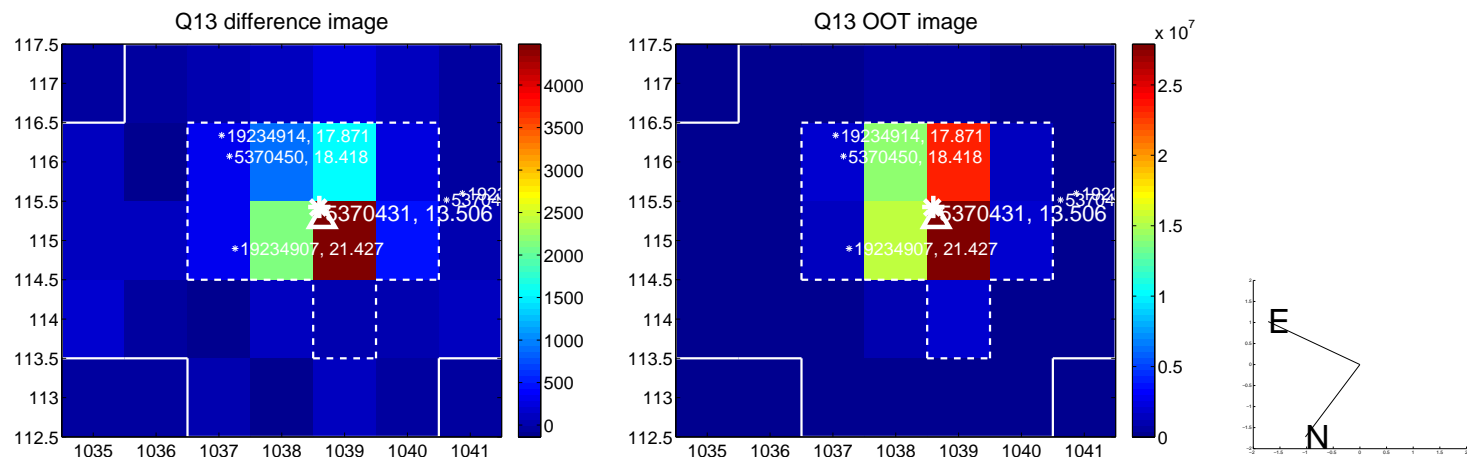




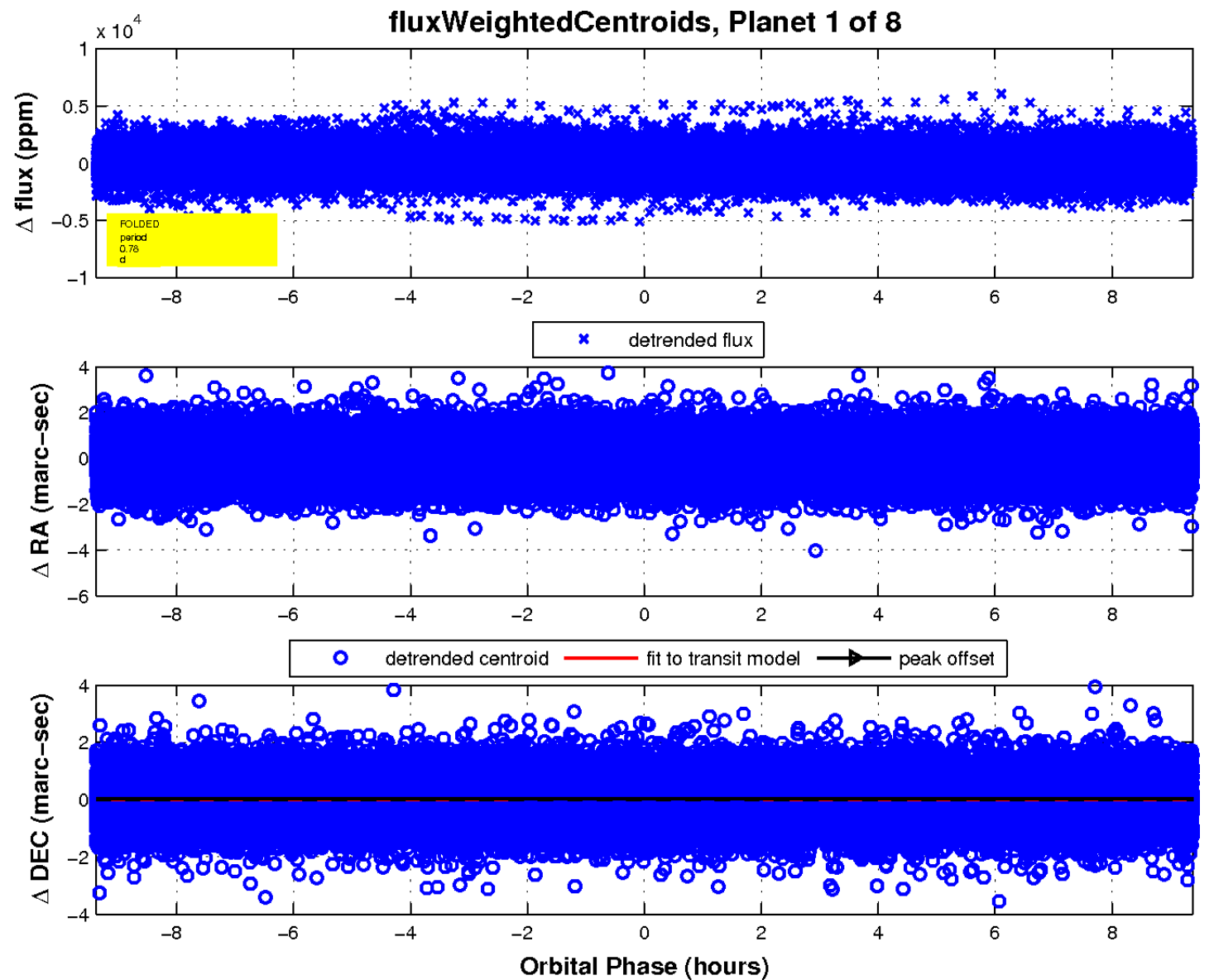
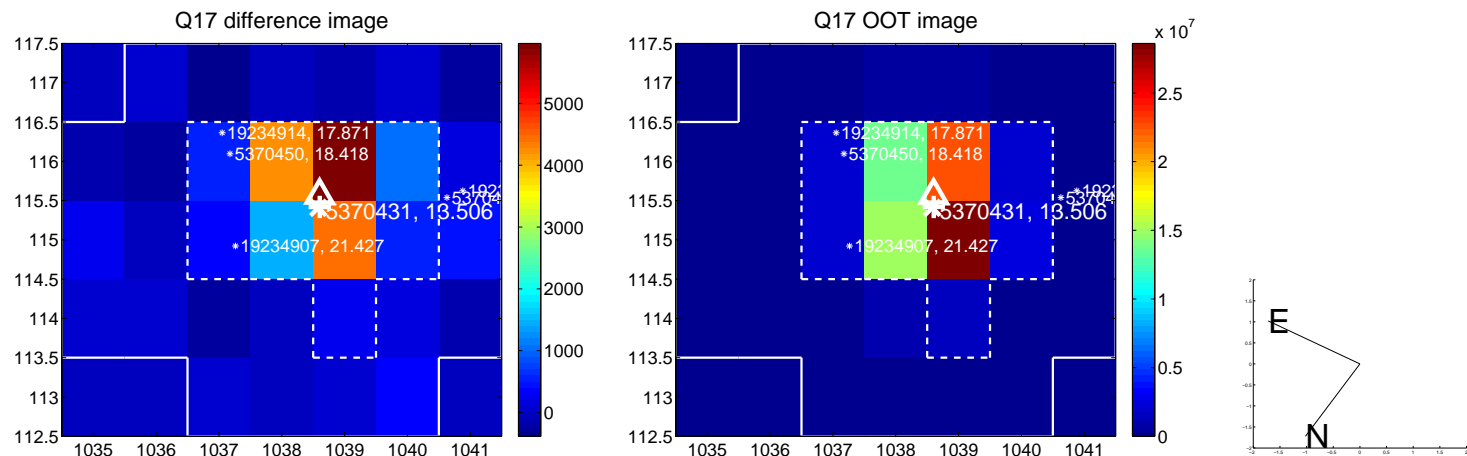
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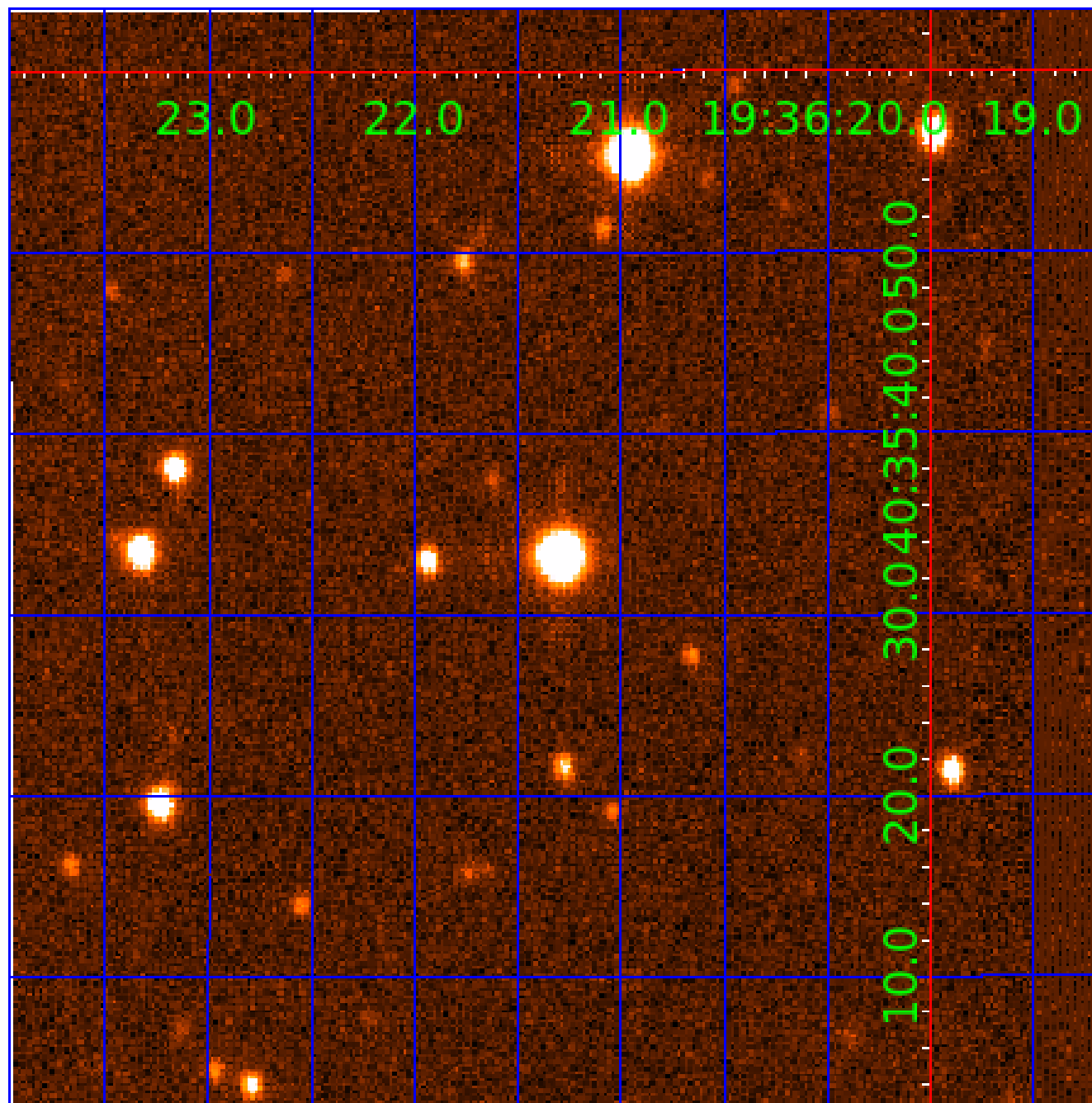


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 005370431

## Q1-17 DR25 TCE Parameters

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## Robovetter Results

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005370431-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS
005370431-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_POS_ALT
005370431-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
005370431-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—HALO_GHOST
005370431-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

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

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

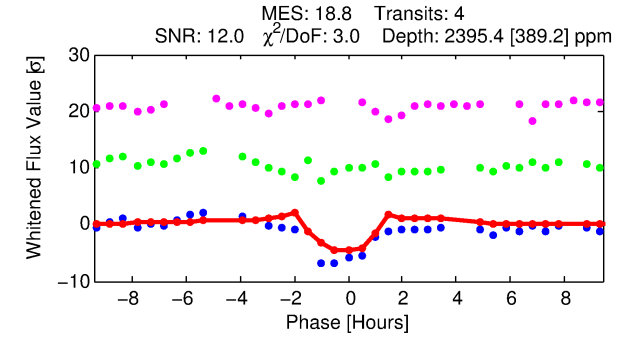
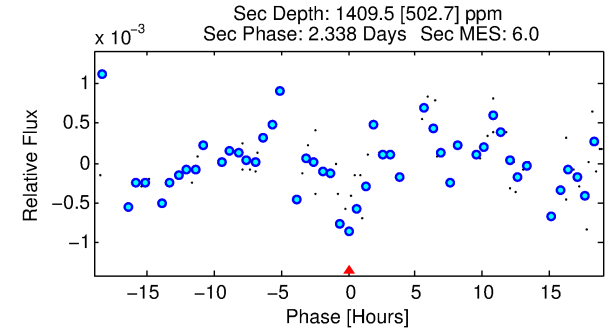
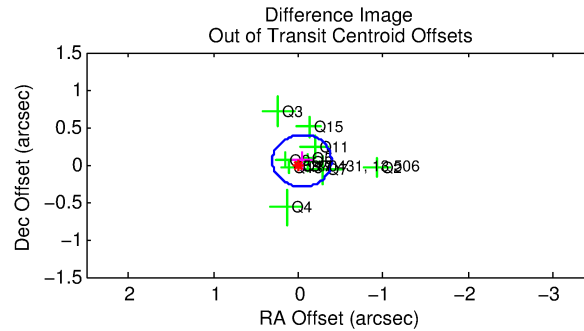
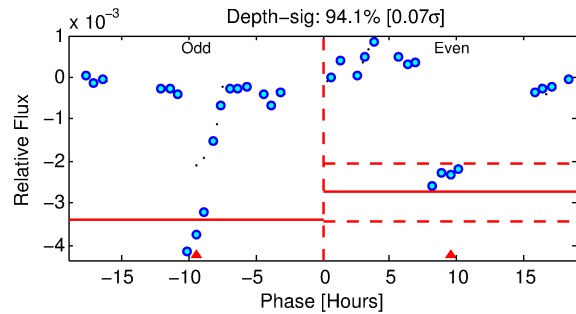
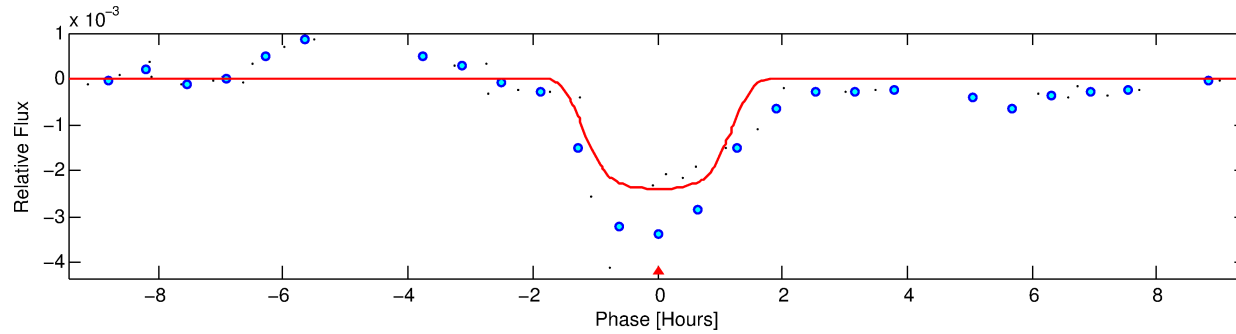
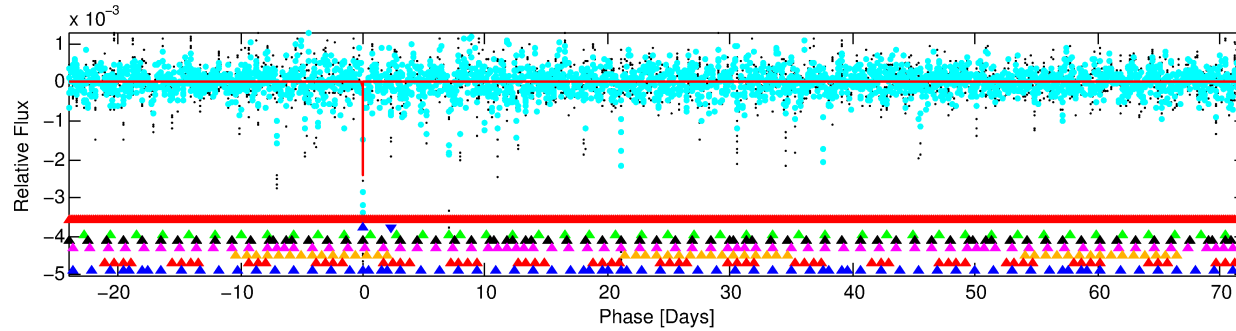
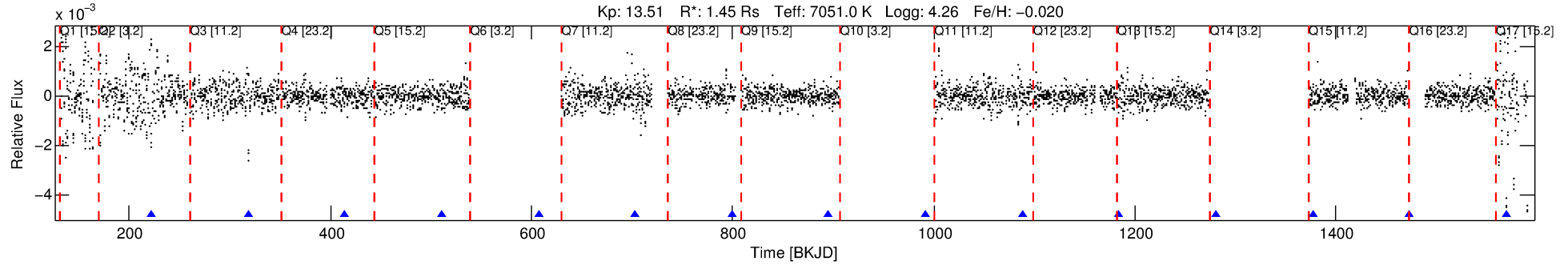
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 005370431-02

No Significant Match Found

# DV One-Page Summary

KIC: 5370431 Candidate: 2 of 8 Period: 96.227 d



## DV Fit Results:

Period = 96.22707 [0.00144] d  
Epoch = 222.0506 [0.0063] BKJD  
Rp/R\* = 0.0527 [0.0083]  
a/R\* = 123.67 [76.60]  
b = 0.91 [0.12]  
Seff = 22.04 [9.90]  
Teq = 552 [62] K  
Rp = 8.36 [3.29] Re  
a = 0.4609 [0.1349] AU  
Ag = 2355.77 [1480.96] [1.59 $\sigma$ ]  
Teffp = 5951 [755] K [7.13 $\sigma$ ]

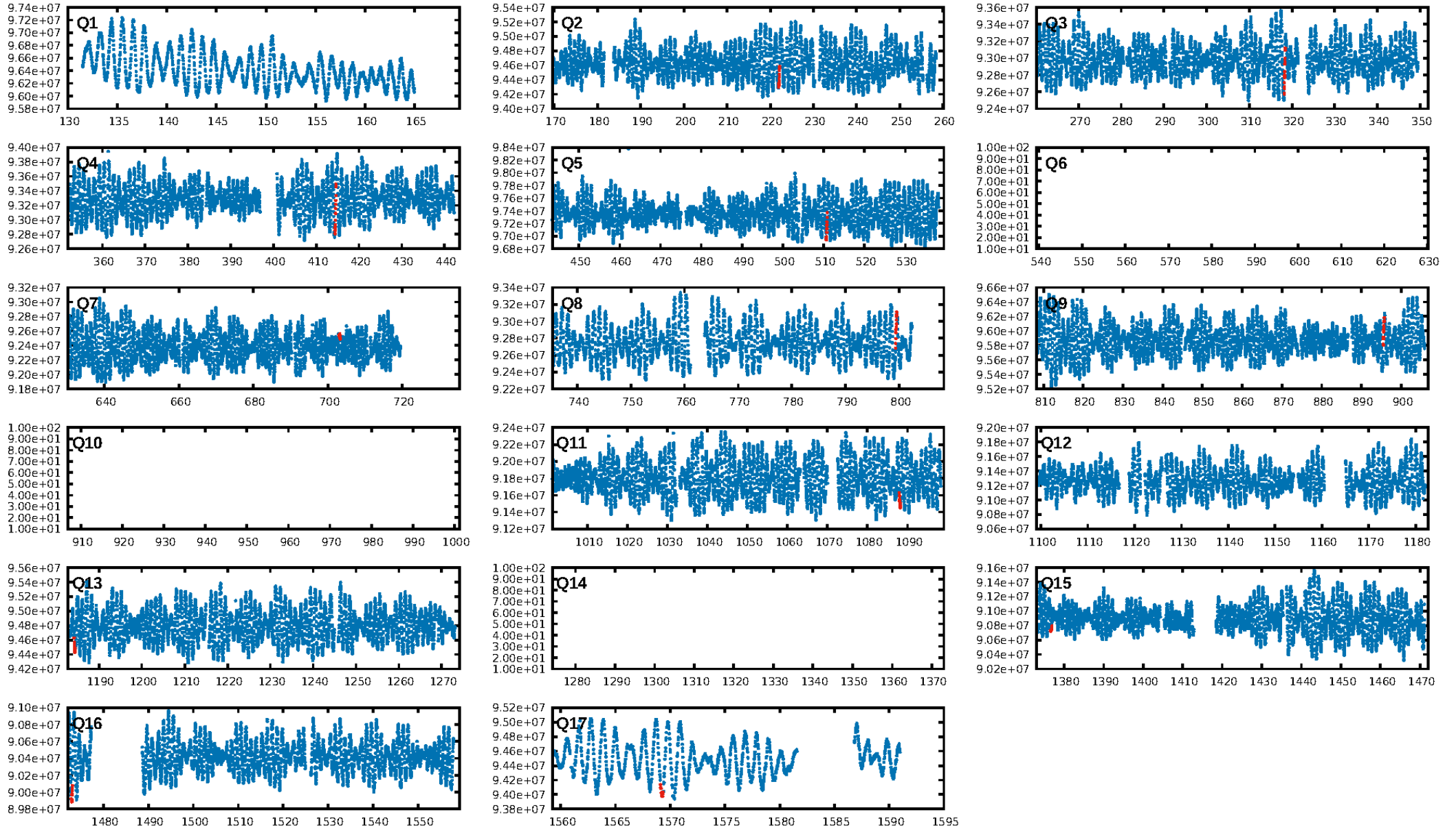
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [433.59 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 55.0%  
Bootstrap-pfa: 6.34e-40  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -2.621  
Centroid-sig: N/A  
Centroid-so: 0.240 arcsec [1.97 $\sigma$ ]  
OotOffset-rm: 0.068 arcsec [0.59 $\sigma$ ]  
KicOffset-rm: 0.070 arcsec [0.63 $\sigma$ ]  
OotOffset-st: 1/4/2/4 [11]  
KicOffset-st: 1/4/2/4 [11]  
DiffImageQuality-fgm: 0.73 [8/11]  
DiffImageOverlap-fno: 0.00 [0/11]

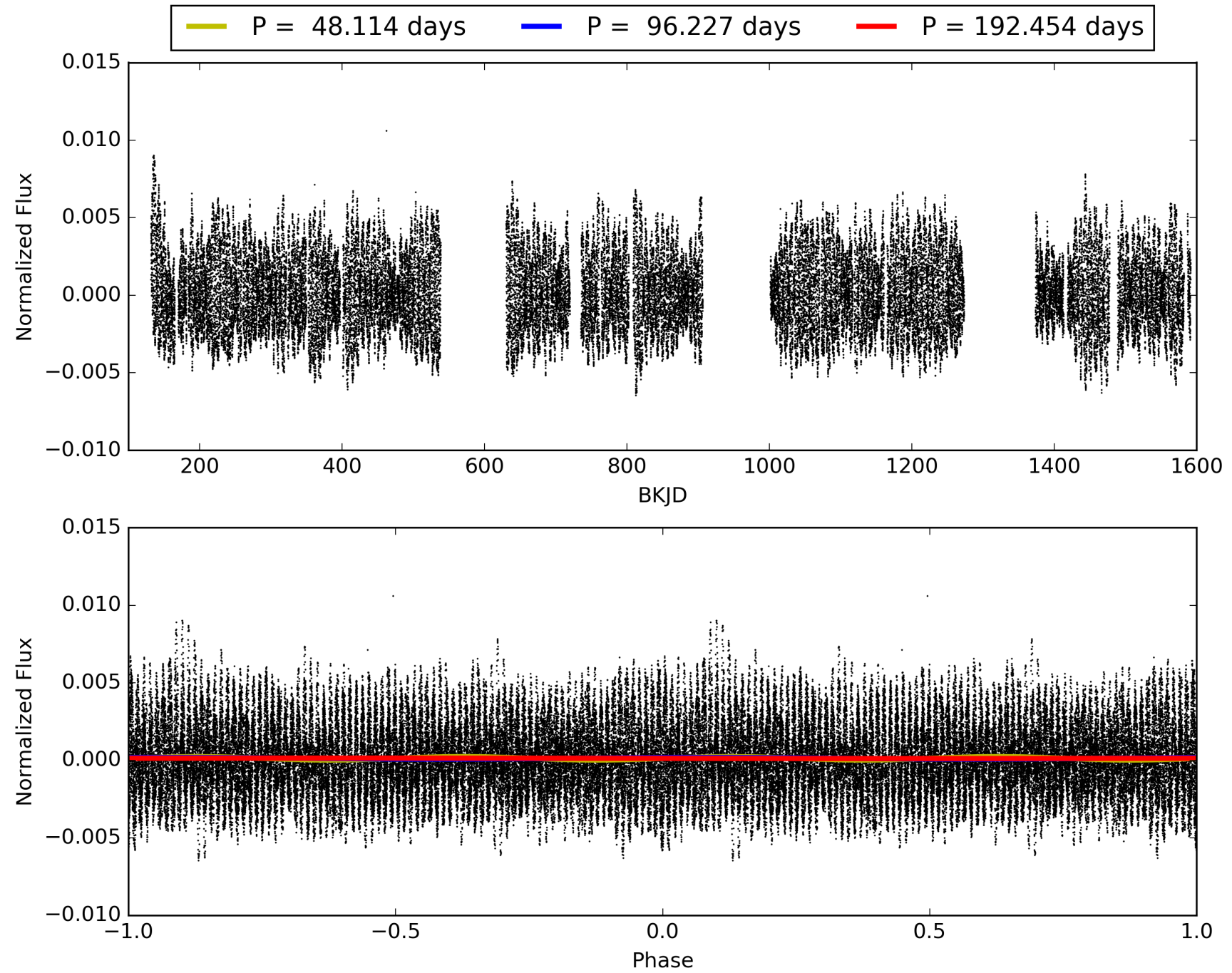
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 02:17:13 Z

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

# TCE 005370431-02, PDC Light Curves

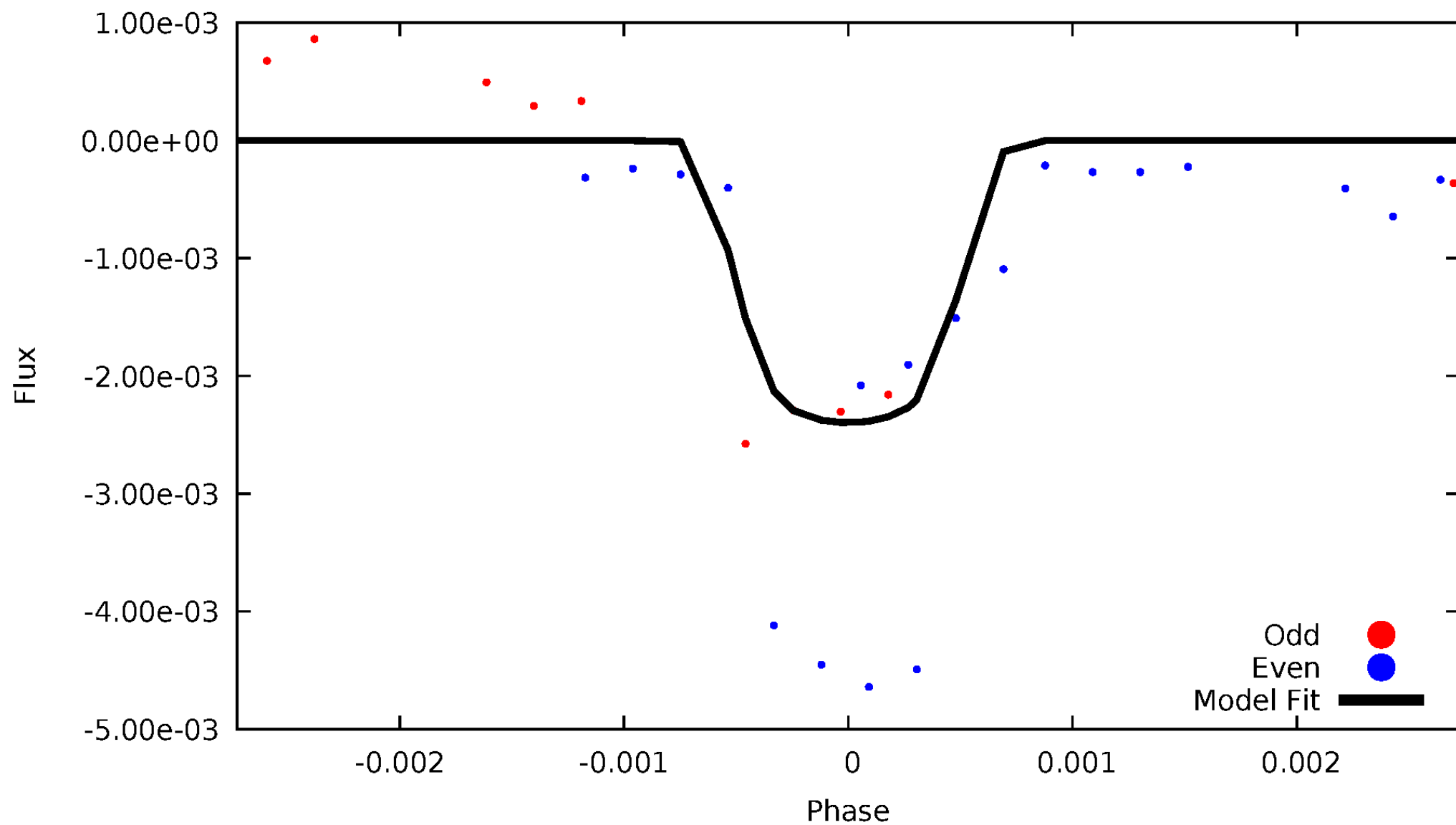


# TCE 005370431-02



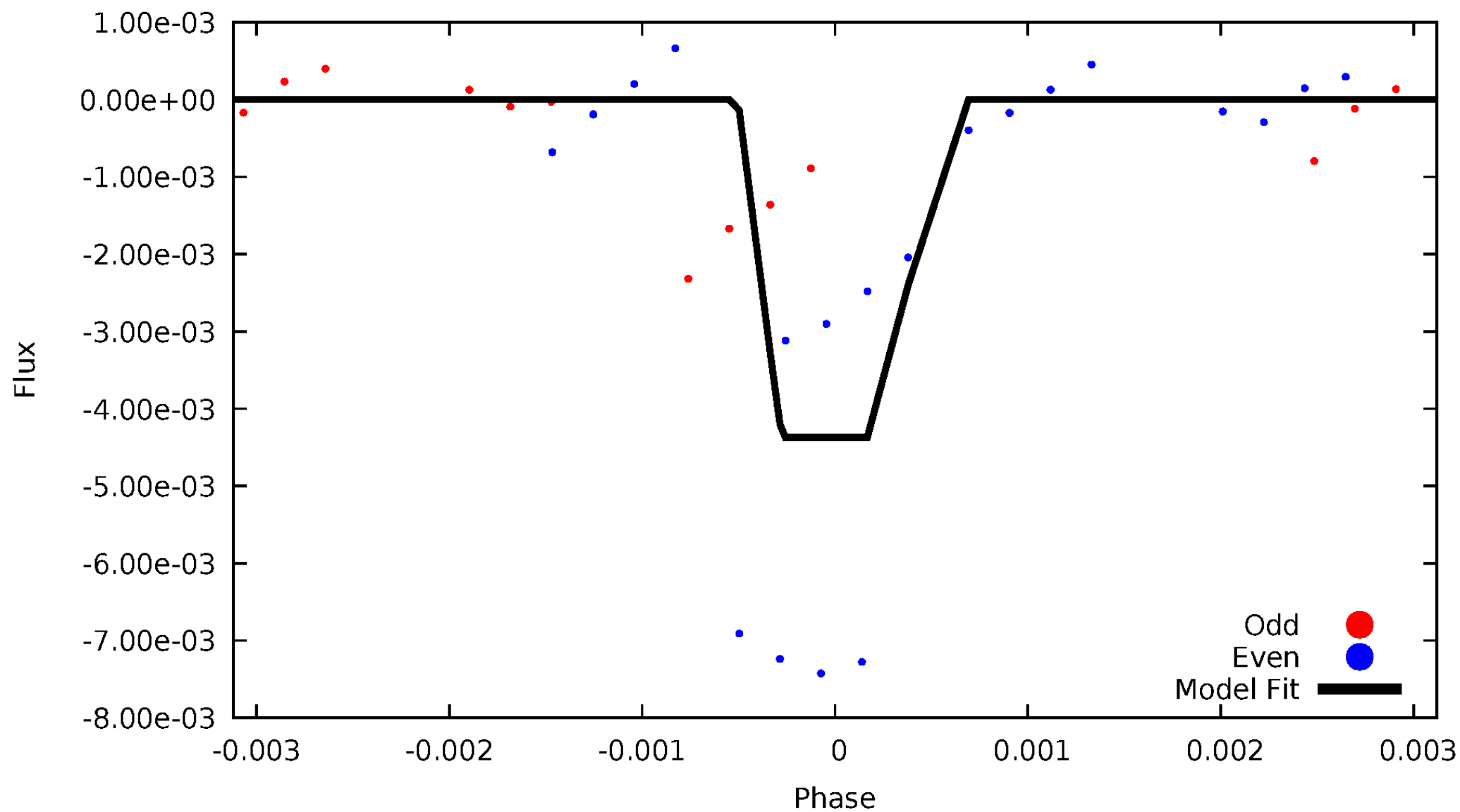
# DV Odd/Even

TCE 005370431-02



# ALT Odd/Even

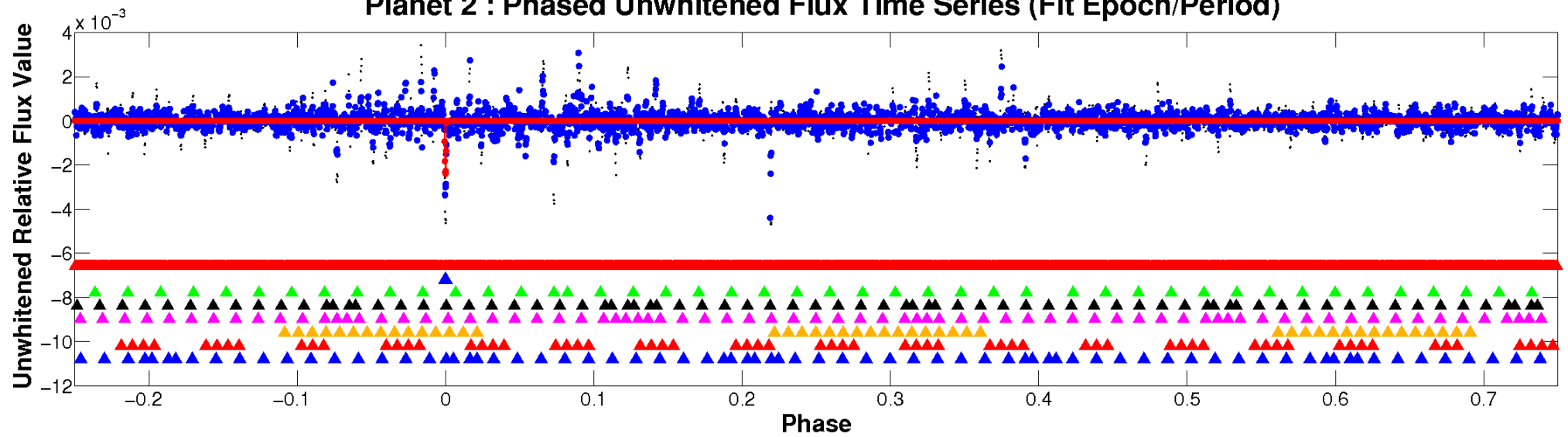
TCE 005370431-02



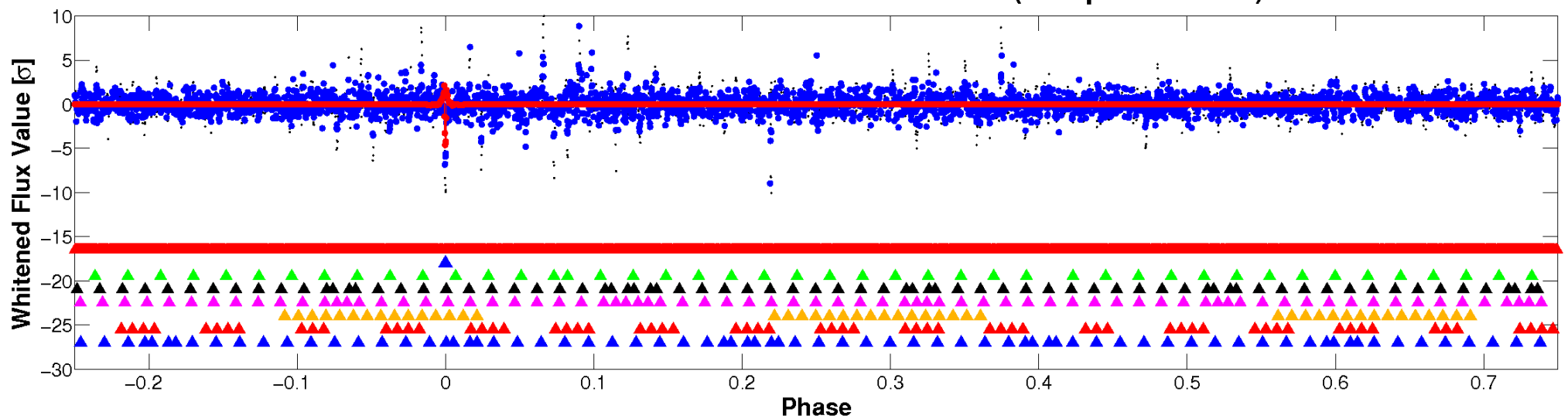


# Non-Whitened Vs. Whitened Light Curve

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

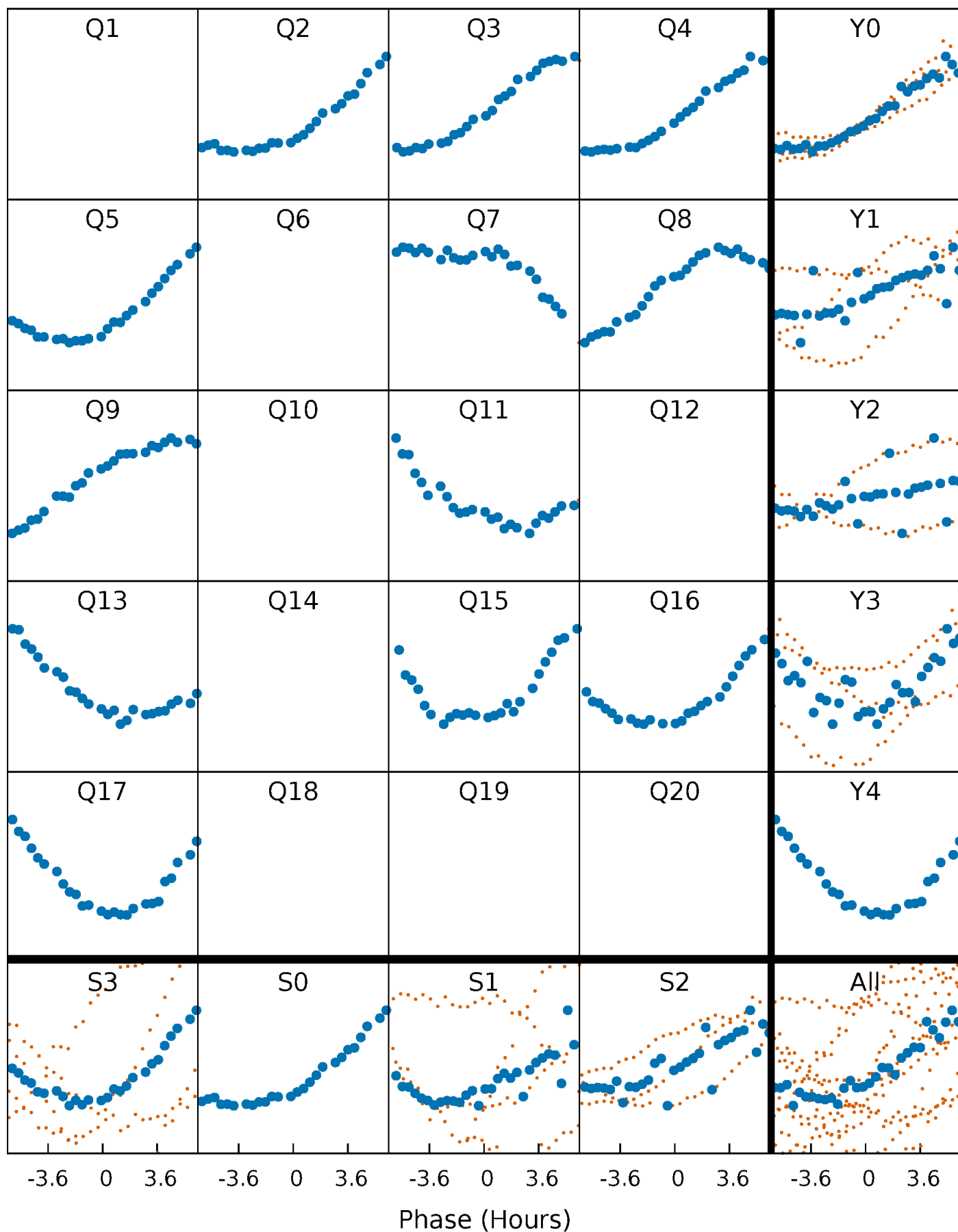


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



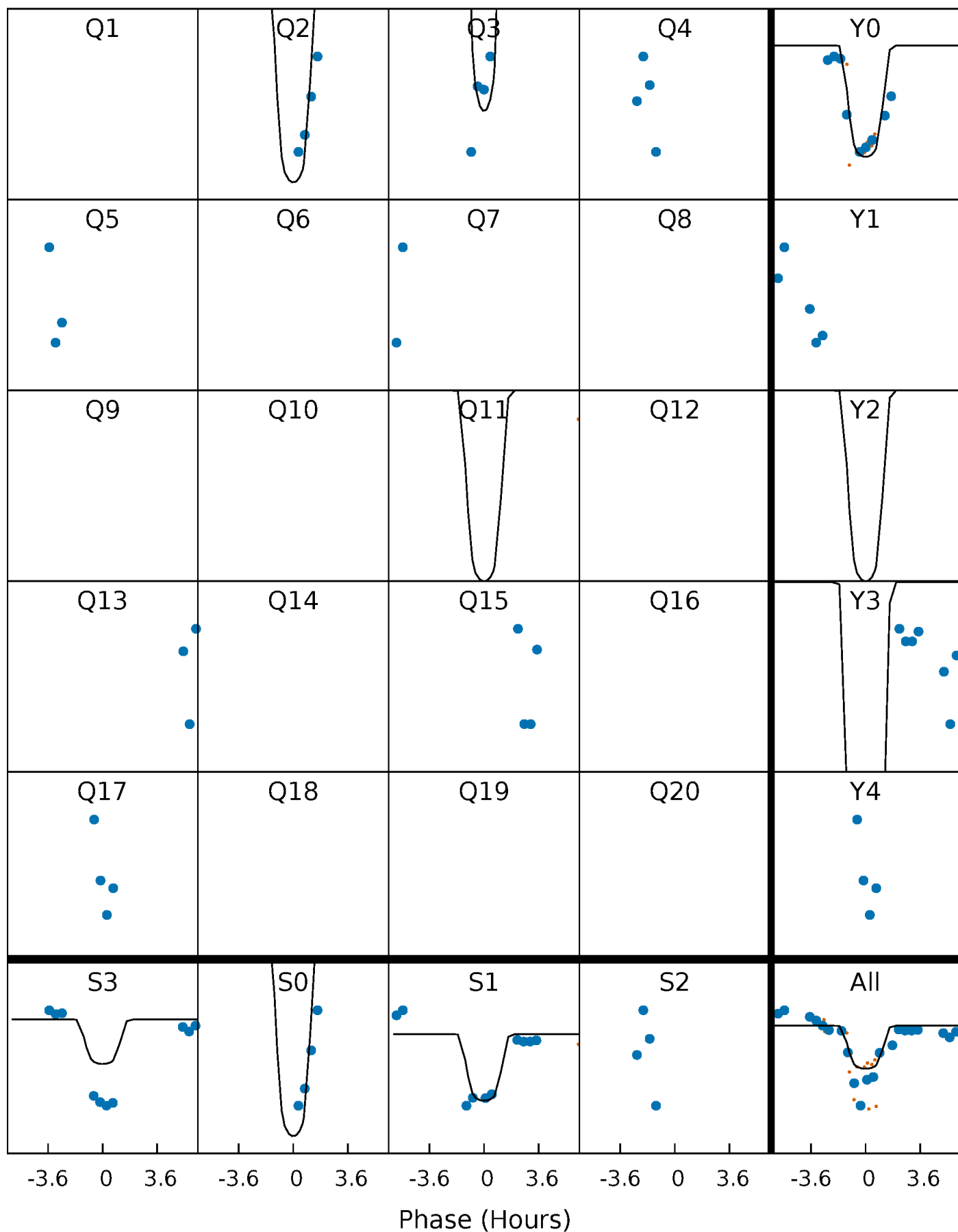
# PDC Quarter-Phased Transit Curves

TCE 005370431-02 P= 96.227075 Days  $T_0=222.050583$  (BKJD)



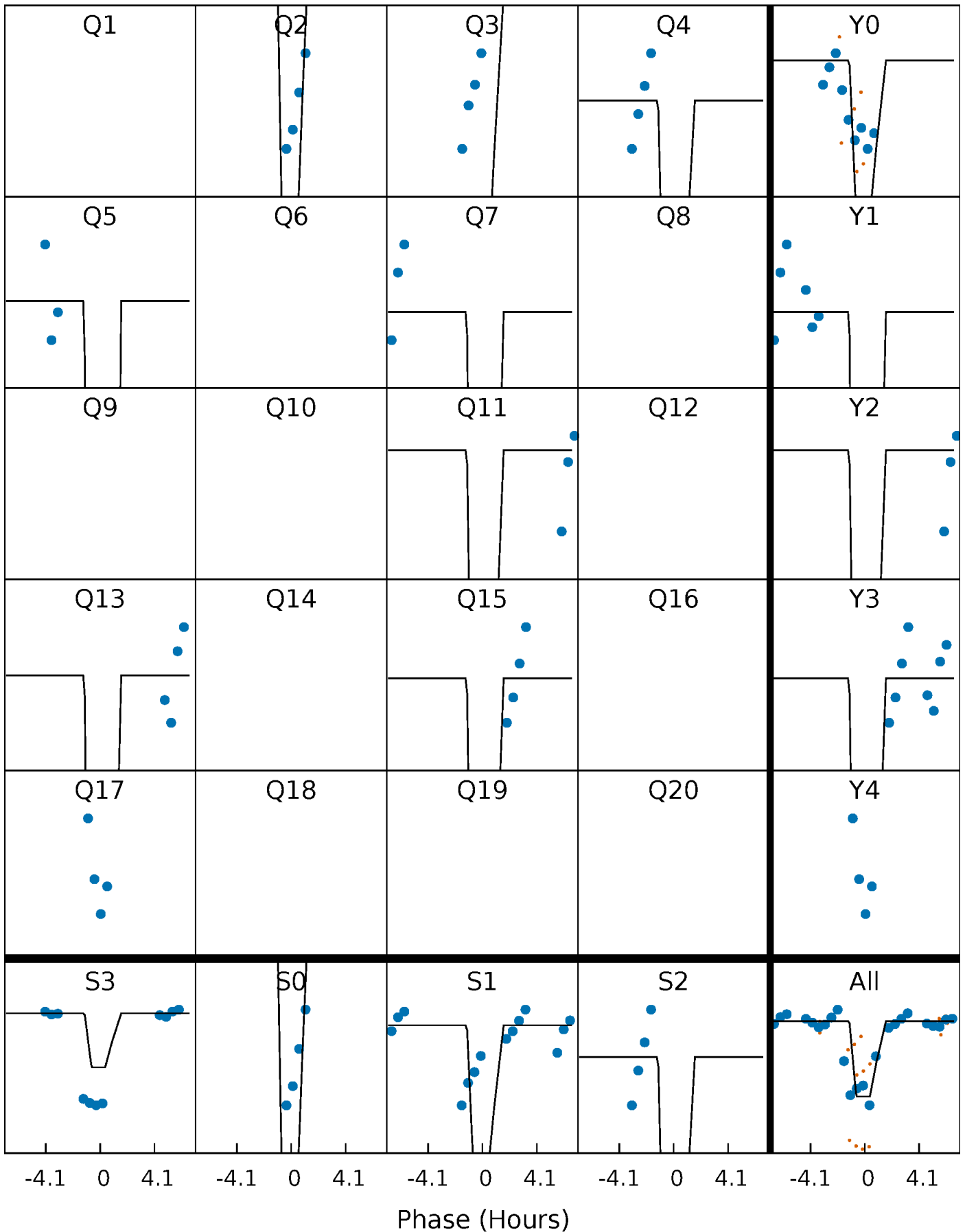
# DV Quarter-Phased Transit Curves

TCE 005370431-02    P= 96.227075 Days     $T_0=222.050583$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

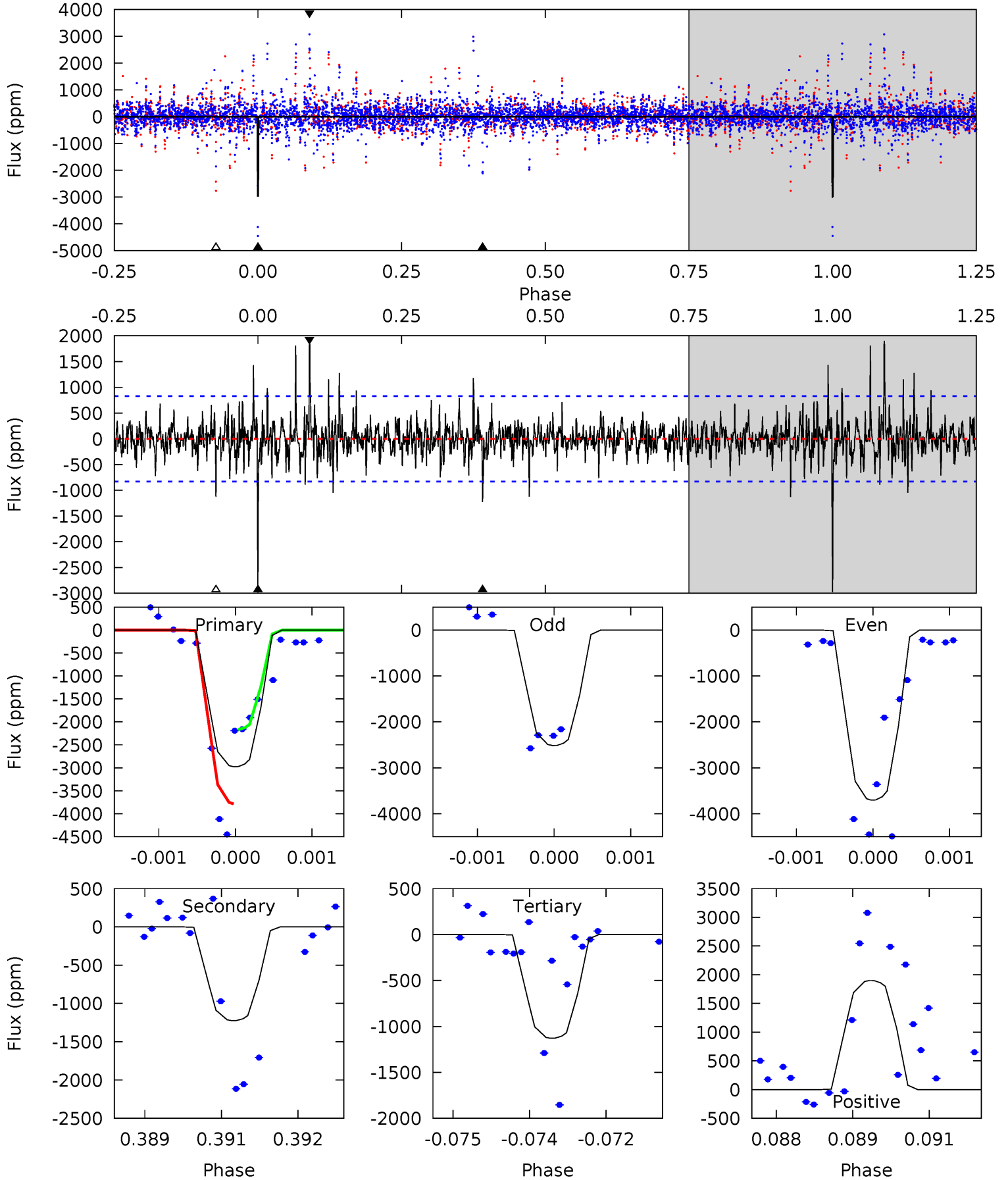
TCE 005370431-02   P= 96.226057 Days    $T_0=222.080702$  (BKJD)



# DV Model-Shift Uniqueness Test

005370431-02, P = 96.227075 Days, E = 125.823508 Days

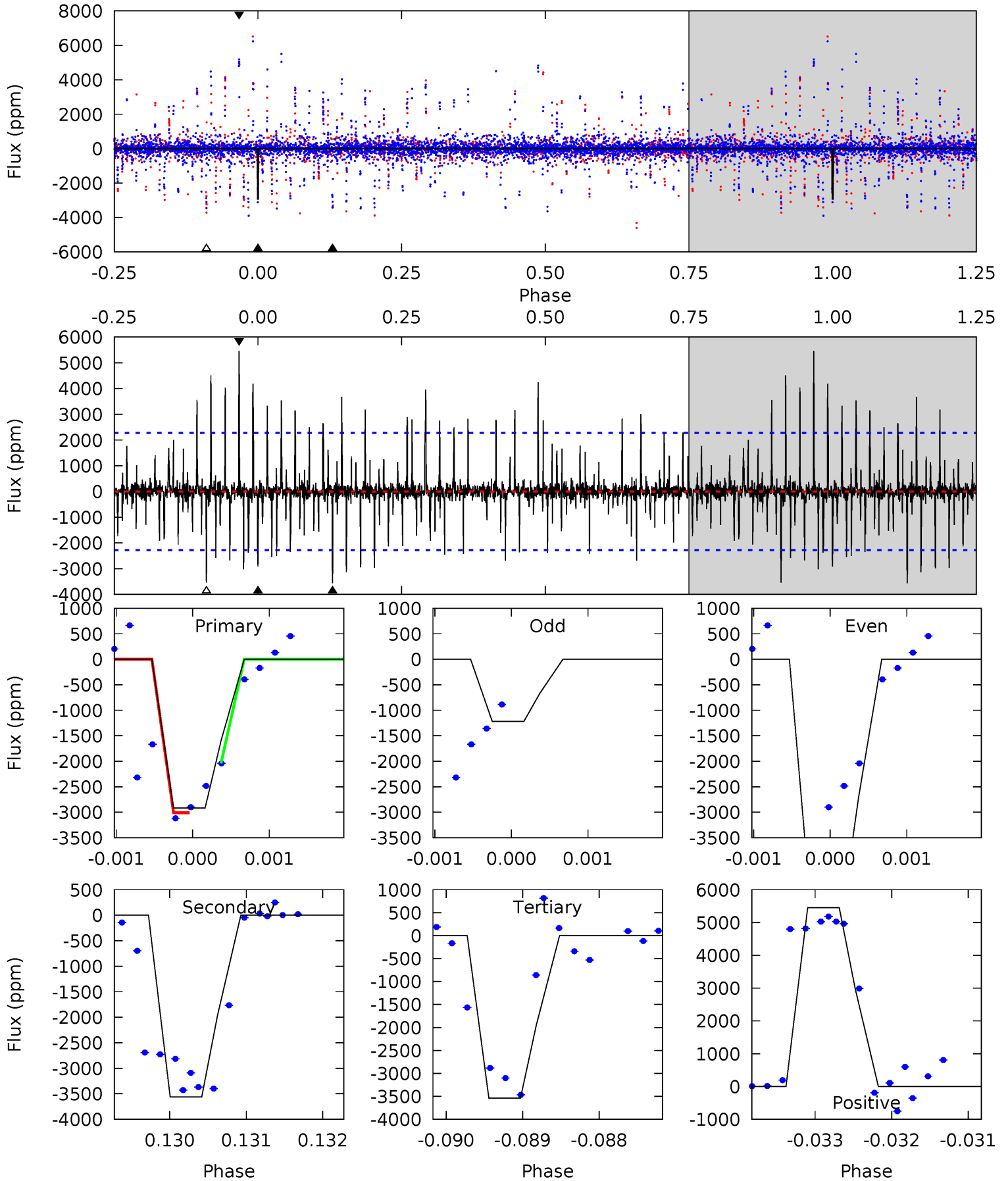
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
19.3	7.96	7.33	12.3	5.39	3.19	1.81	12.0	7.00	0.62	-4.39	4.12	1.11	0.39	5.27



# Alt Model-Shift Uniqueness Test

005370431-02, P = 96.226057 Days, E = 125.854645 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
6.96	8.51	8.46	13.0	5.45	3.28	1.64	-1.50	-6.06	0.05	-4.52	3.95	1.33	0.60	0.95



### Stellar Parameters For KIC 005370431

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7051^{+194}_{-315}$	$4.262^{+0.073}_{-0.218}$	$-0.020^{+0.200}_{-0.350}$	$1.454^{+0.524}_{-0.225}$	$1.409^{+0.222}_{-0.202}$	$0.645^{+0.254}_{-0.347}$
	+3%/-4%	+2%/-5%	+1000%/-1750%	+36%/-15%	+16%/-14%	+39%/-54%
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 005370431-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-1224 \pm 154$	$8.59^{+2.07}_{-1.56}$	$780^{+66}_{-41}$	$5720^{+549}_{-458}$	$1903^{+1008}_{-627}$
Alt.	$-3561 \pm 419$	$10.93^{+2.36}_{-1.82}$	$786^{+57}_{-46}$	$6634^{+594}_{-486}$	$3395^{+1534}_{-1046}$

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



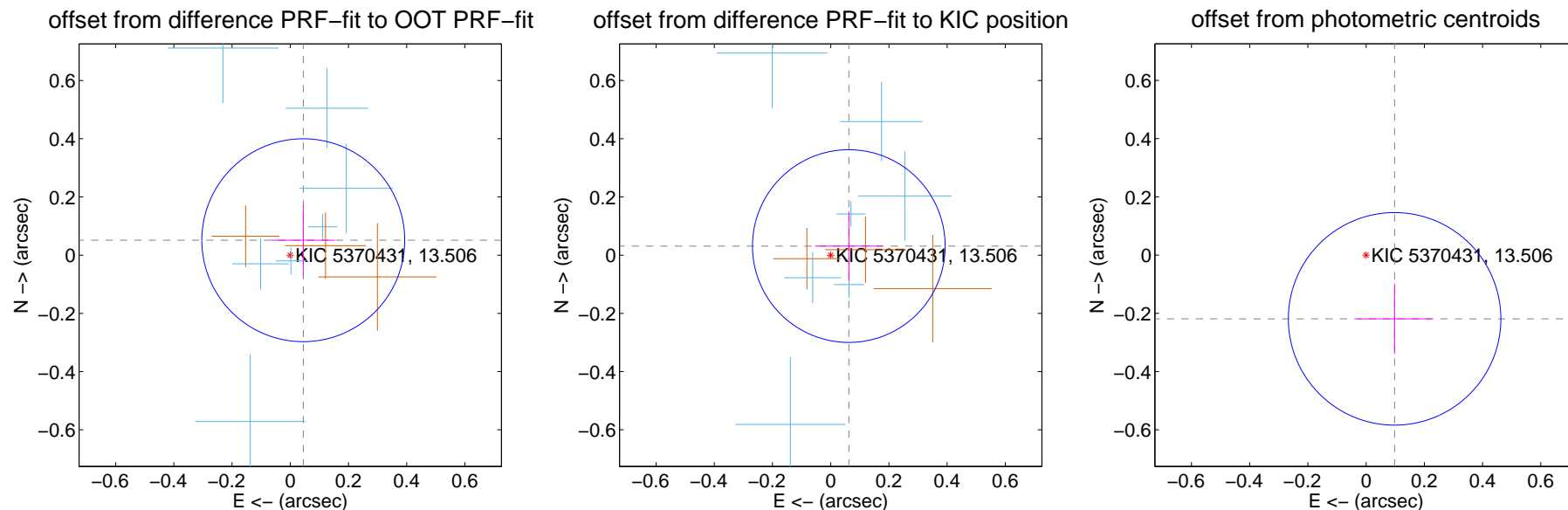
## DV Centroid Data

Supplemental centroid analysis for 005370431-02. Kepler magnitude: 13.51. Transit SNR 11.95

There are 8 quarters with good PRF difference image offsets

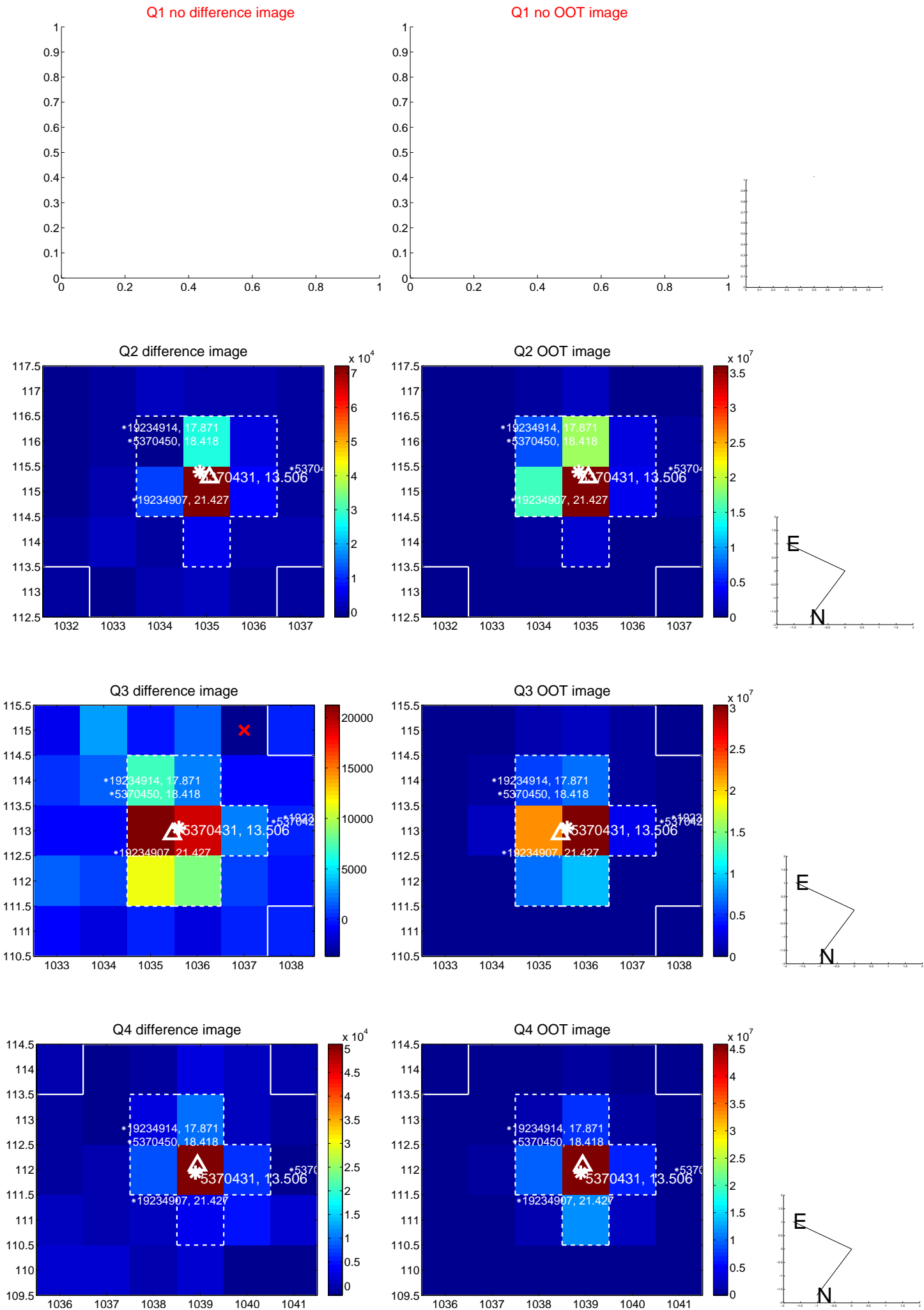
The direct PRF centroid is offset from the target star catalog position by about 0.10 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.068 \pm 0.116$	0.59	$-0.045 \pm 0.110$	$0.051 \pm 0.121$
PRF-fit source offset from KIC position	$0.070 \pm 0.110$	0.63	$-0.062 \pm 0.116$	$0.031 \pm 0.119$
photometric centroid source offset	$0.24 \pm 0.12$	1.97	$-0.10 \pm 0.13$	$-0.22 \pm 0.12$

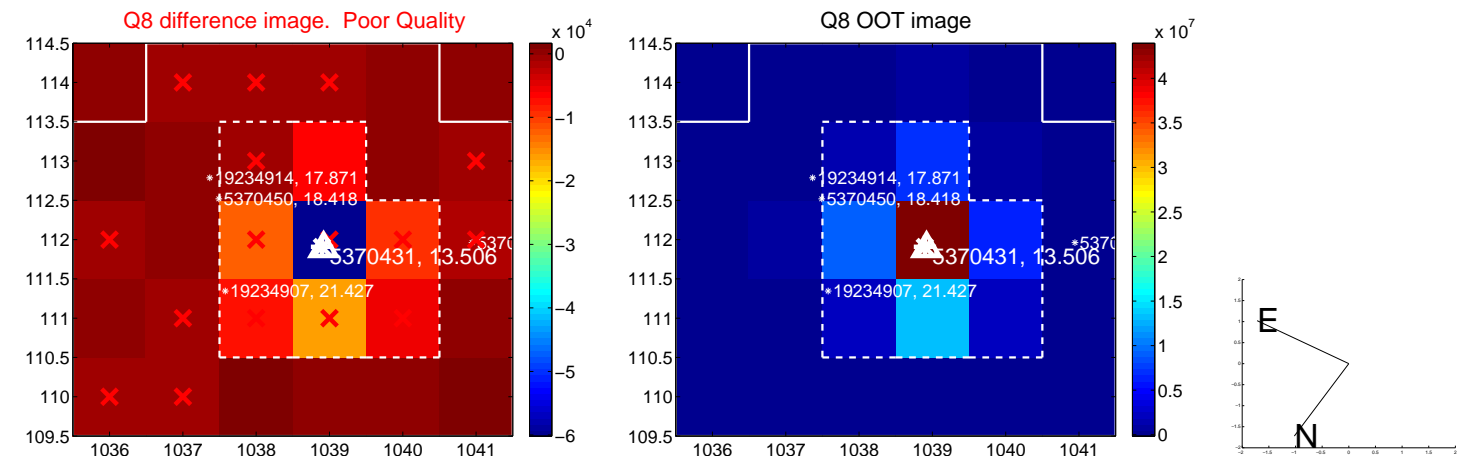
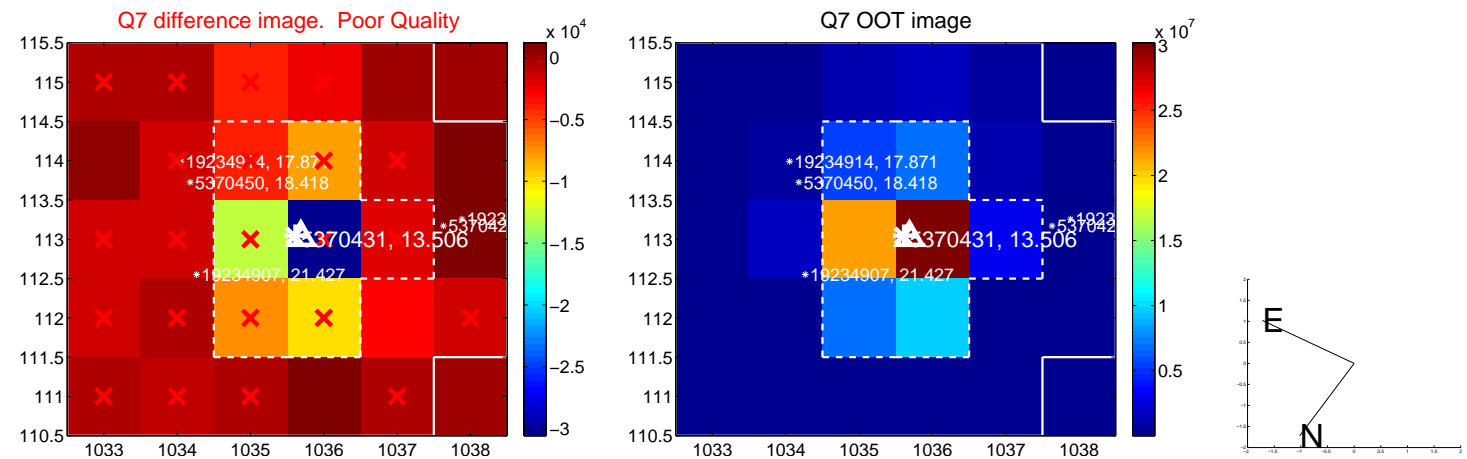
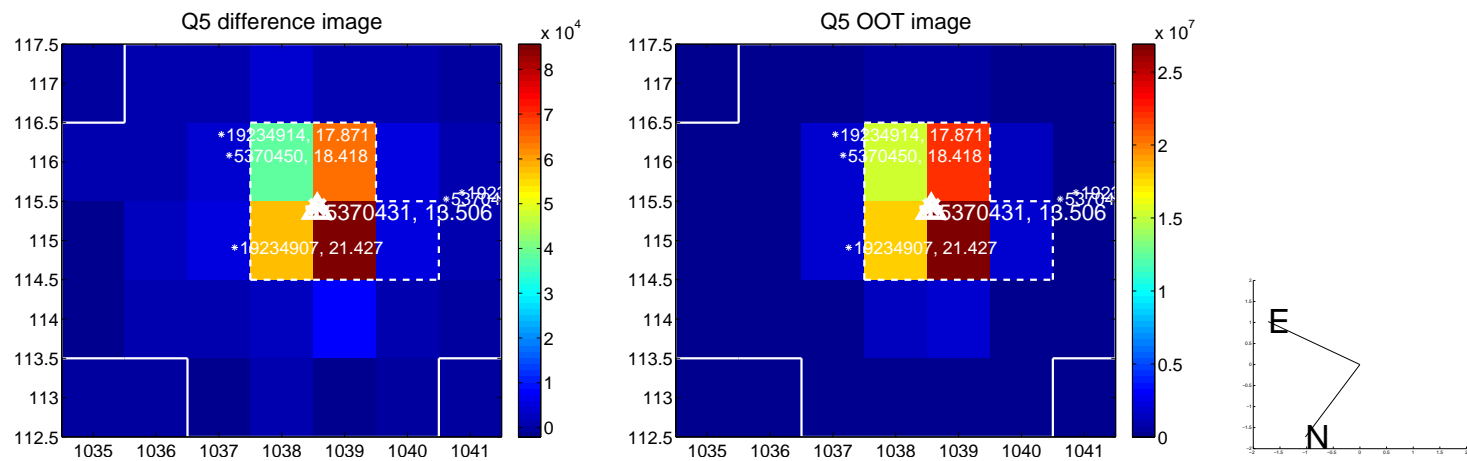


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

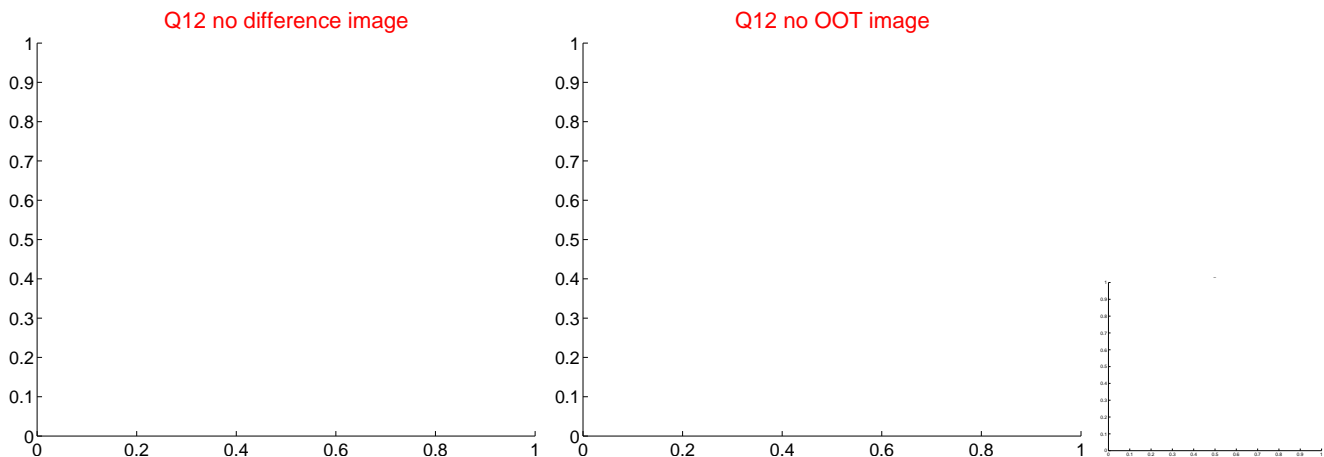
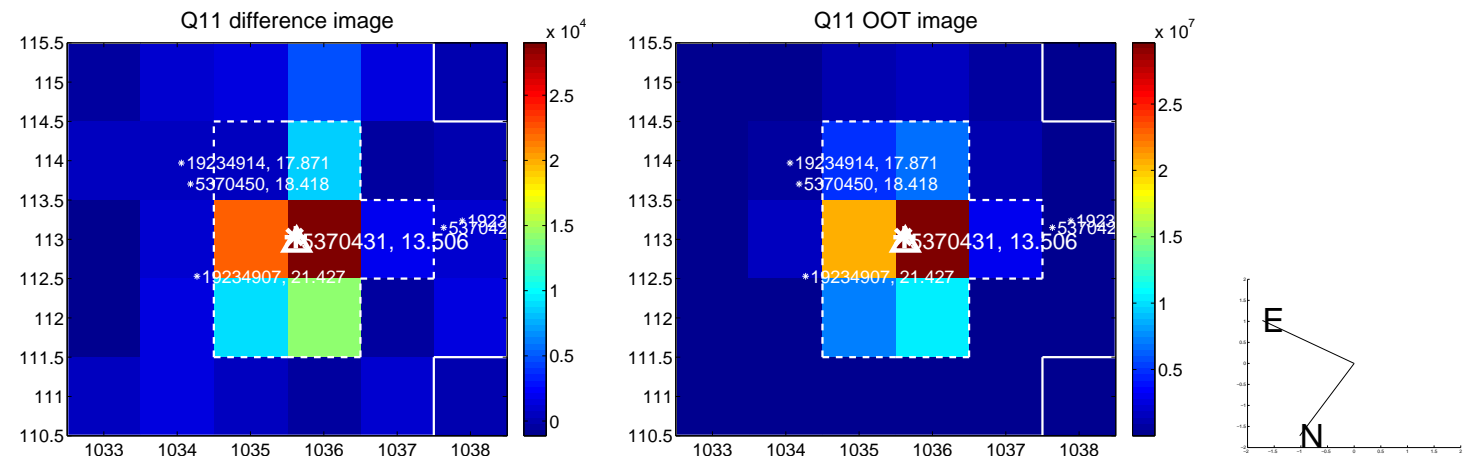
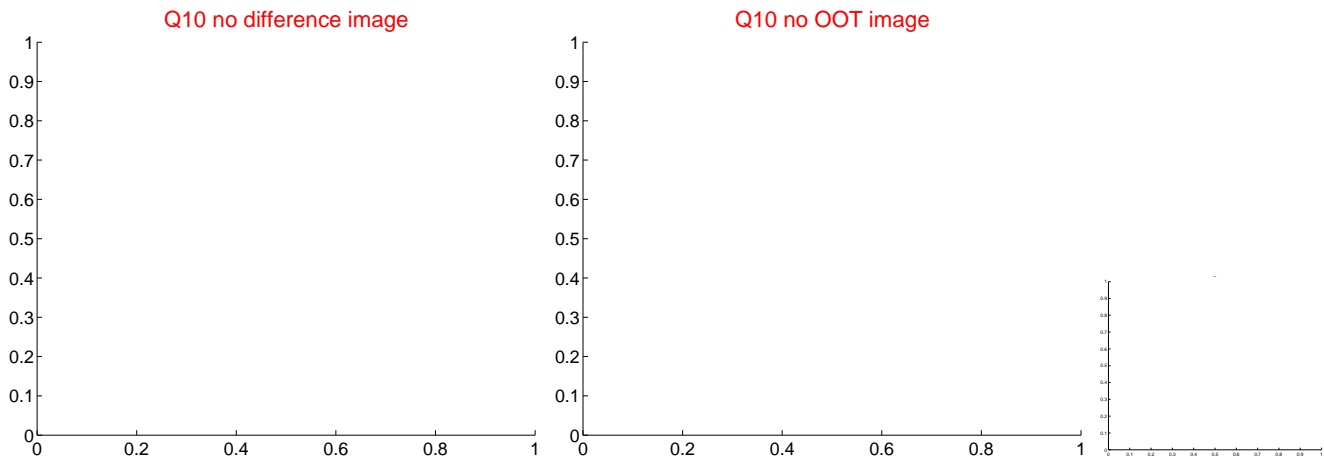
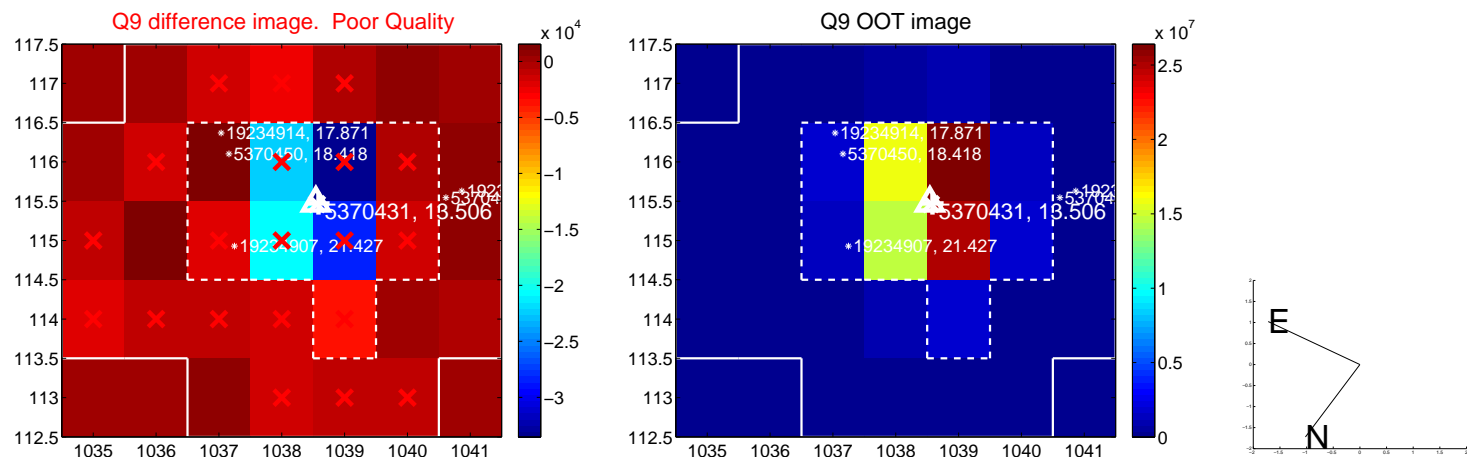
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



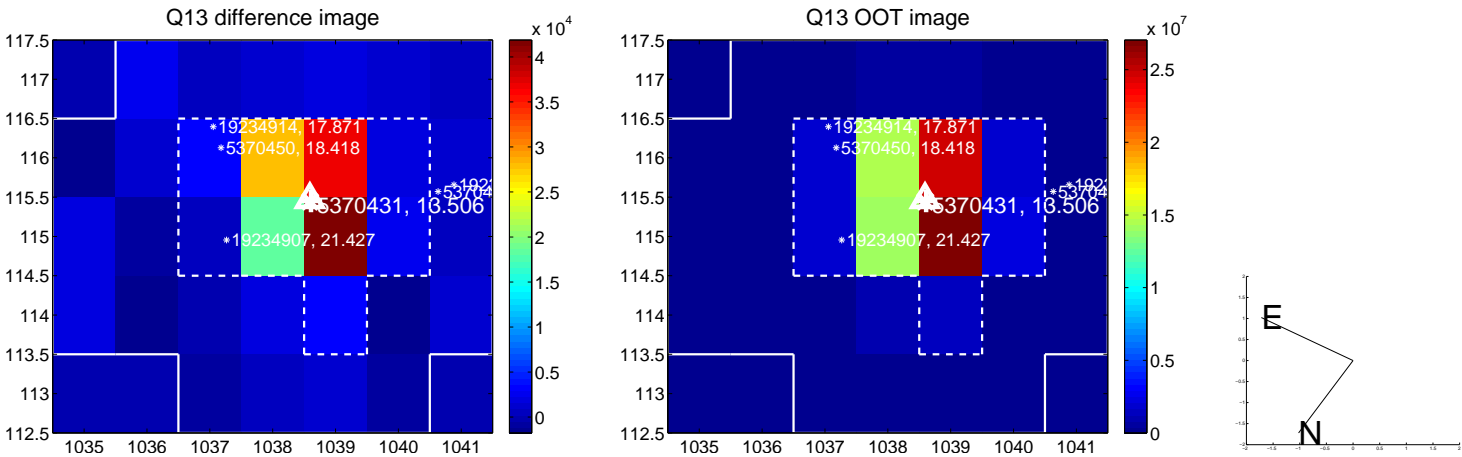
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



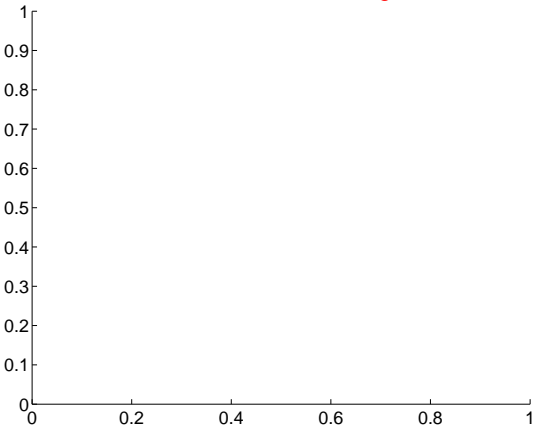
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



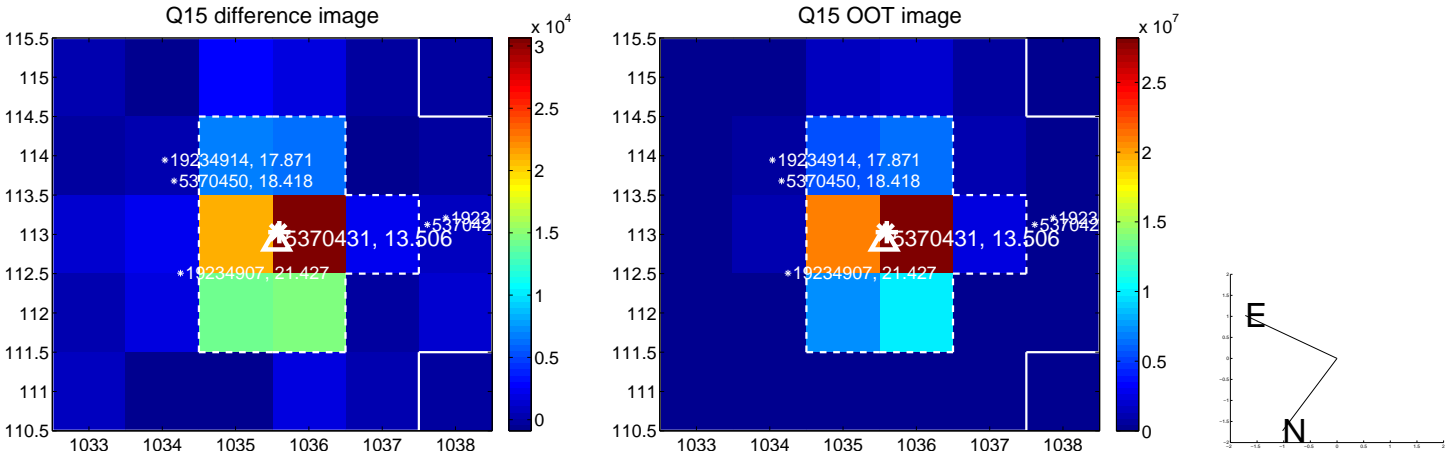
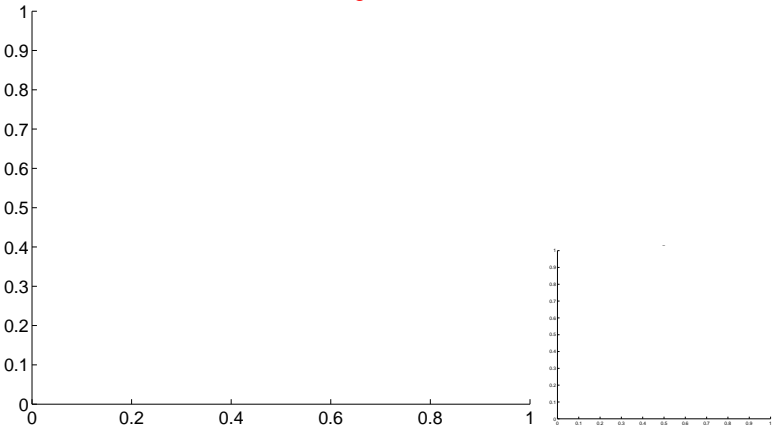
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



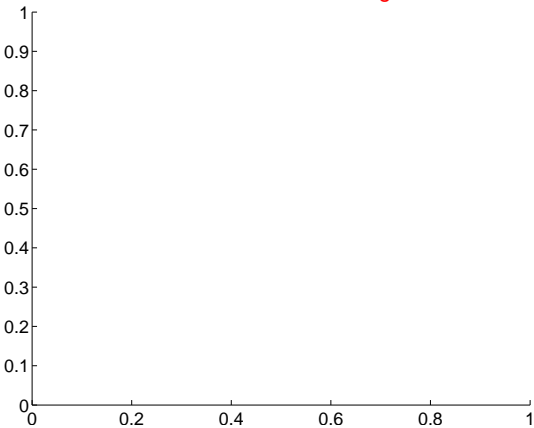
Q14 no difference image



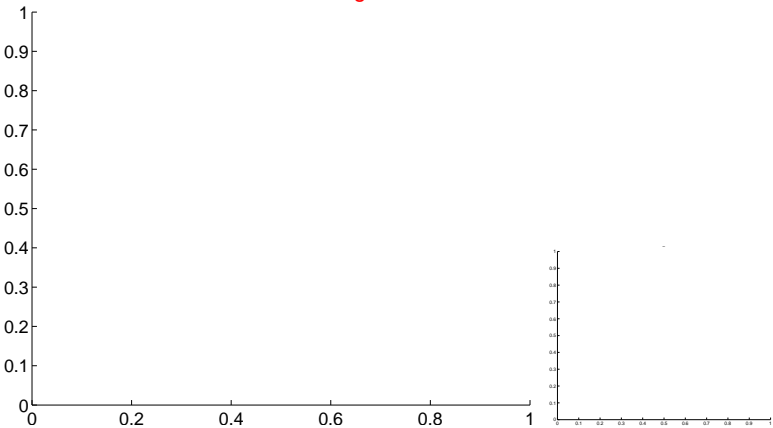
Q14 no OOT image



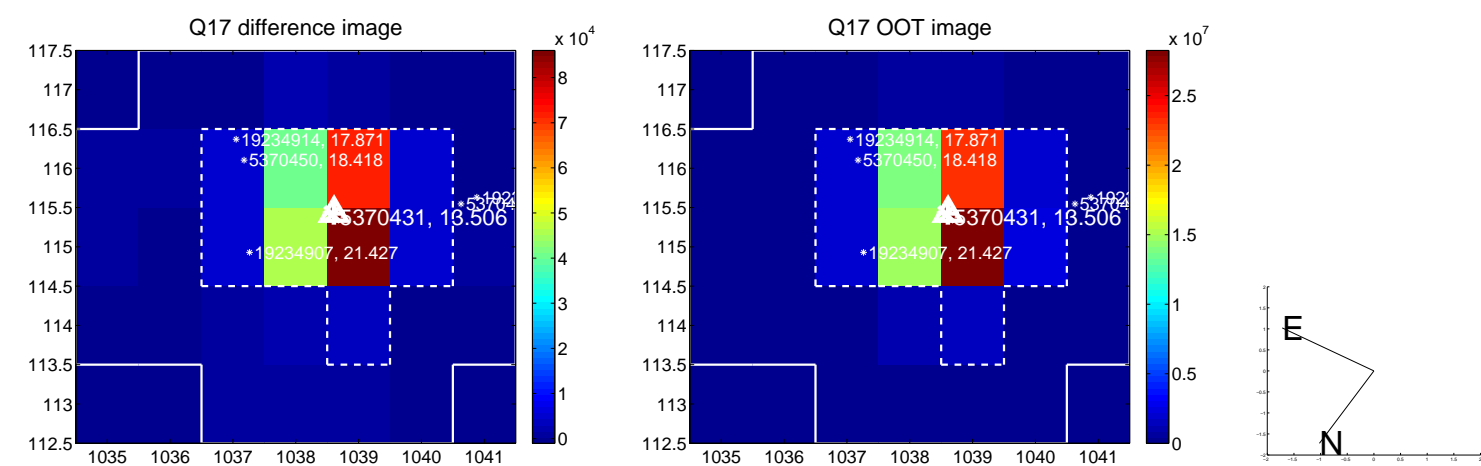
Q16 no difference image



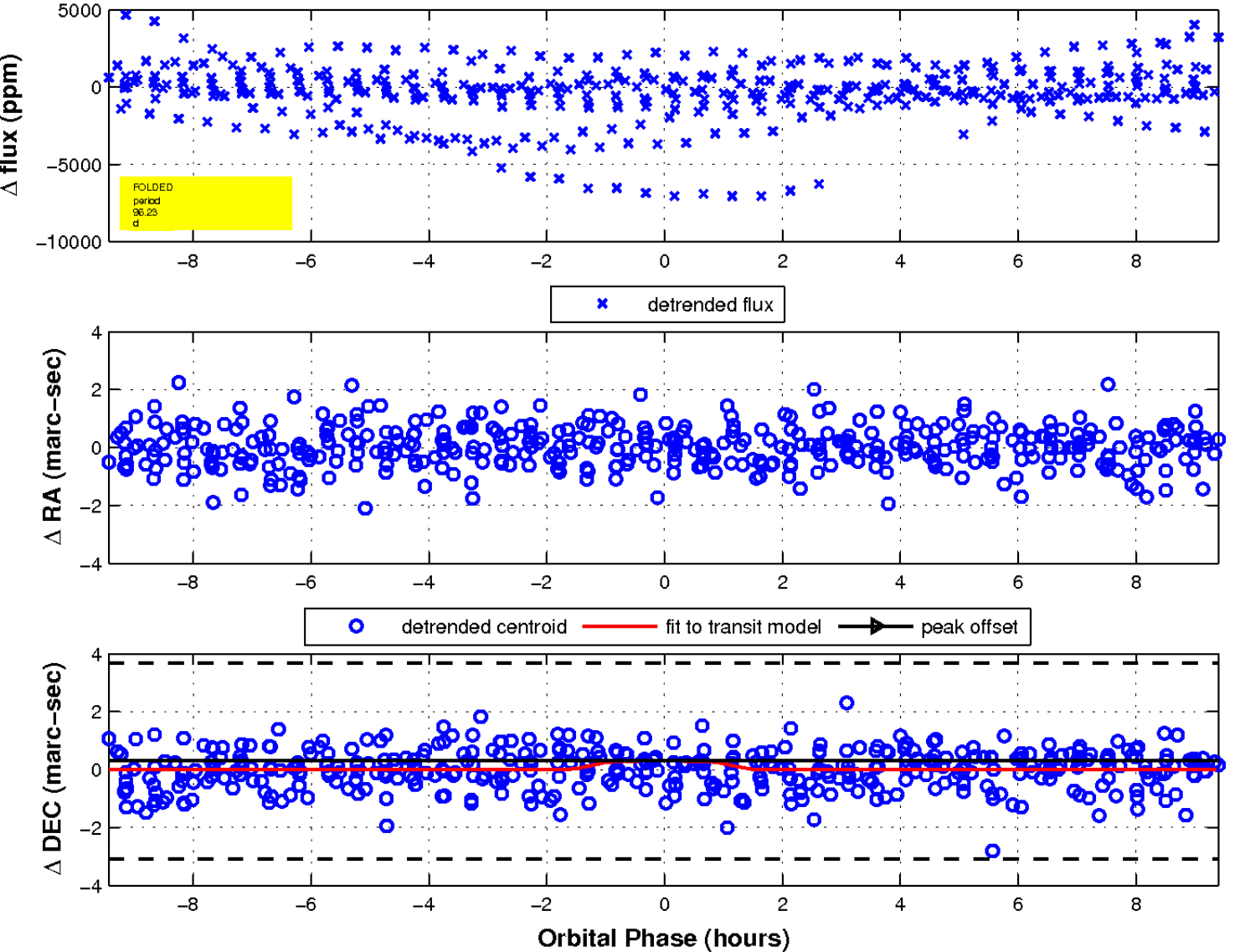
Q16 no OOT image



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

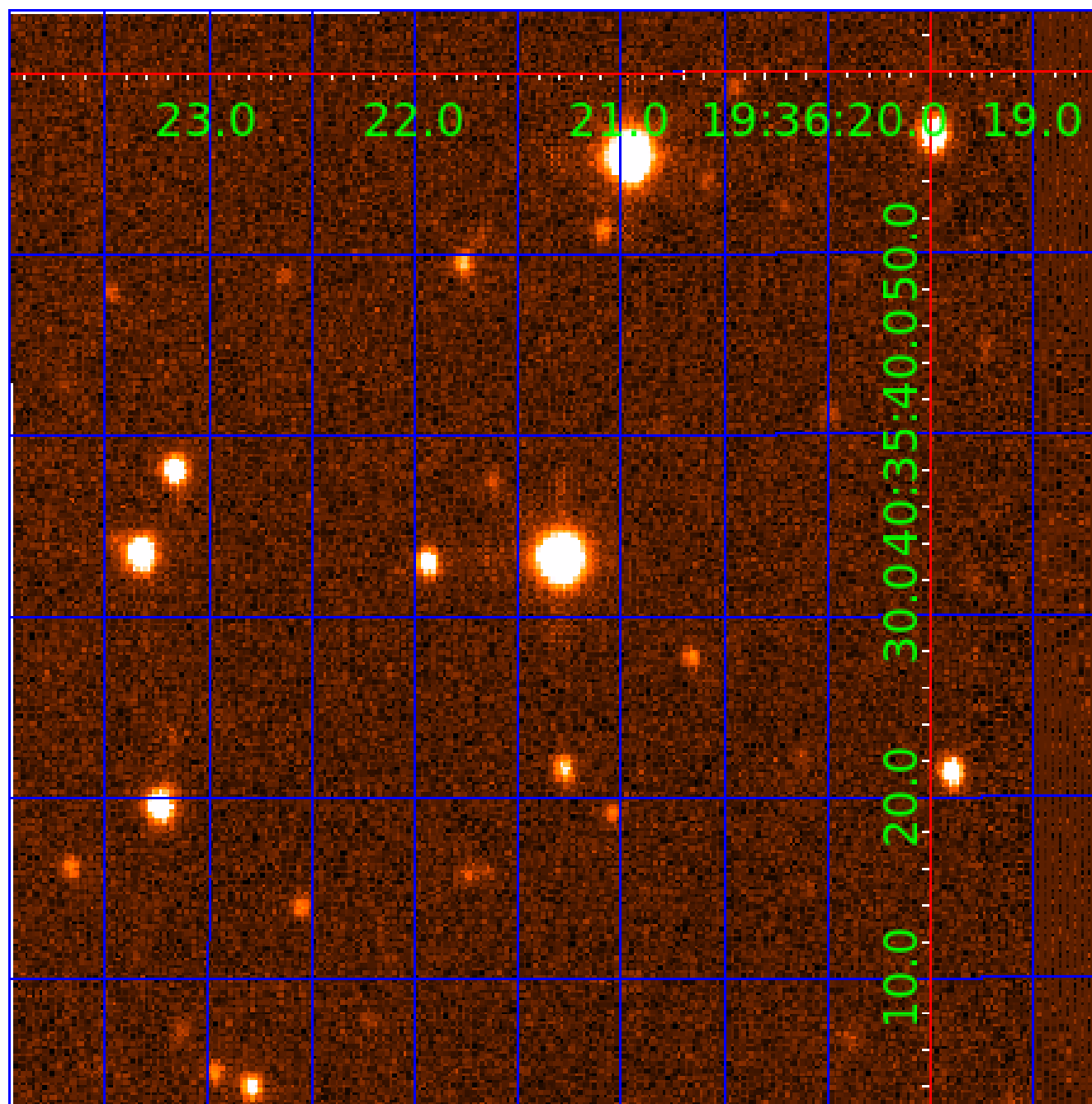


fluxWeightedCentroids, Planet 2 of 8



UKIRT Image

Declination





# KIC 005370431

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
005370431-01	OBS	No	0.781860	131.783803	10.8	5.471	8.4	1.8	1.45	7051	0.51	13492.79
005370431-02	OBS	No	96.227075	222.050583	2395.4	3.148	18.8	12.0	1.45	7051	8.36	22.04
005370431-03	OBS	No	32.784515	133.747890	1183.7	1.555	17.4	7.2	1.45	7051	5.46	92.62
005370431-04	OBS	No	19.539904	136.581723	146.8	0.581	15.7	0.4	1.45	7051	1.84	184.66
005370431-05	OBS	No	19.533730	136.876849	1023.5	2.075	18.2	9.7	1.45	7051	5.07	184.74
005370431-08	OBS	No	19.553301	143.887382	967.7	5.353	12.9	8.7	1.45	7051	8.41	184.49

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
005370431-01	OBS	FP	0.00	1	0	0	0	LPP_DV
005370431-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS
005370431-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_POS_ALT
005370431-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
005370431-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—HALO_GHOST
005370431-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

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

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

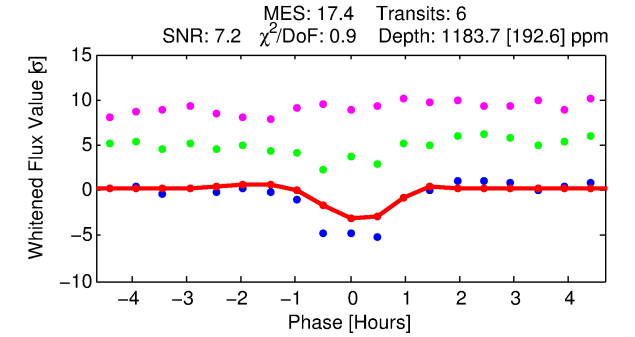
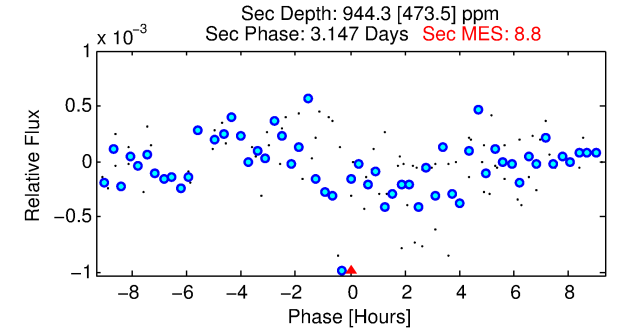
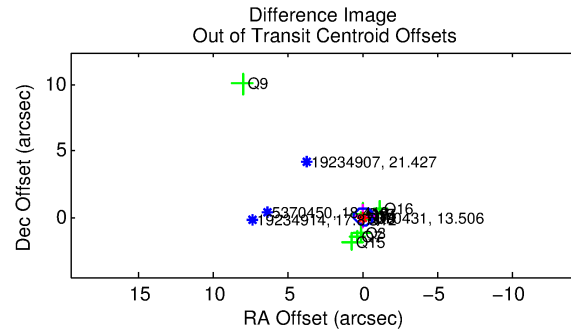
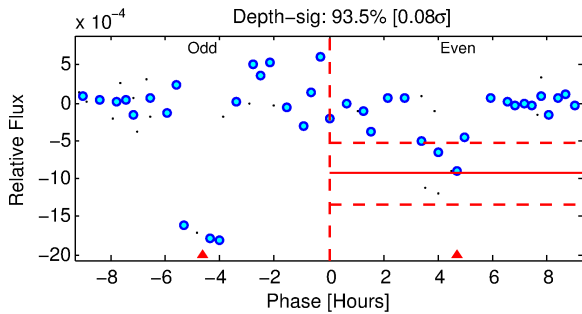
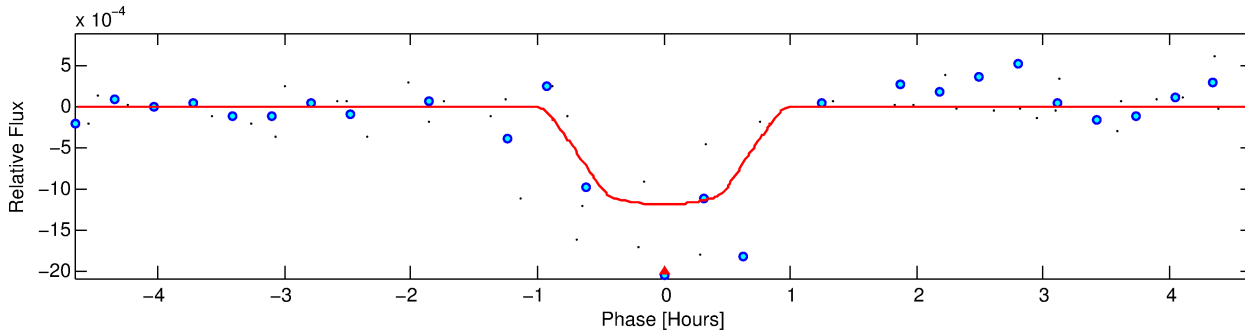
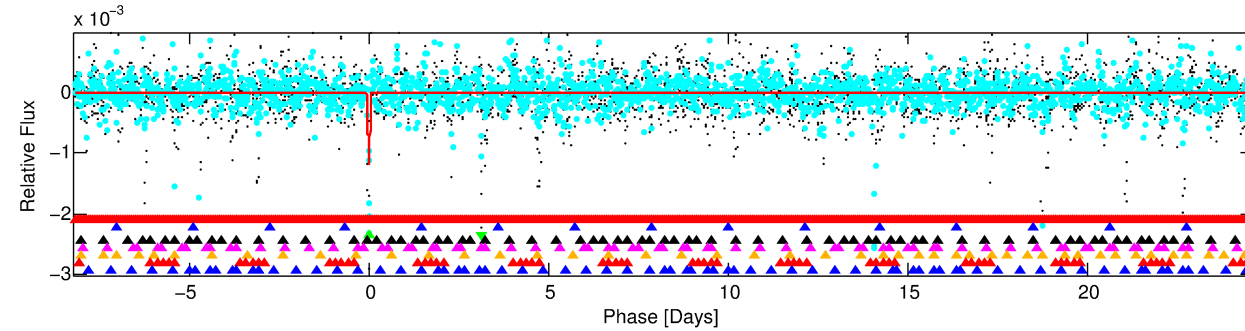
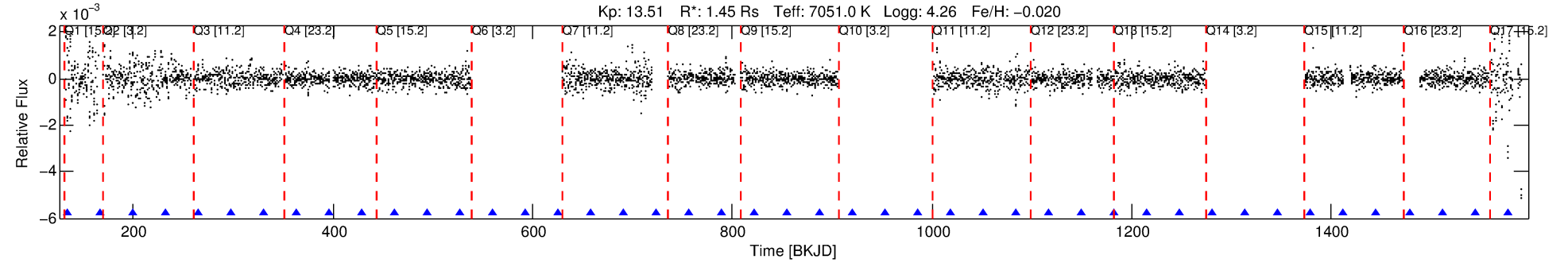
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 005370431-03

No Significant Match Found

# DV One-Page Summary

KIC: 5370431 Candidate: 3 of 8 Period: 32.785 d



## DV Fit Results:

Period = 32.78452 [0.00021] d  
Epoch = 133.7479 [0.0054] BKJD  
Rp/R\* = 0.0344 [0.0507]  
a/R\* = 113.56 [983.76]  
b = 0.76 [4.94]  
Seff = 92.62 [41.59]  
Teq = 791 [89] K  
Rp = 5.46 [8.27] Re  
a = 0.2248 [0.0658] AU  
Ag = 881.91 [2660.11] [0.33 $\sigma$ ]  
Teffp = 6665 [4988] K [1.18 $\sigma$ ]

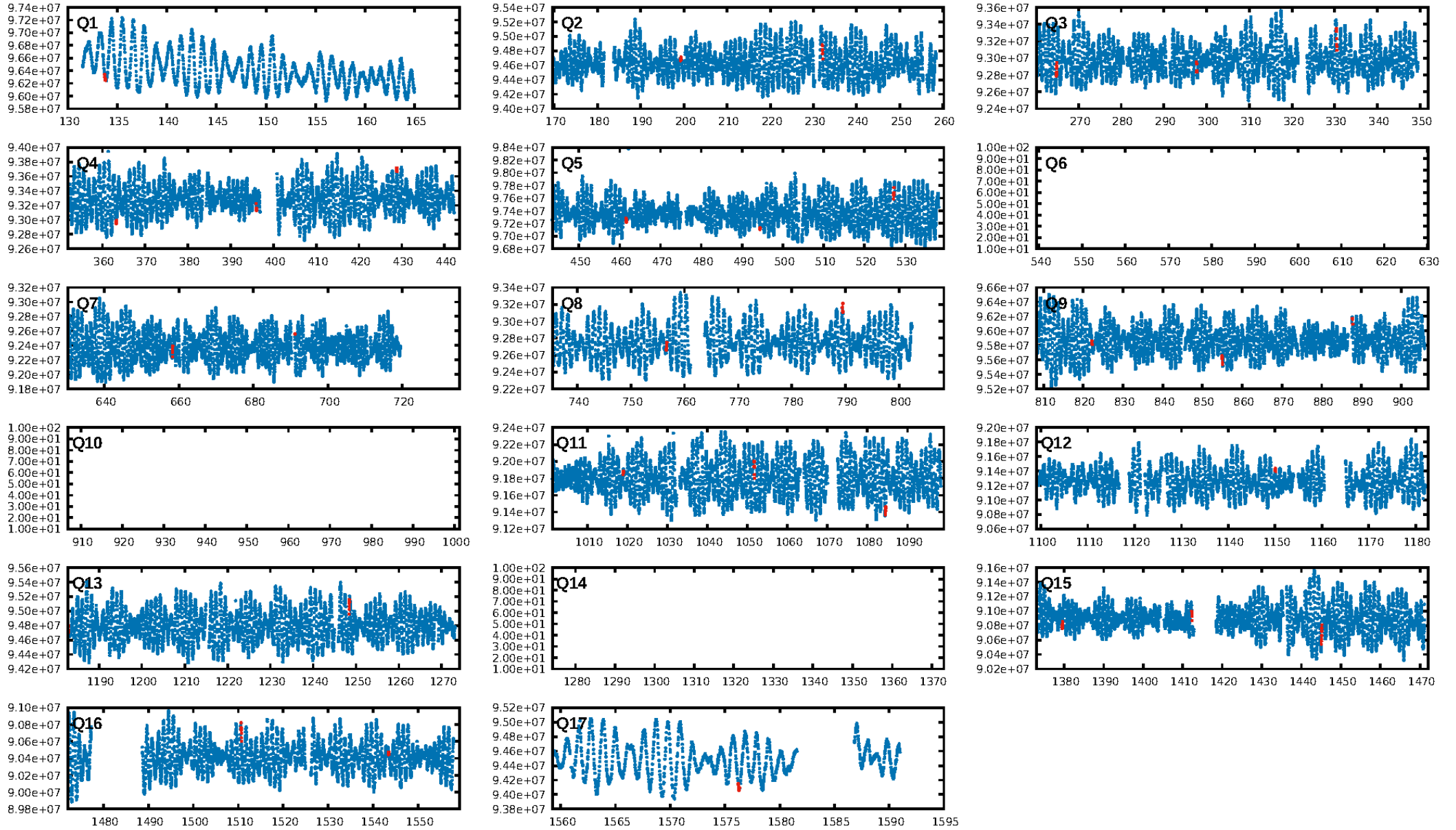
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [12.09 $\sigma$ ]  
LongPeriod-sig: 100.0% [433.59 $\sigma$ ]  
ModelChiSquare2-sig: 79.6%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 1.68e-47  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: 0.5764  
Centroid-sig: N/A  
Centroid-so: 0.344 arcsec [1.76 $\sigma$ ]  
OotOffset-rm: 0.137 arcsec [0.65 $\sigma$ ]  
KicOffset-rm: 0.181 arcsec [0.37 $\sigma$ ]  
OotOffset-st: 1/4/3/4 [12]  
KicOffset-st: 1/4/3/4 [12]  
DiffImageQuality-fgm: 0.50 [6/12]  
DiffImageOverlap-fno: 0.21 [3/14]

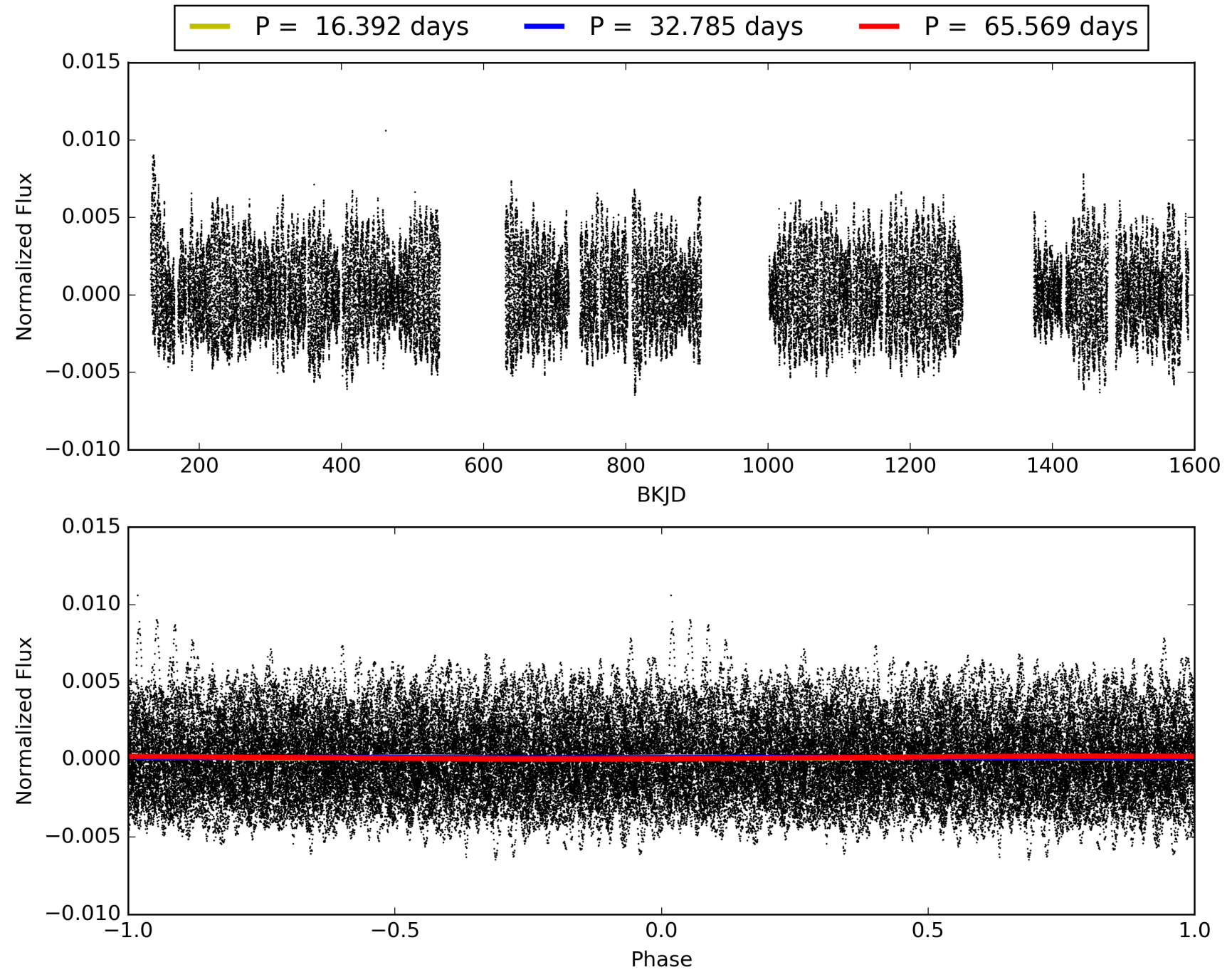
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 02:17:17 Z

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

# TCE 005370431-03, PDC Light Curves

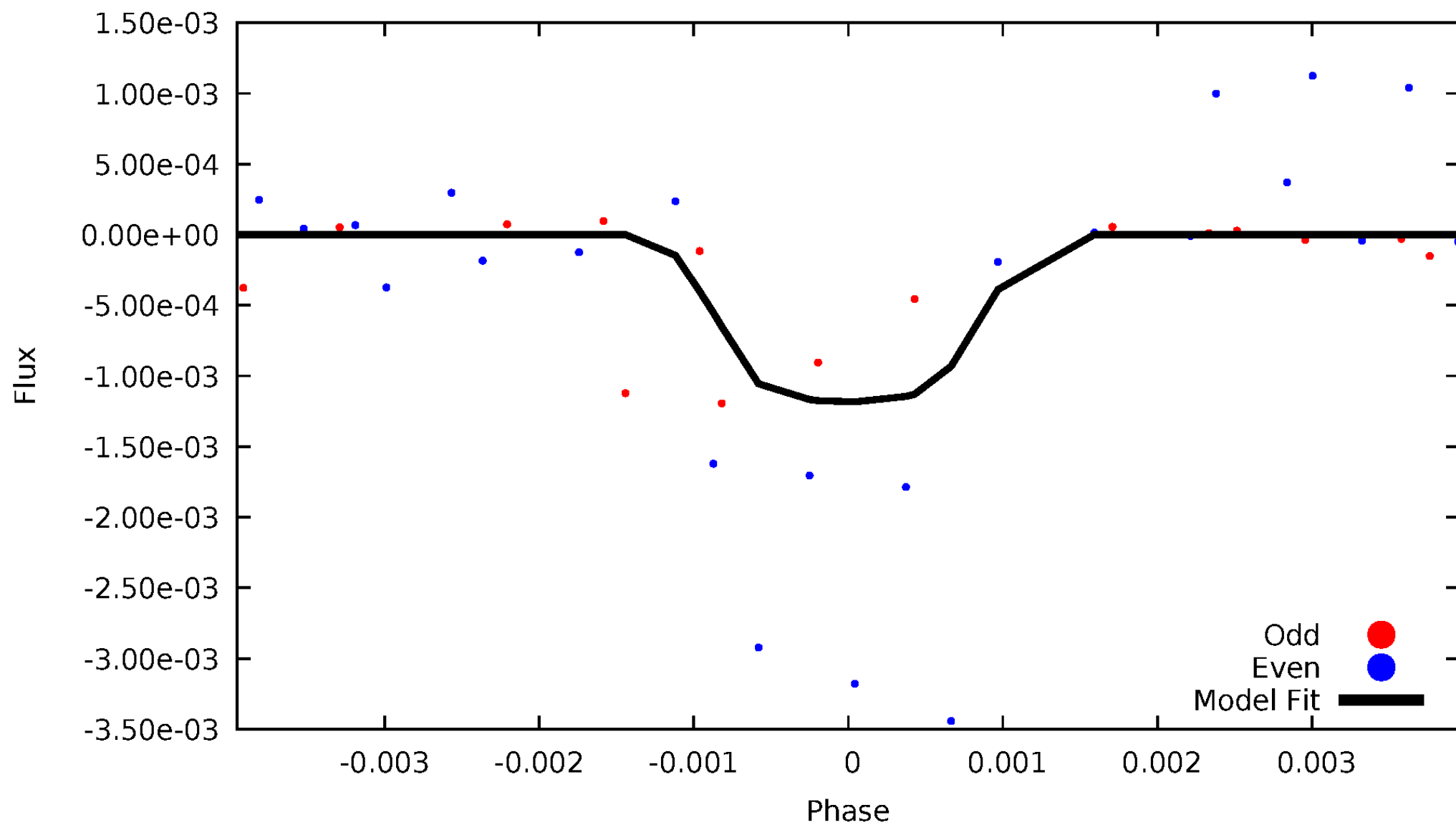


# TCE 005370431-03



# DV Odd/Even

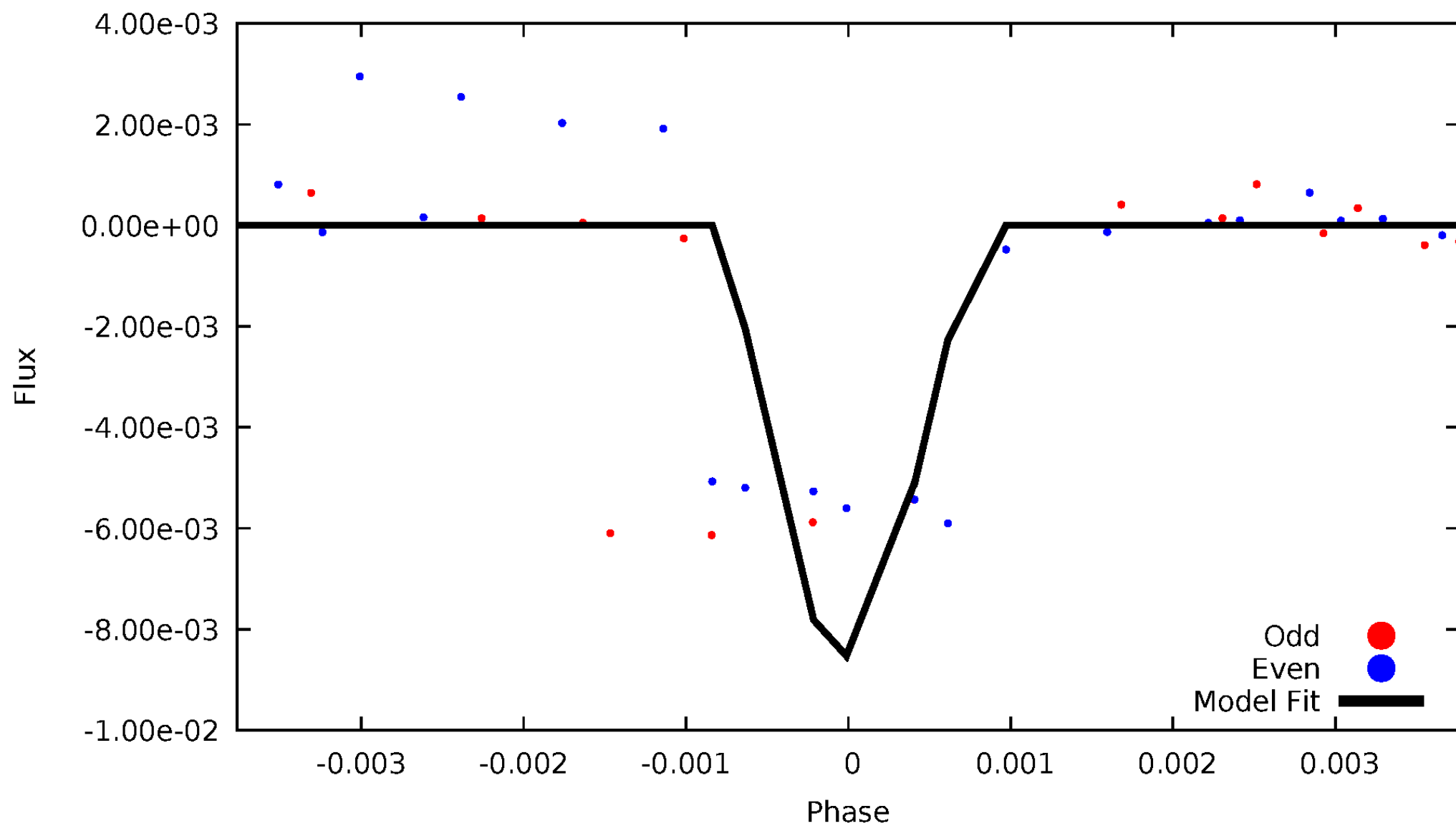
TCE 005370431-03





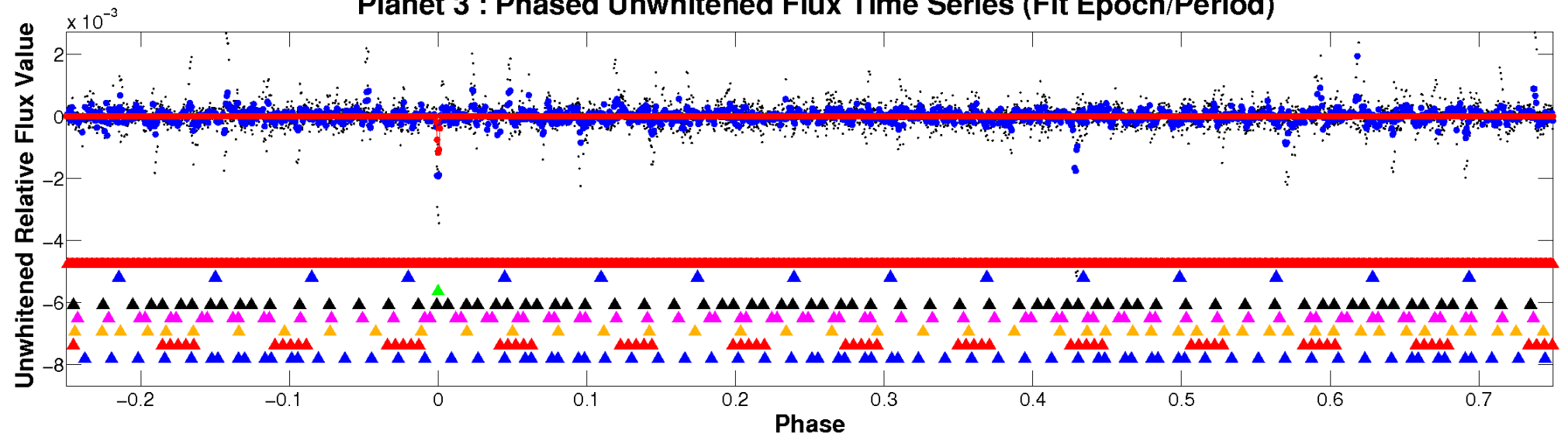
# ALT Odd/Even

TCE 005370431-03

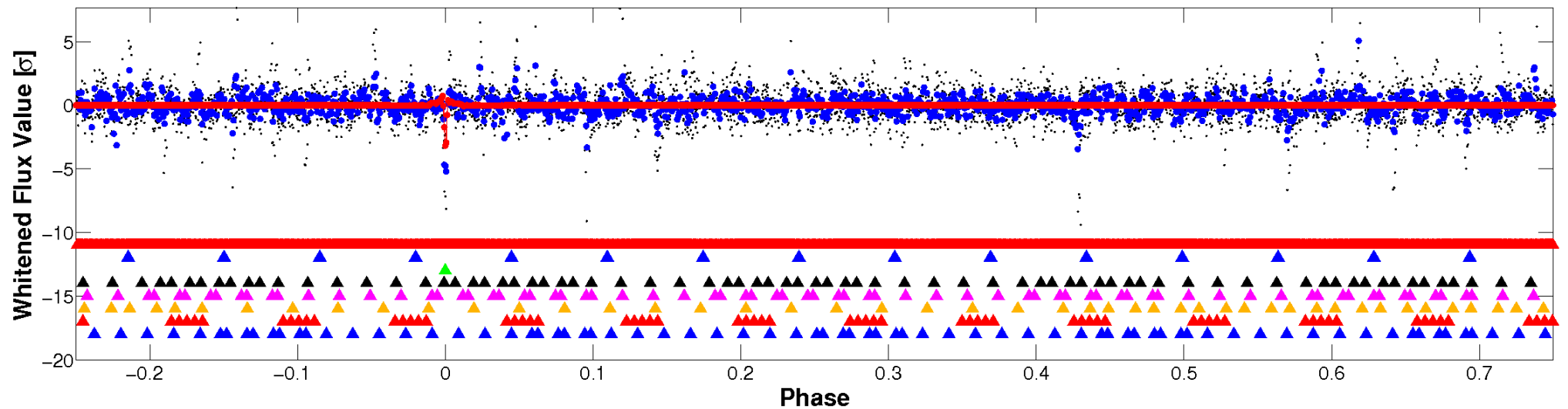


# Non-Whitened Vs. Whitened Light Curve

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

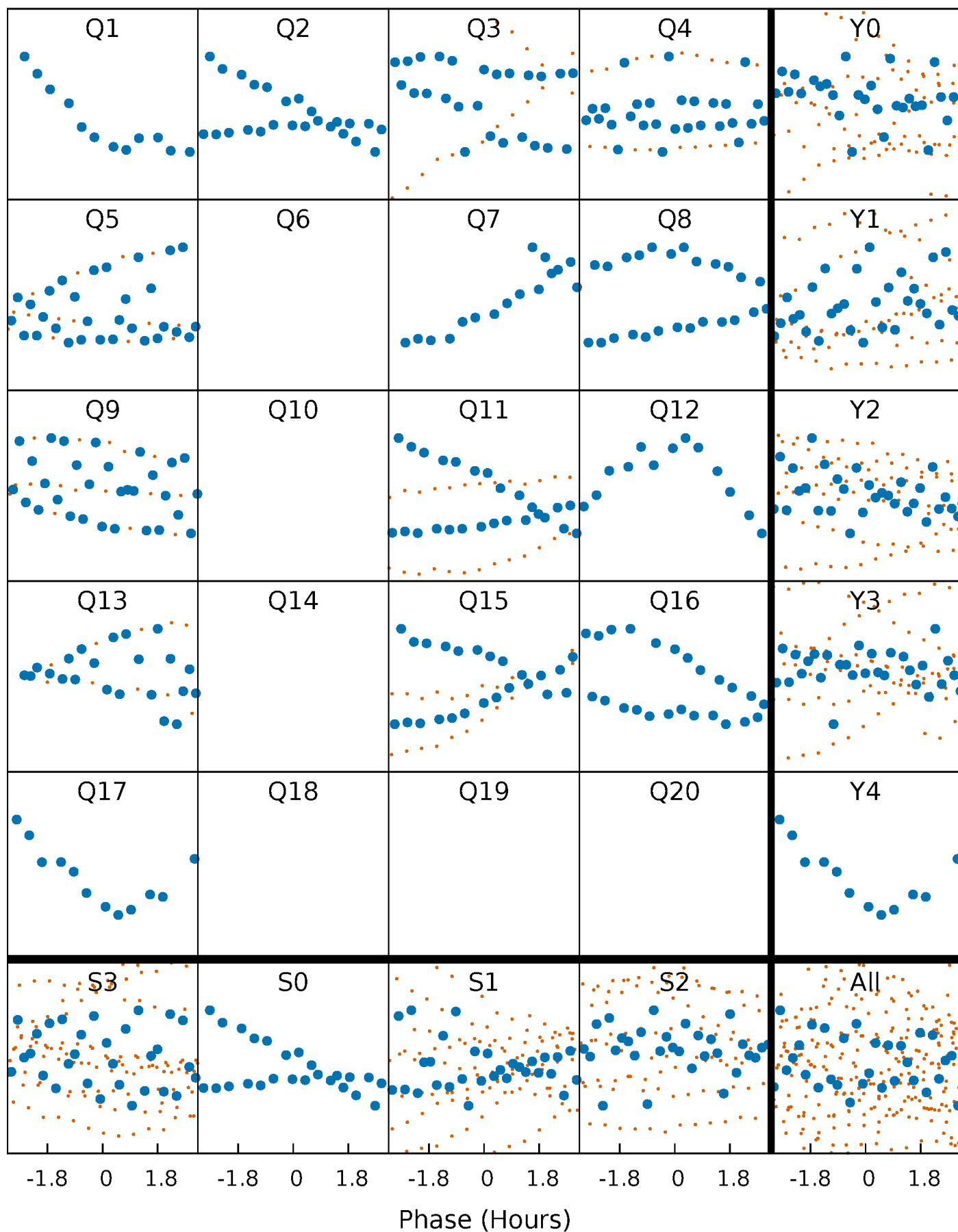


## Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



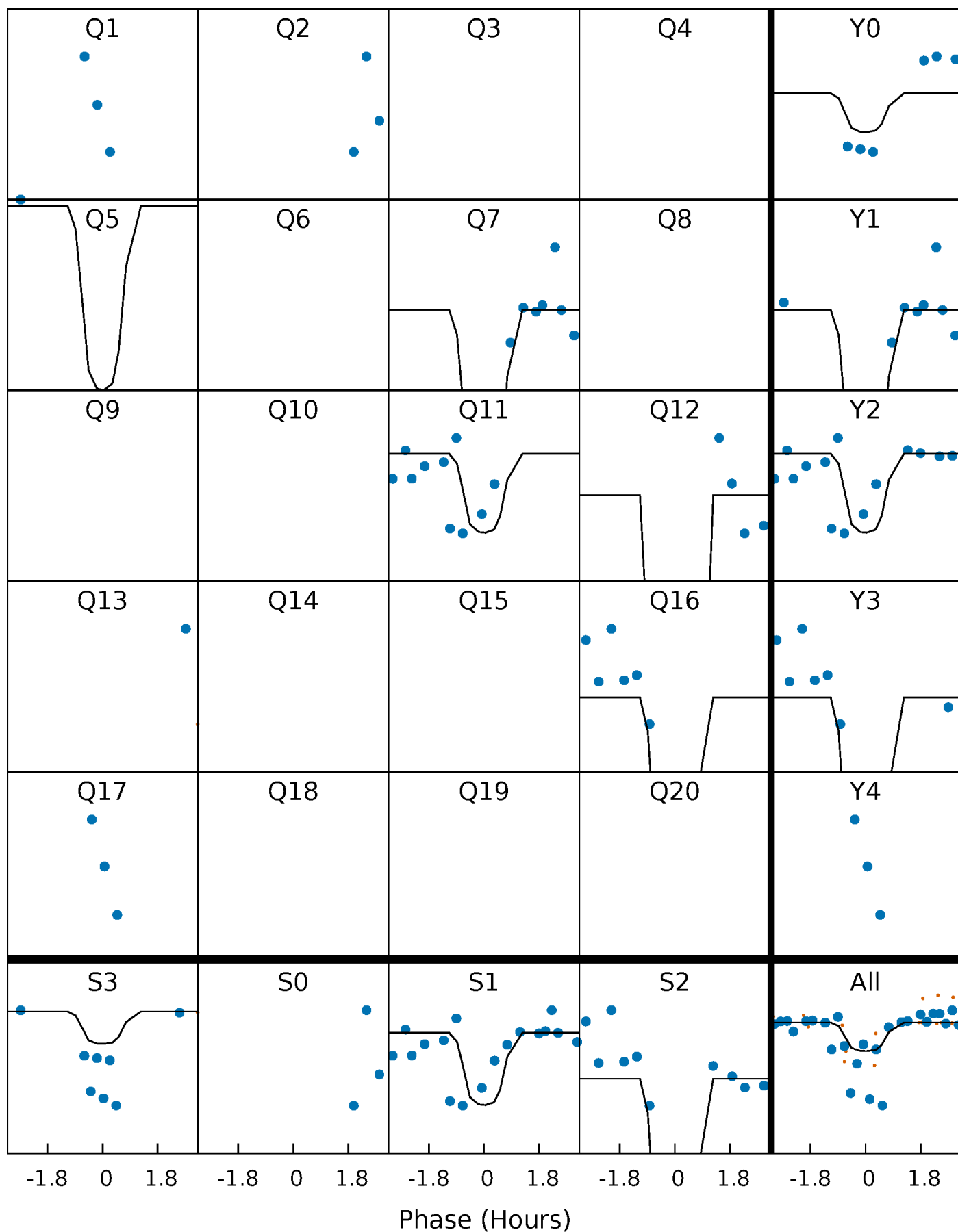
# PDC Quarter-Phased Transit Curves

TCE 005370431-03 P= 32.784515 Days  $T_0=133.747890$  (BKJD)



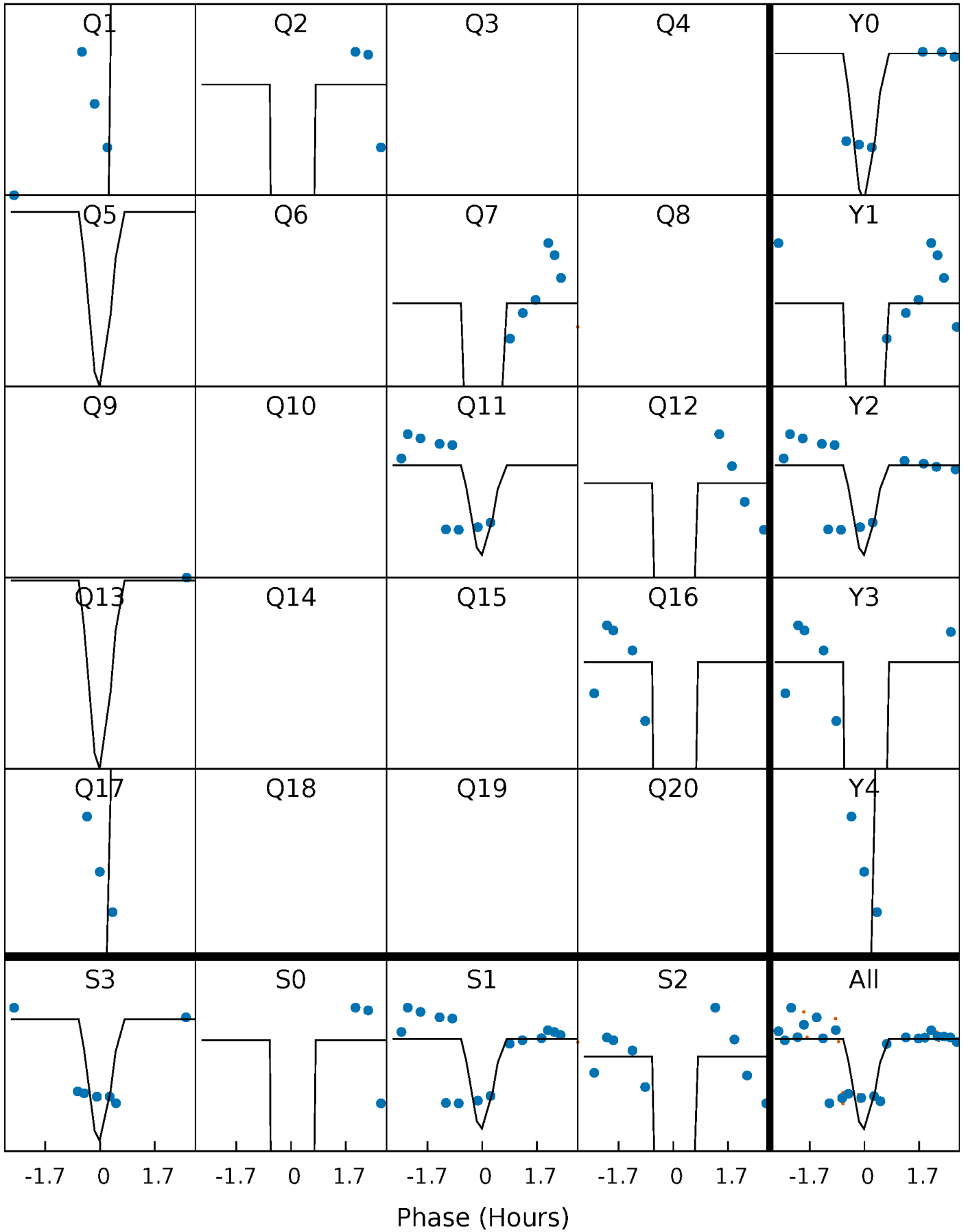
# DV Quarter-Phased Transit Curves

TCE 005370431-03   P= 32.784515 Days    $T_0=133.747890$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

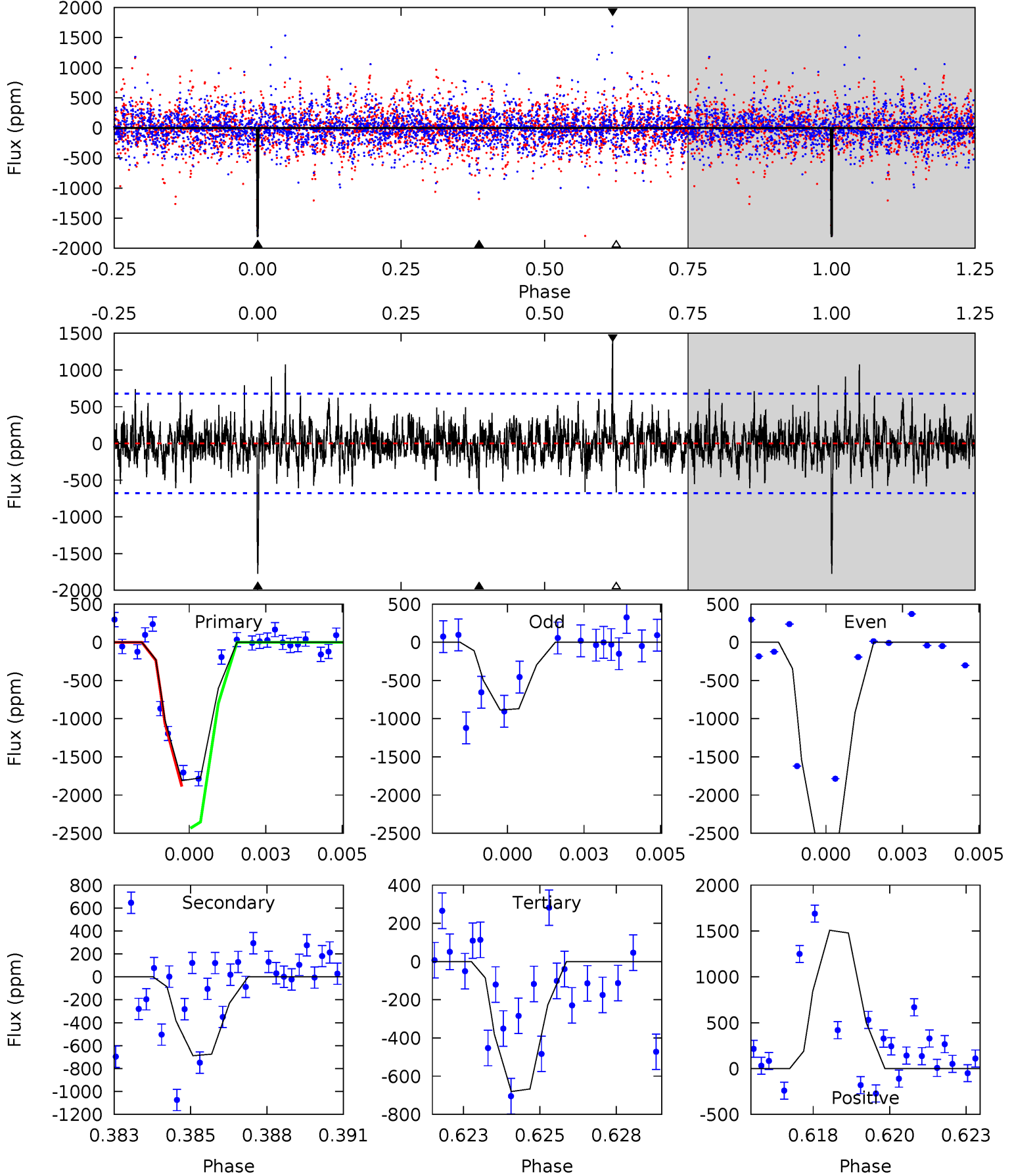
TCE 005370431-03     $P = 32.784582$  Days     $T_0 = 133.746721$  (BKJD)



# DV Model-Shift Uniqueness Test

005370431-03, P = 32.784515 Days, E = 100.963375 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
13.9	5.26	5.20	11.5	5.28	3.02	1.54	8.65	2.32	0.06	-6.27	7.54	1.09	0.45	0

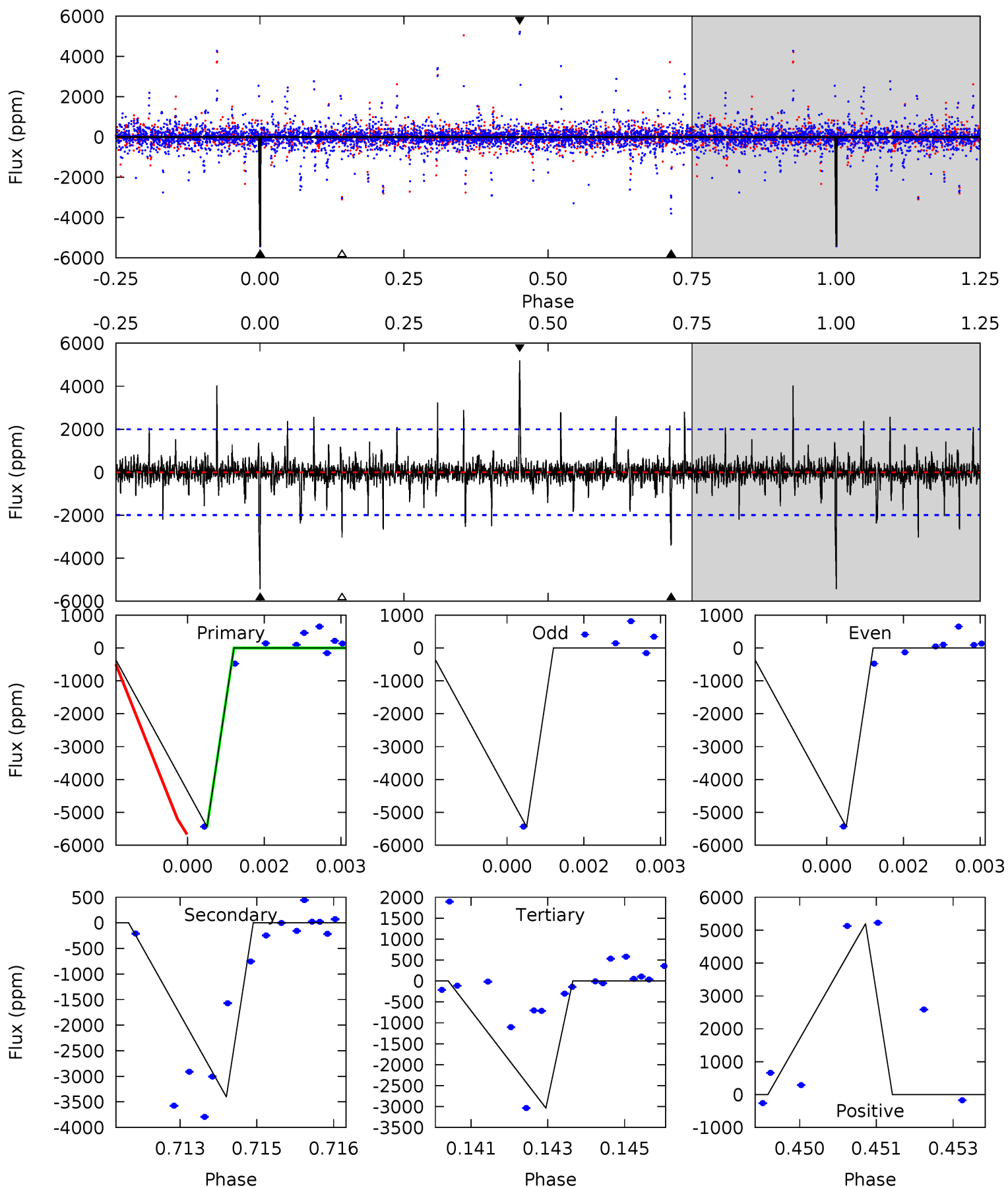




# Alt Model-Shift Uniqueness Test

005370431-03, P = 32.784582 Days, E = 100.962139 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
14.6	9.16	8.18	14.0	5.37	3.15	1.13	6.46	0.66	0.98	-4.83	0.00	0.99	0.49	0.46



### Stellar Parameters For KIC 005370431

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$7051^{+194}_{-315}$	$4.262^{+0.073}_{-0.218}$	$-0.020^{+0.200}_{-0.350}$	$1.454^{+0.524}_{-0.225}$	$1.409^{+0.222}_{-0.202}$	$0.645^{+0.254}_{-0.347}$
	+3%/-4%	+2%/-5%	+1000%/-1750%	+36%/-15%	+16%/-14%	+39%/-54%
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 005370431-03 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-675 \pm 128$	$8.78^{+6.93}_{-5.61}$	$1122^{+96}_{-66}$	$5005^{+3282}_{-1057}$	$235^{+1478}_{-163}$
Alt.	$-3397 \pm 371$	$15.56^{+8.29}_{-8.19}$	$1125^{+97}_{-70}$	$5545^{+2739}_{-950}$	$383^{+1337}_{-224}$

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

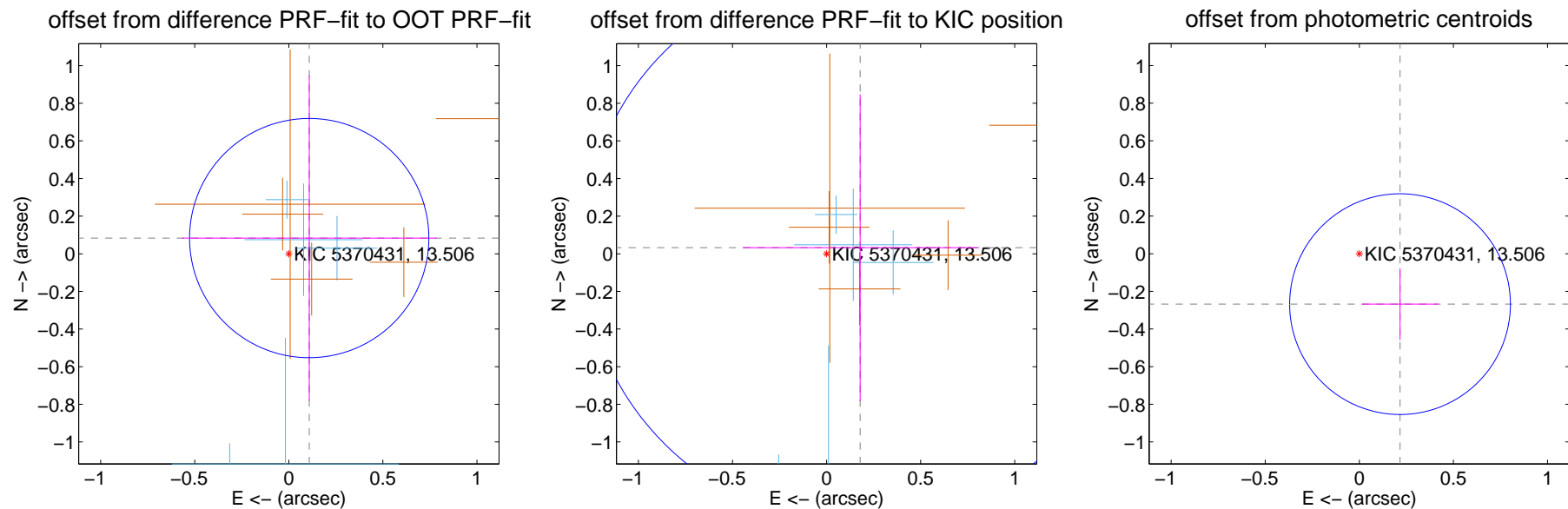
## DV Centroid Data

Supplemental centroid analysis for 005370431-03. Kepler magnitude: 13.51. Transit SNR 7.16

There are 6 quarters with good PRF difference image offsets

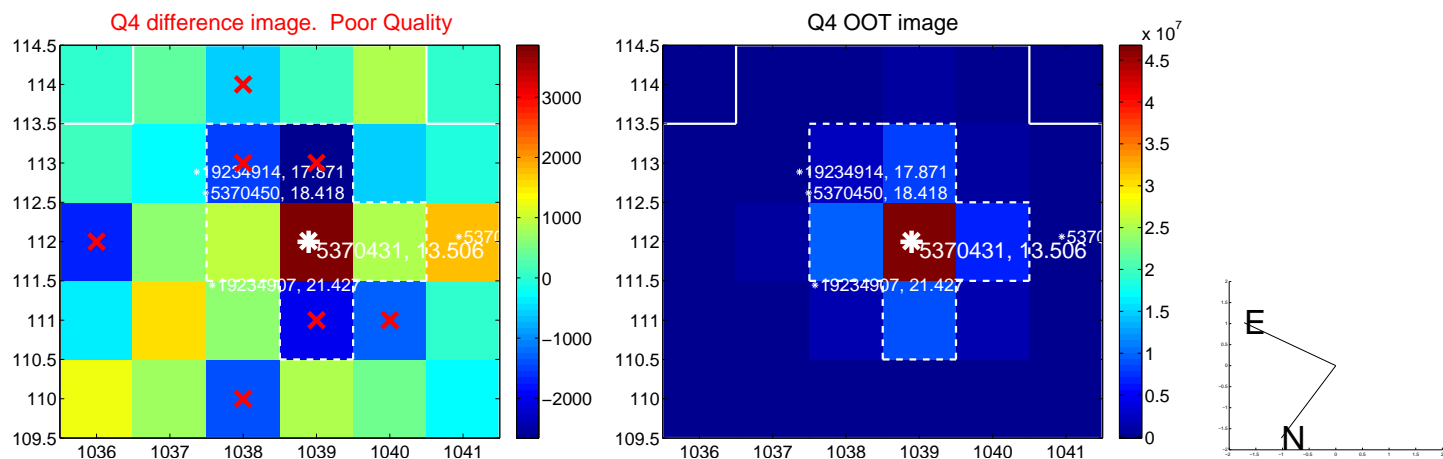
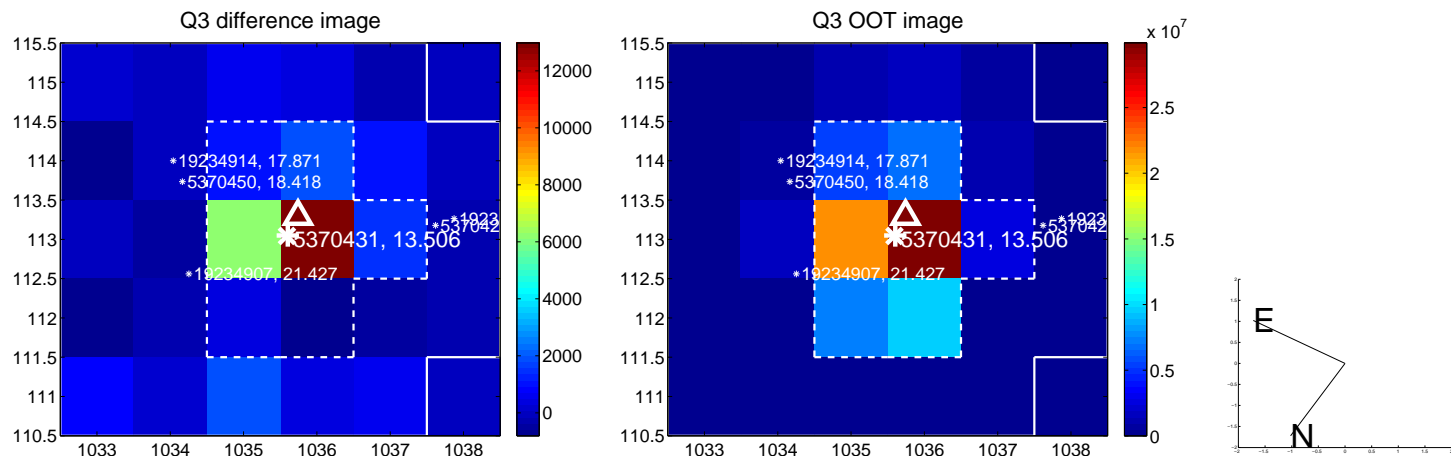
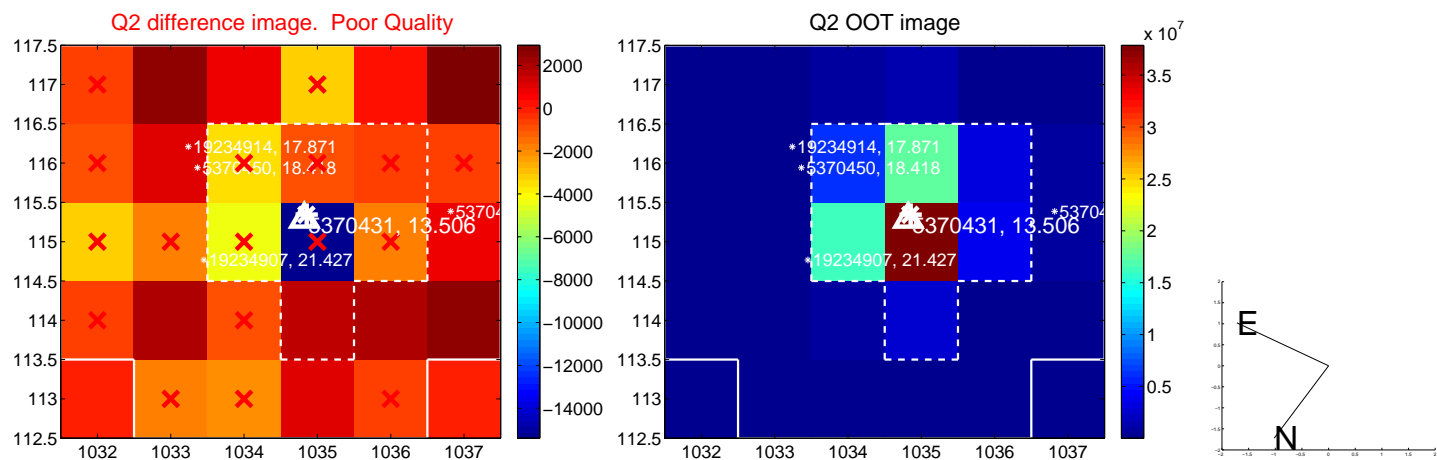
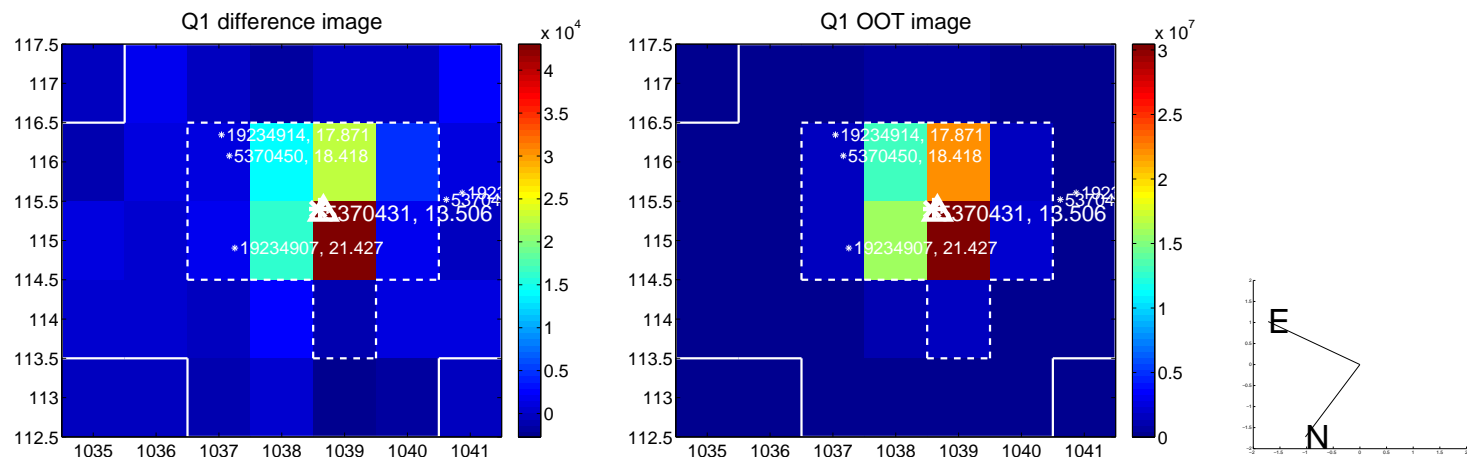
The direct PRF centroid is offset from the target star catalog position by about 0.10 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.137 \pm 0.212$	0.65	$-0.108 \pm 0.676$	$0.083 \pm 0.864$
PRF-fit source offset from KIC position	$0.181 \pm 0.491$	0.37	$-0.178 \pm 0.624$	$0.032 \pm 0.815$
photometric centroid source offset	$0.34 \pm 0.20$	1.76	$-0.22 \pm 0.20$	$-0.27 \pm 0.19$

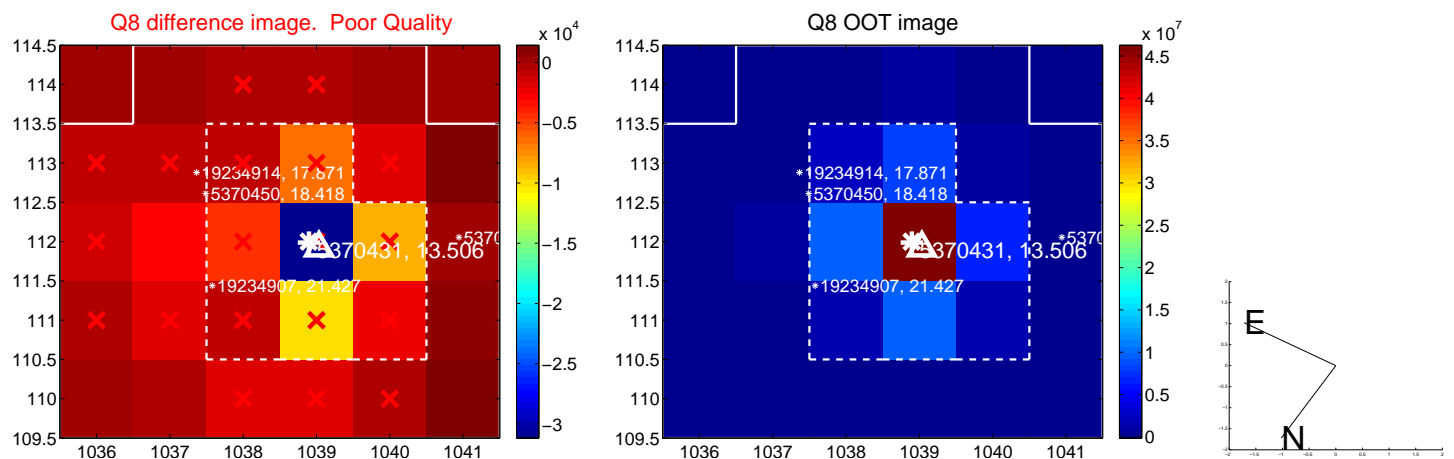
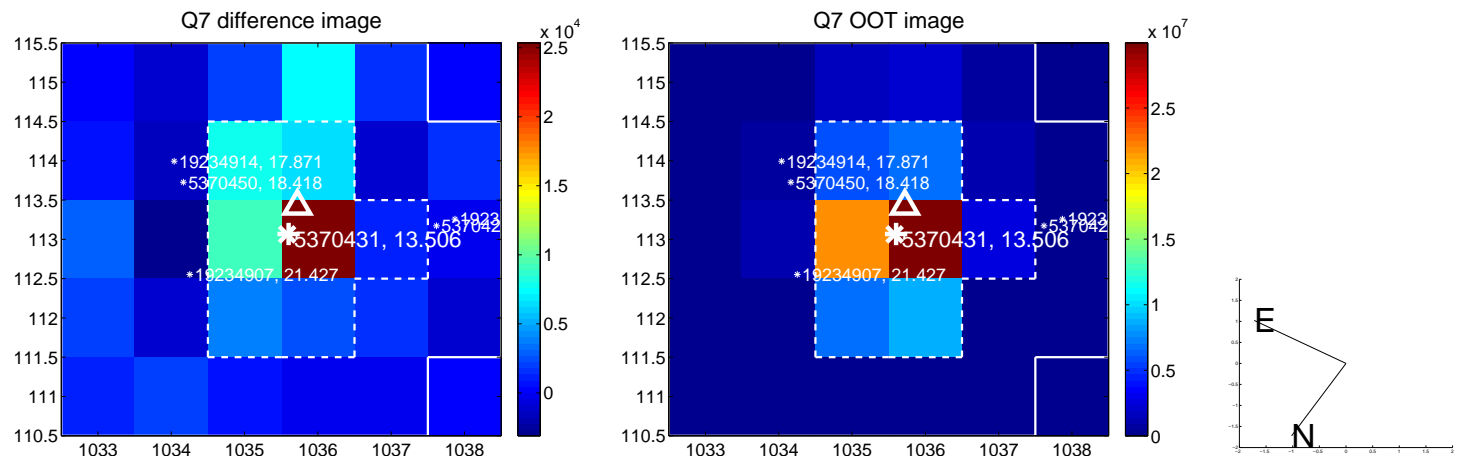
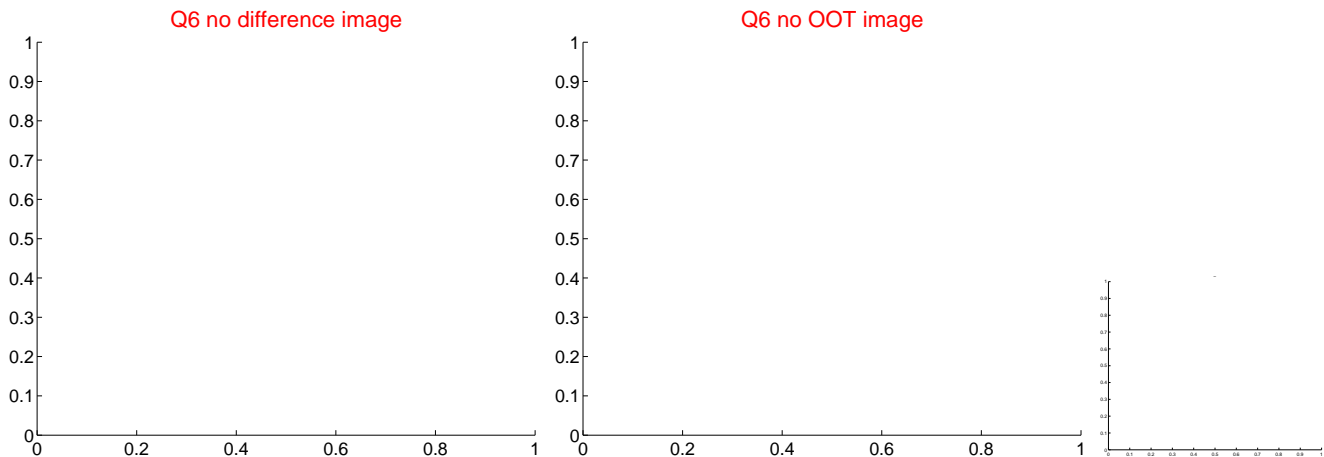
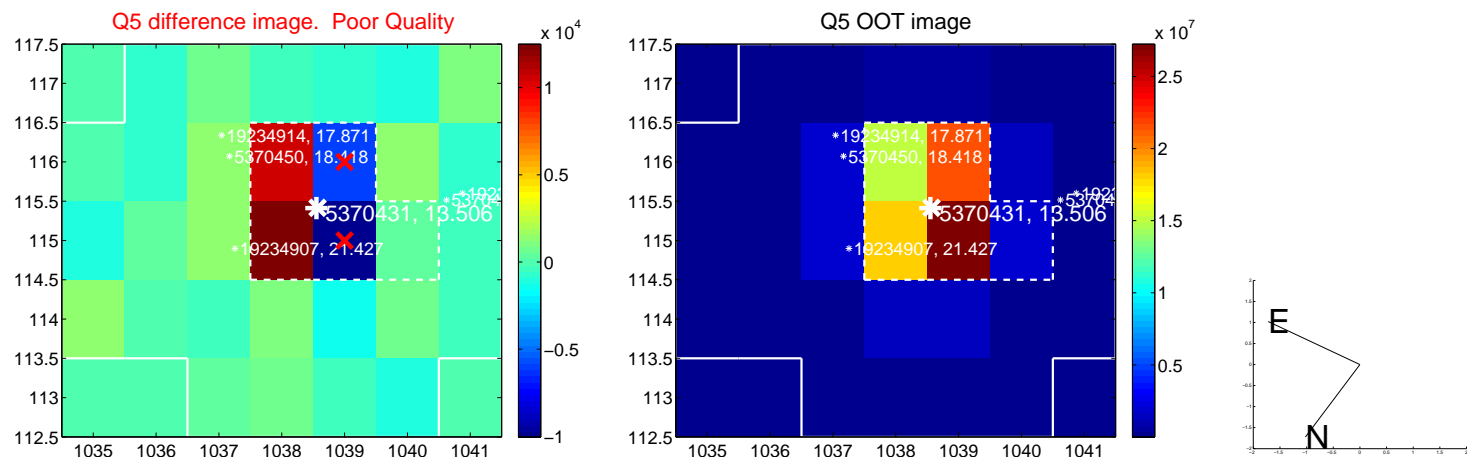


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

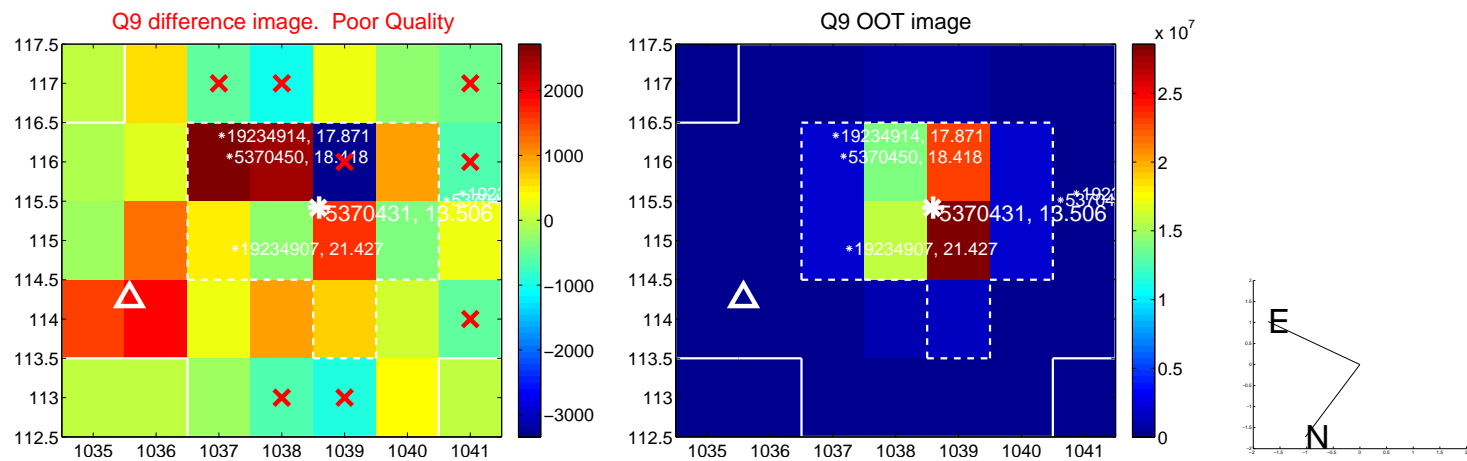
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



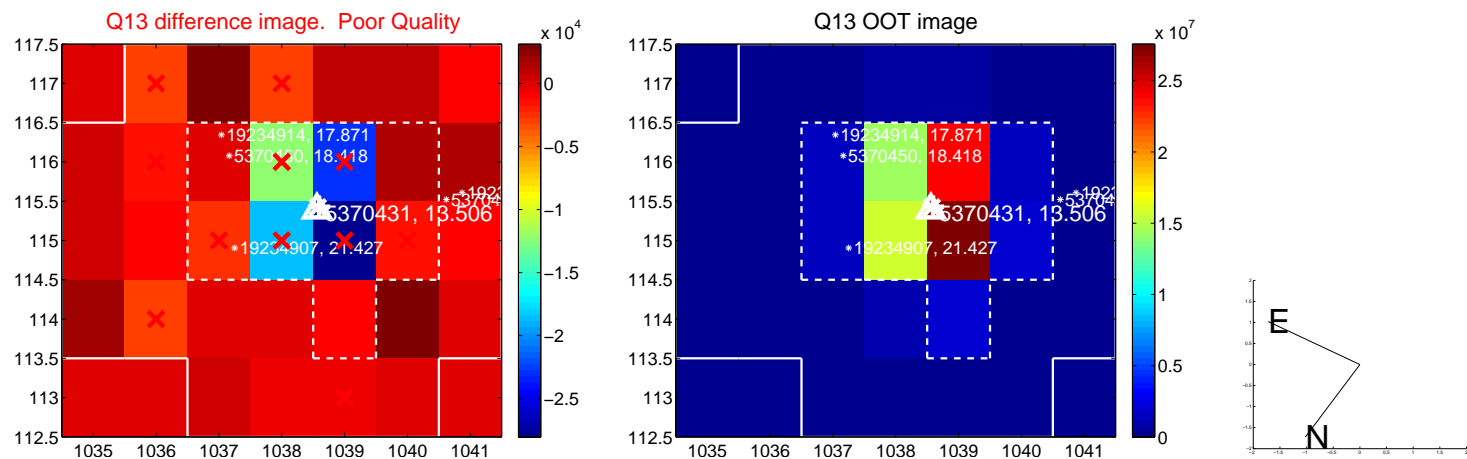
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

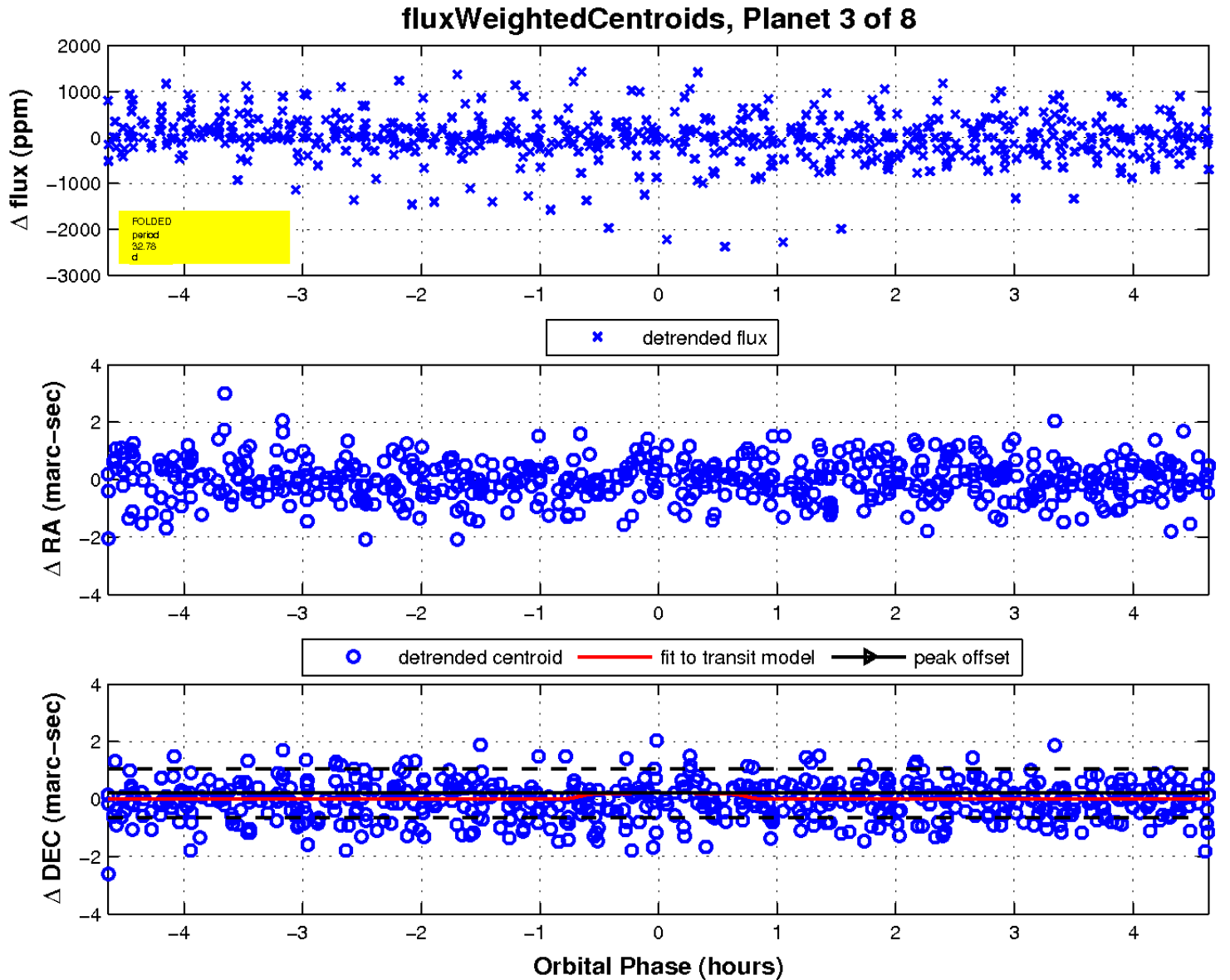
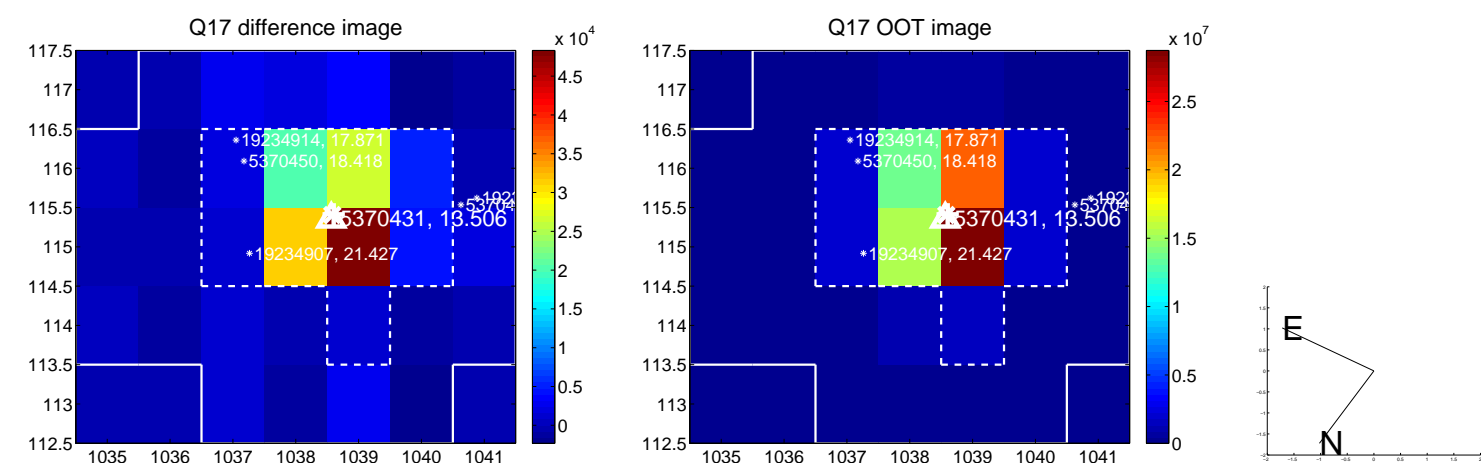


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



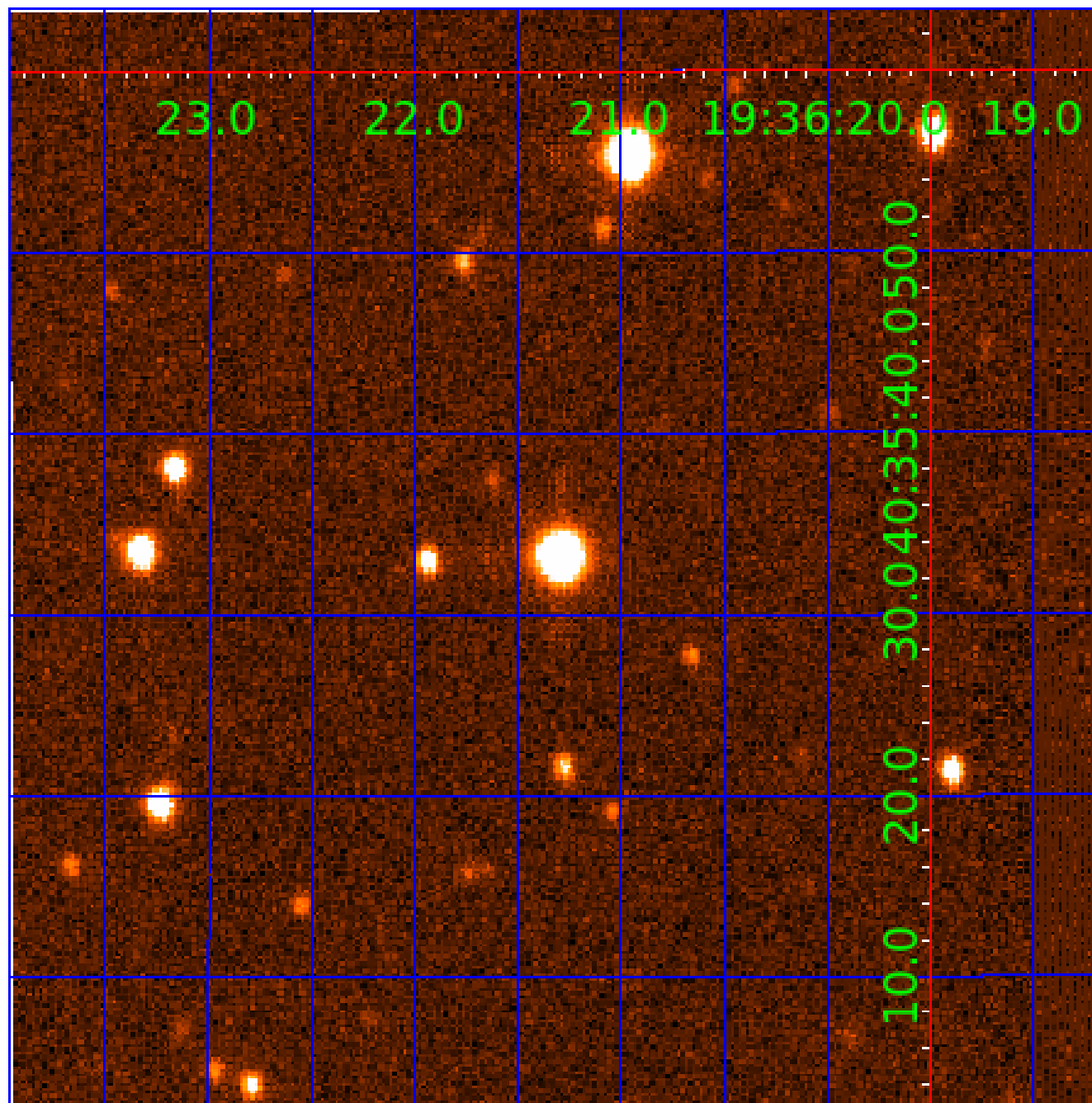


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 005370431

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
005370431-01	OBS	No	0.781860	131.783803	10.8	5.471	8.4	1.8	1.45	7051	0.51	13492.79
005370431-02	OBS	No	96.227075	222.050583	2395.4	3.148	18.8	12.0	1.45	7051	8.36	22.04
005370431-03	OBS	No	32.784515	133.747890	1183.7	1.555	17.4	7.2	1.45	7051	5.46	92.62
005370431-04	OBS	No	19.539904	136.581723	146.8	0.581	15.7	0.4	1.45	7051	1.84	184.66
005370431-05	OBS	No	19.533730	136.876849	1023.5	2.075	18.2	9.7	1.45	7051	5.07	184.74
005370431-08	OBS	No	19.553301	143.887382	967.7	5.353	12.9	8.7	1.45	7051	8.41	184.49

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
005370431-01	OBS	FP	0.00	1	0	0	0	LPP_DV
005370431-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS
005370431-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_POS_ALT
005370431-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
005370431-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—HALO_GHOST
005370431-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

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

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

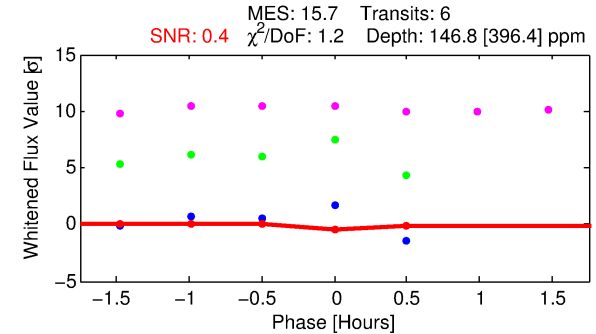
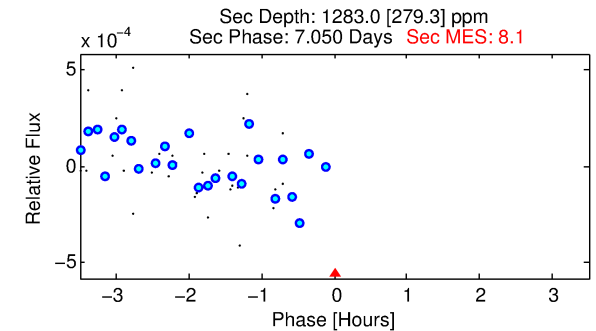
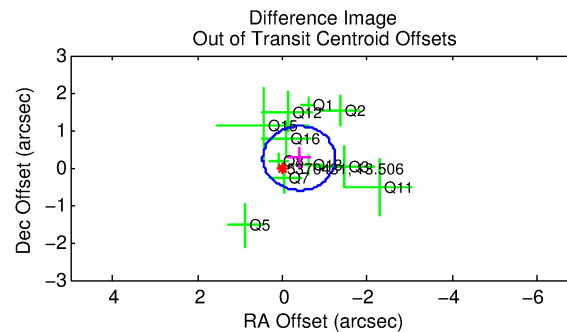
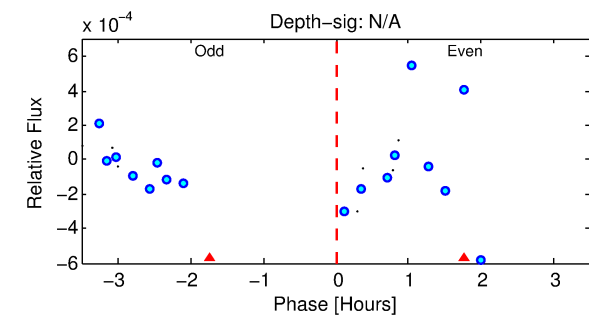
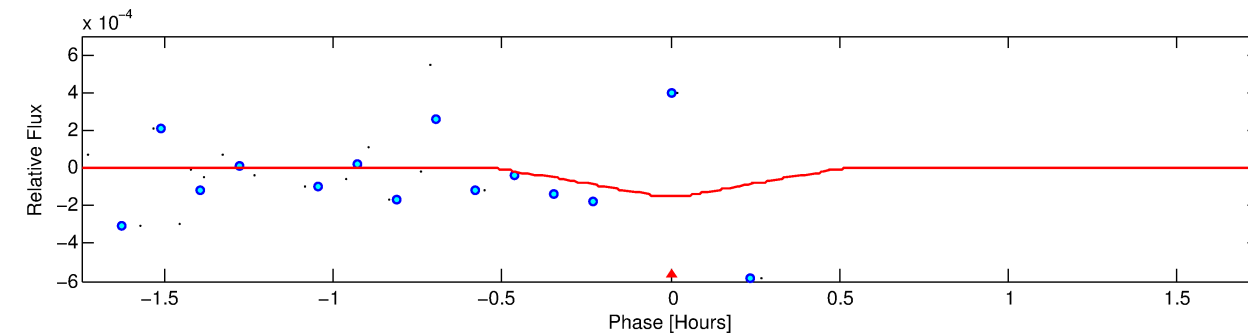
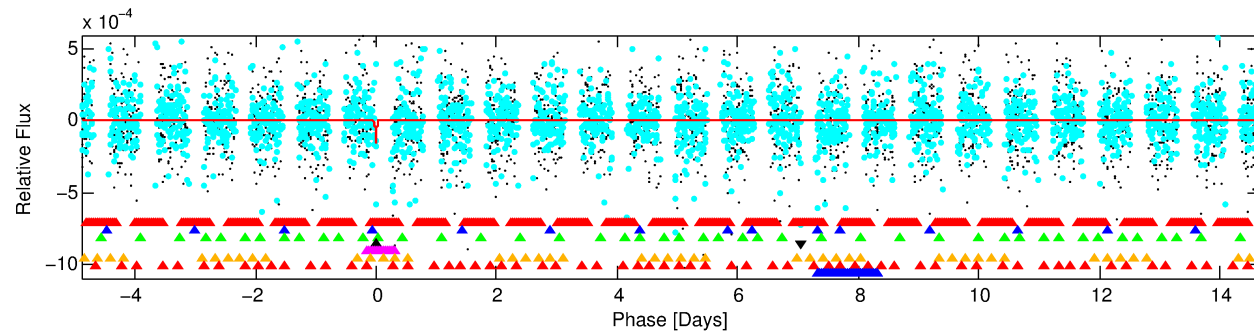
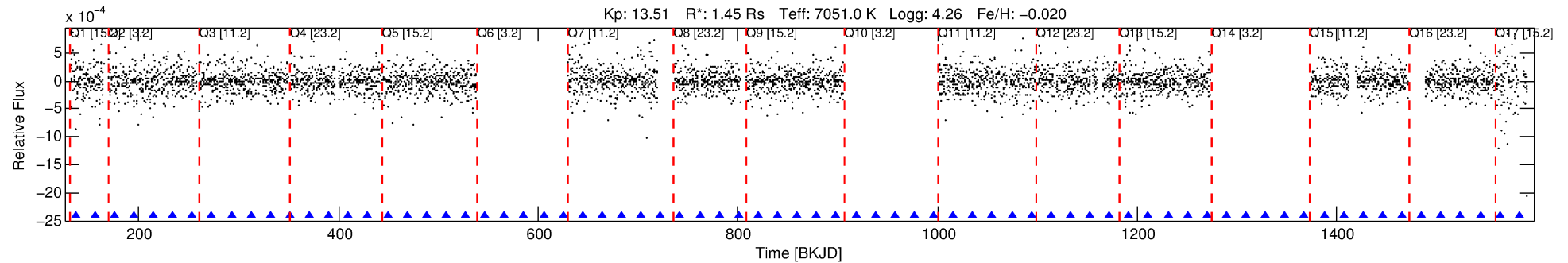
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 005370431-04

No Significant Match Found

# DV One-Page Summary

KIC: 5370431 Candidate: 4 of 8 Period: 19.540 d



## DV Fit Results:

Period = 19.53990 [0.00339] d  
Epoch = 136.5817 [0.2399] BKJD  
Rp/R\* = 0.0116 [0.6238]  
a/R\* = 251.39 [79997.45]  
b = 0.25 [1156.31]  
Seff = 184.66 [82.92]  
Teq = 940 [106] K  
Rp = 1.84 [98.98] Re  
a = 0.1592 [0.0466] AU  
Ag = 5277.66 [567384.87] [0.01σ]  
Teffp = 12387 [332924] K [0.03σ]

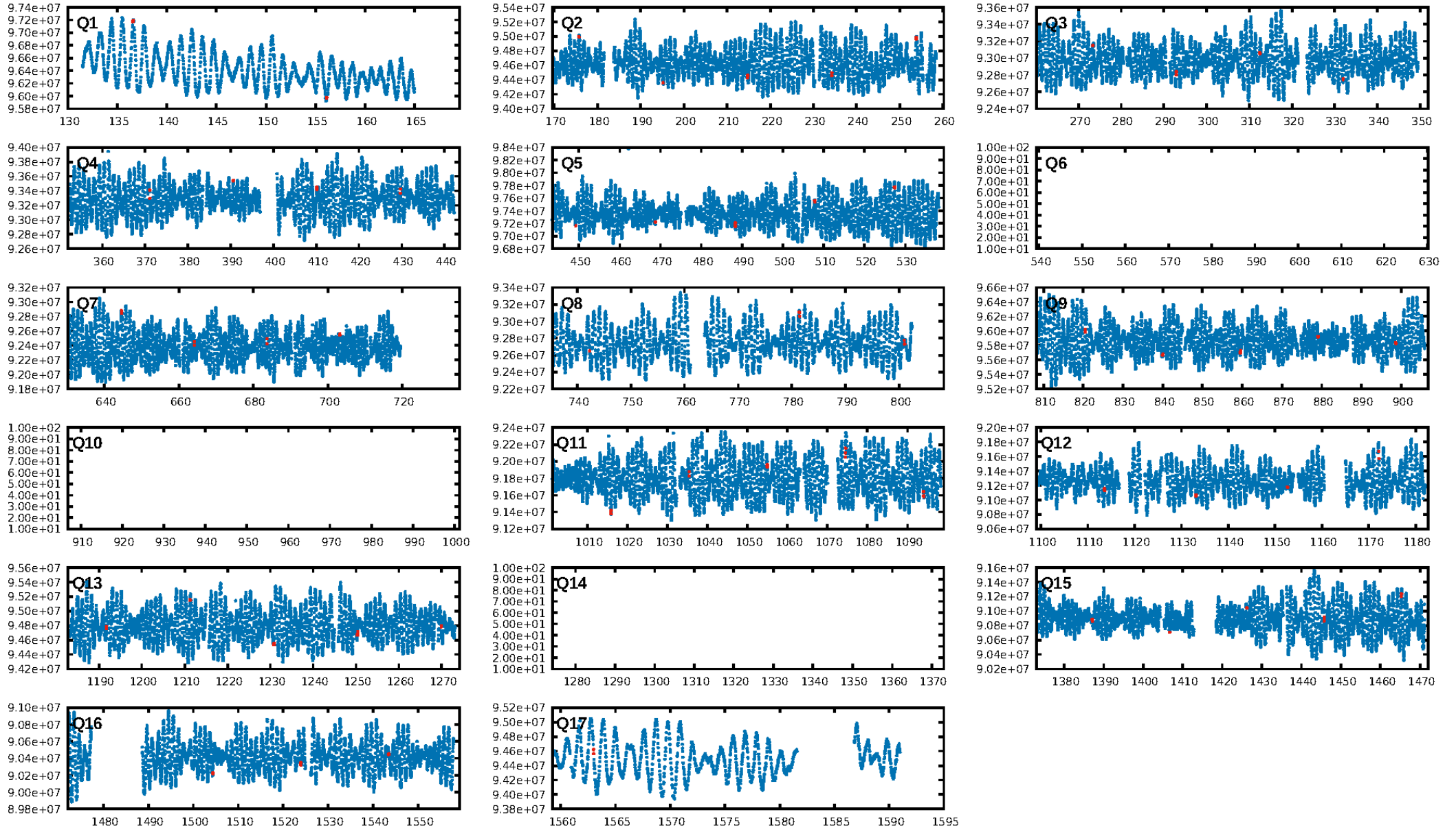
## DV Diagnostic Results:

ShortPeriod-sig: 5.5% [0.07σ]  
LongPeriod-sig: 4.8% [0.06σ]  
ModelChiSquare2-sig: 21.7%  
ModelChiSquareGof-sig: 82.0%  
Bootstrap-pfa: 1.49e-40  
RollingBand-fgt: 1.00 [5/5]  
**GhostDiagnostic-chr: 4.15**  
Centroid-sig: N/A  
Centroid-so: 3.163 arcsec [1.68σ]  
OotOffset-rm: 0.469 arcsec [1.65σ]  
KicOffset-rm: 0.596 arcsec [2.28σ]  
OotOffset-st: 1/4/3/3 [11]  
KicOffset-st: 1/4/3/3 [11]  
DiffImageQuality-fgm: 0.36 [4/11]  
DiffImageOverlap-fno: 0.00 [0/13]

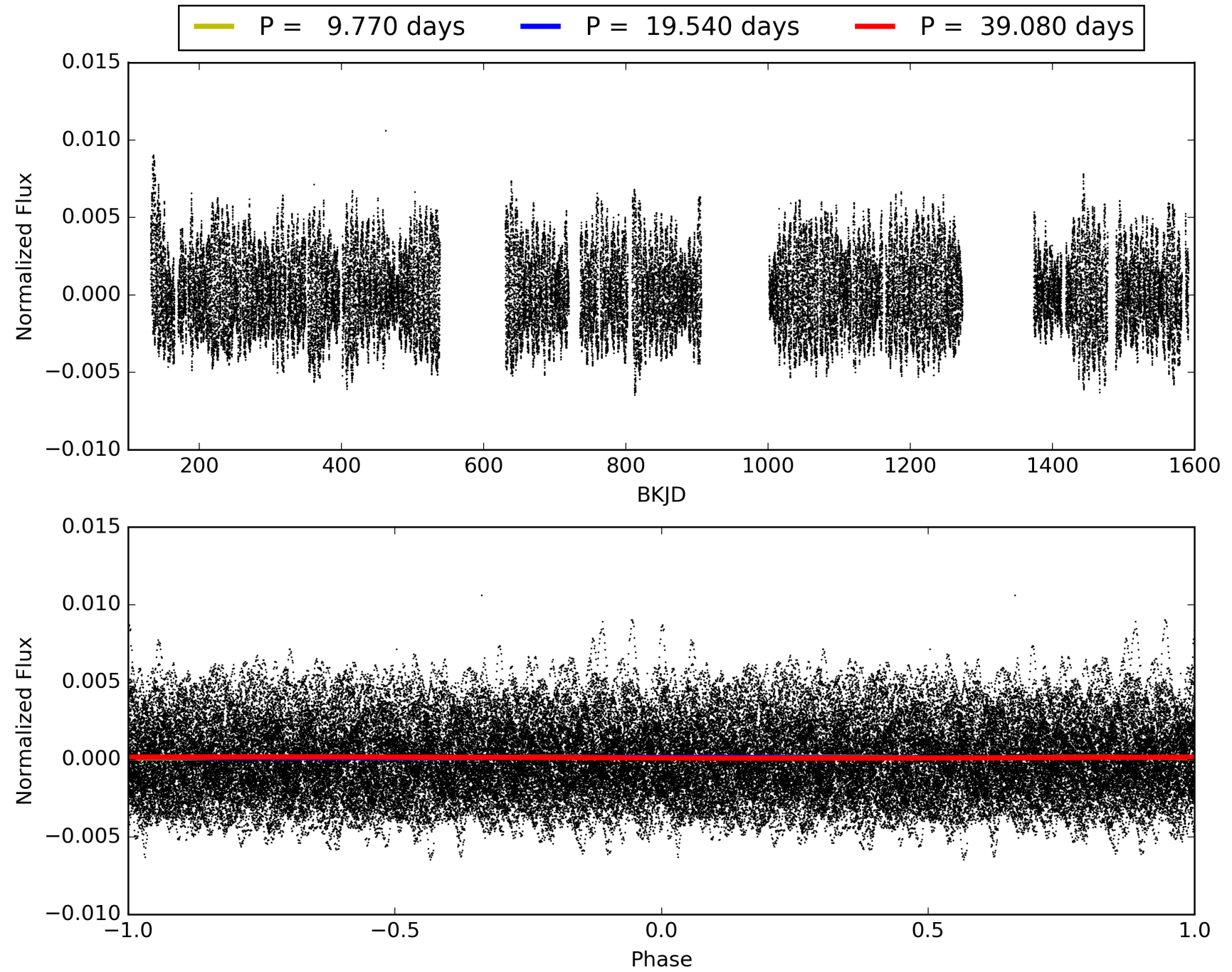
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 02:17:20 Z

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

# TCE 005370431-04, PDC Light Curves

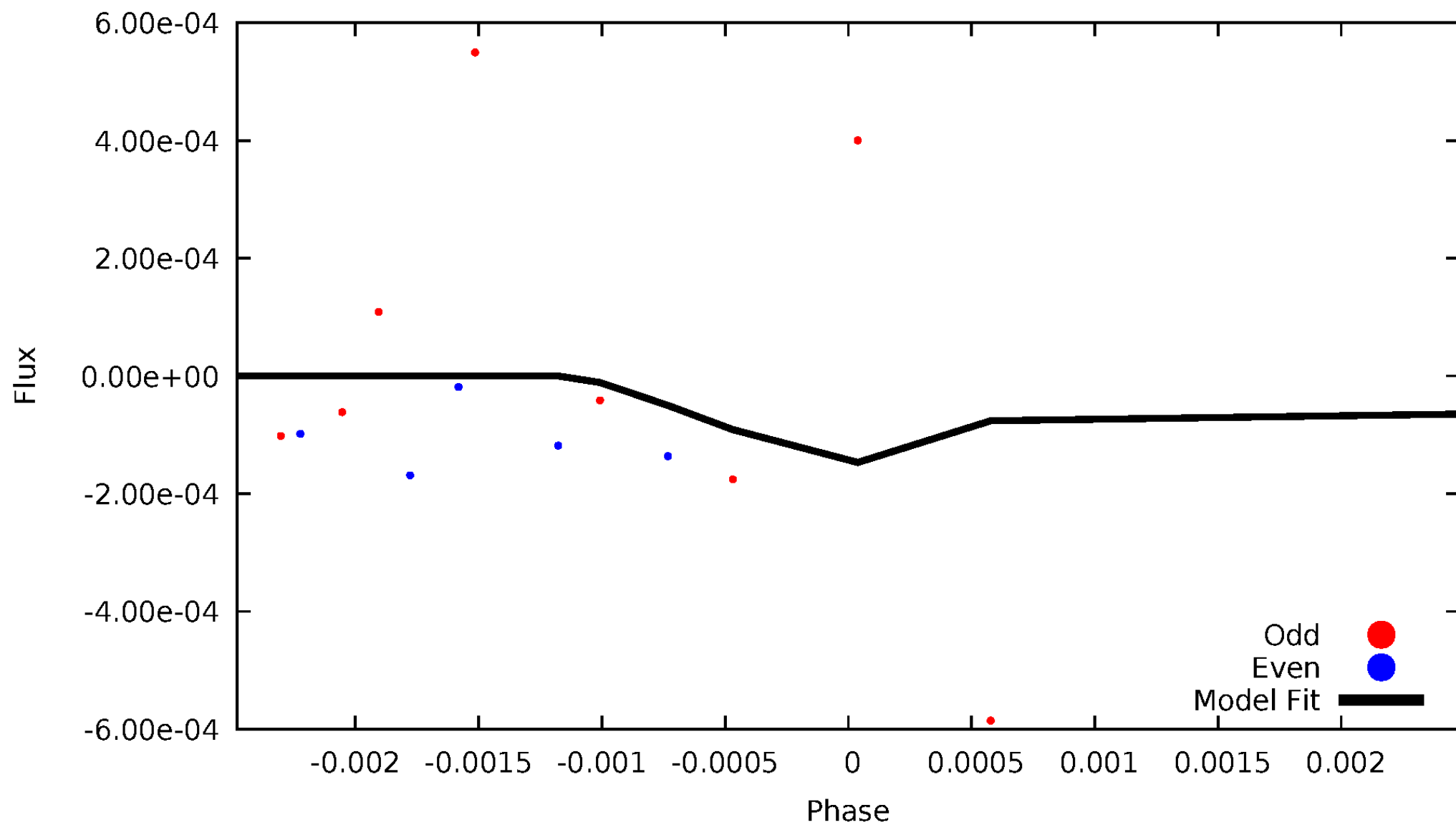


# TCE 005370431-04



# DV Odd/Even

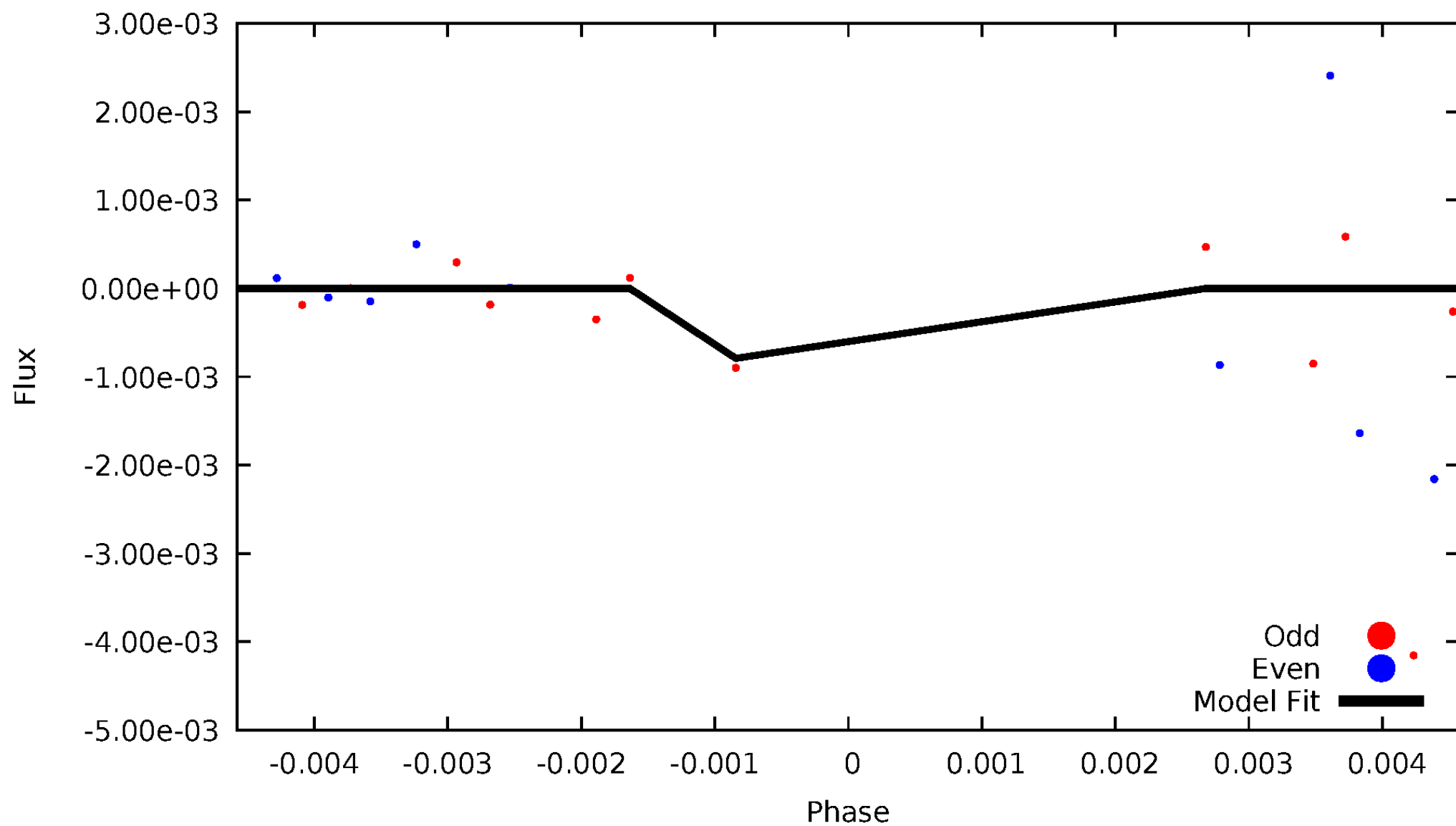
TCE 005370431-04





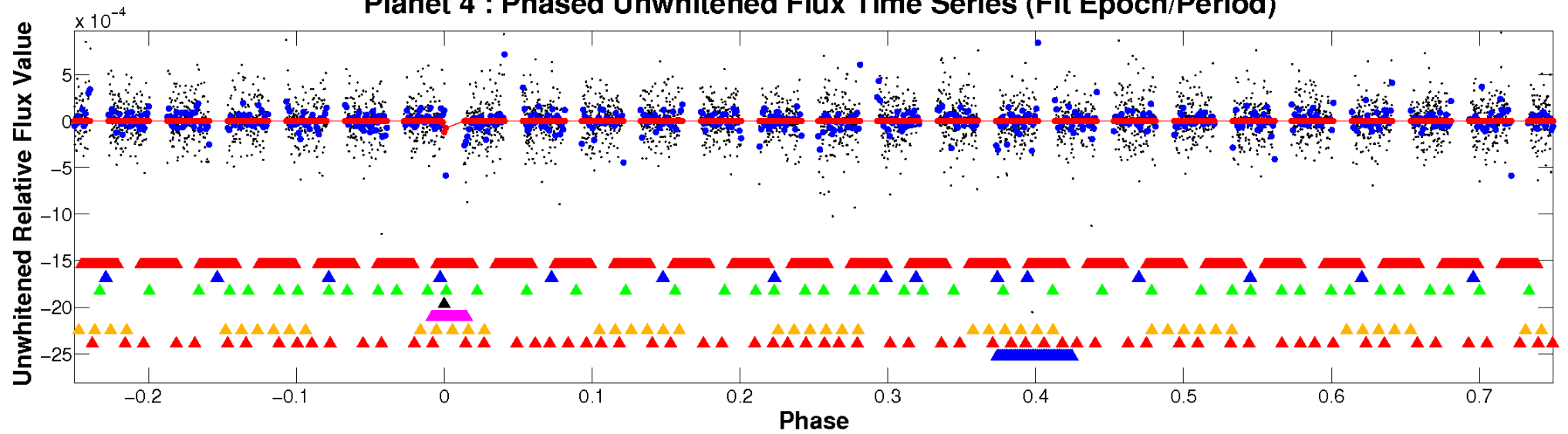
# ALT Odd/Even

TCE 005370431-04

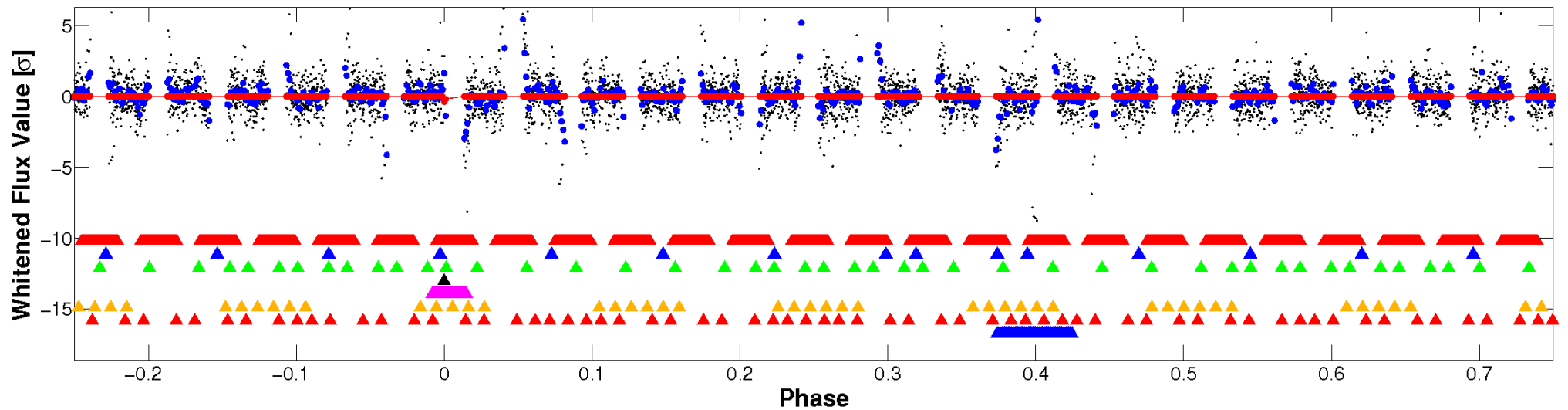


# Non-Whitened Vs. Whitened Light Curve

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

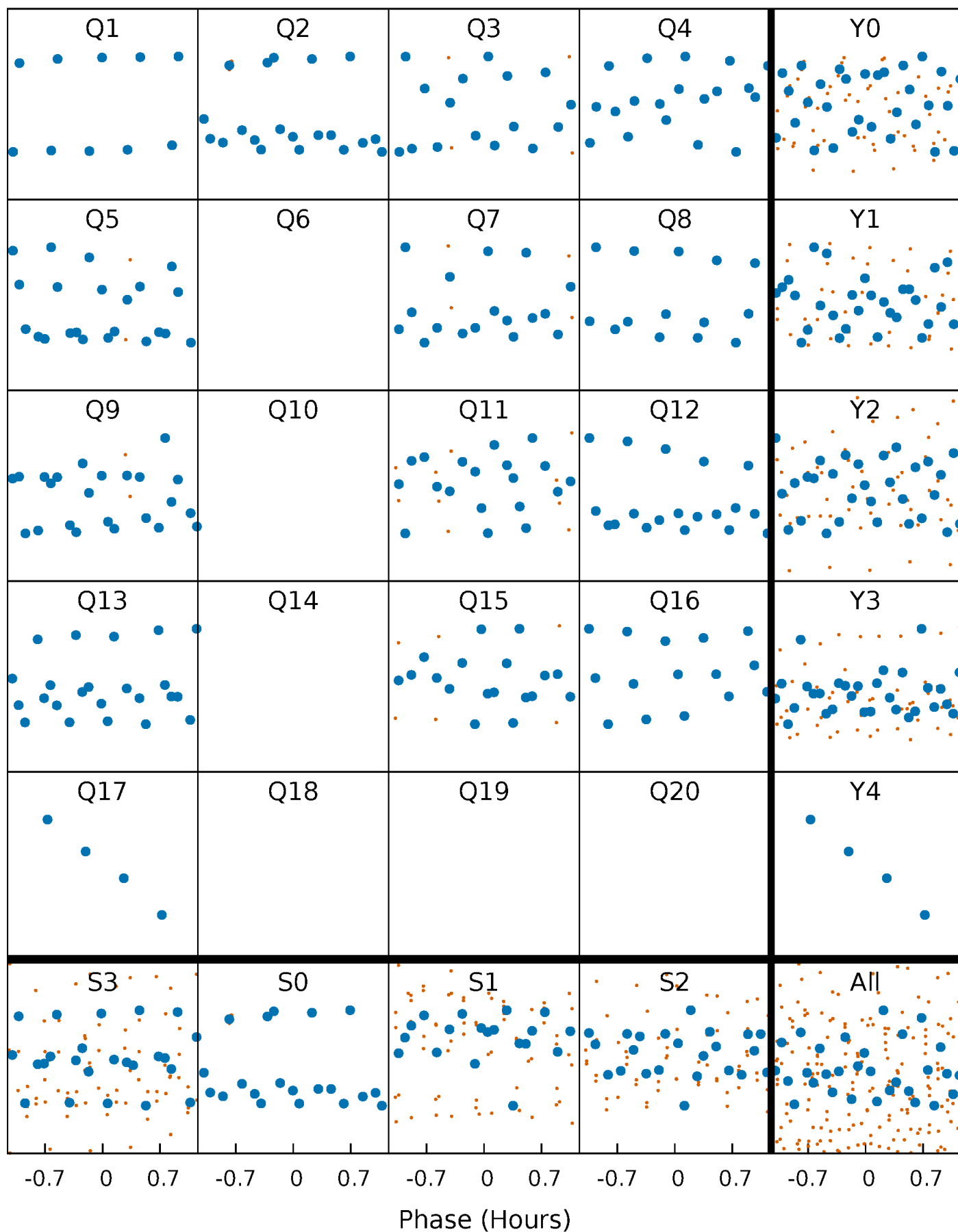


## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



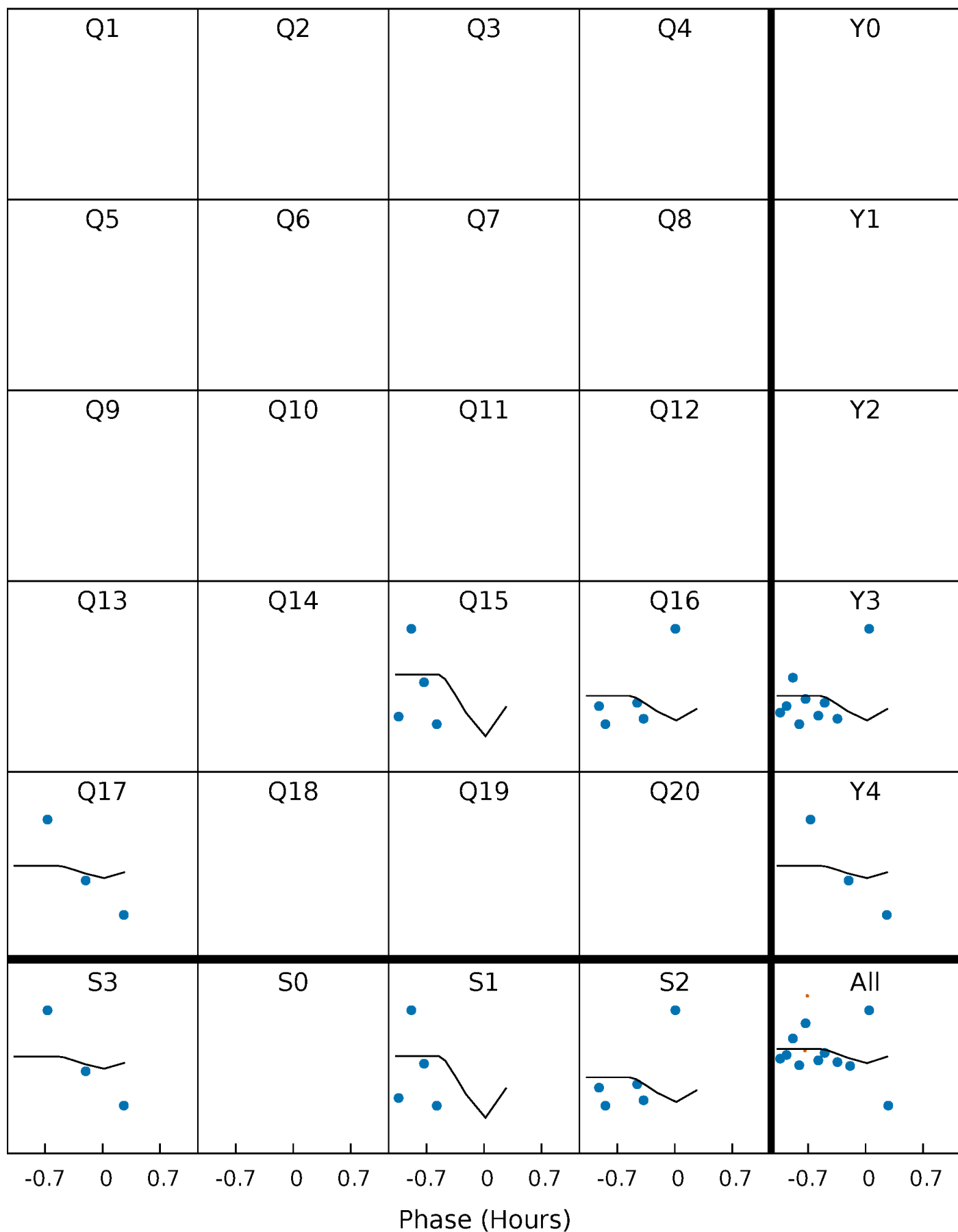
# PDC Quarter-Phased Transit Curves

TCE 005370431-04   P= 19.539904 Days    $T_0=136.581723$  (BKJD)



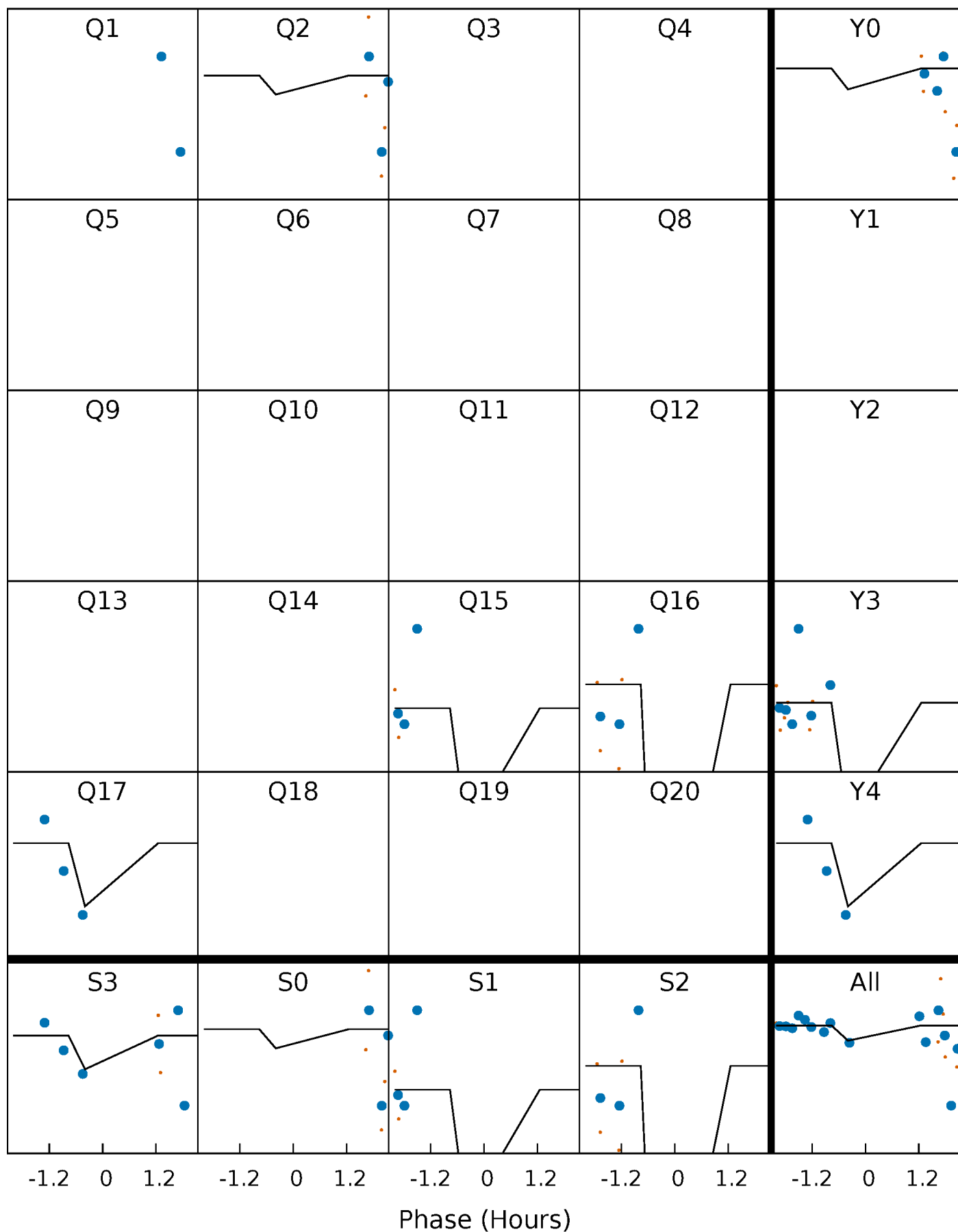
# DV Quarter-Phased Transit Curves

TCE 005370431-04   P= 19.539904 Days    $T_0=136.581723$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

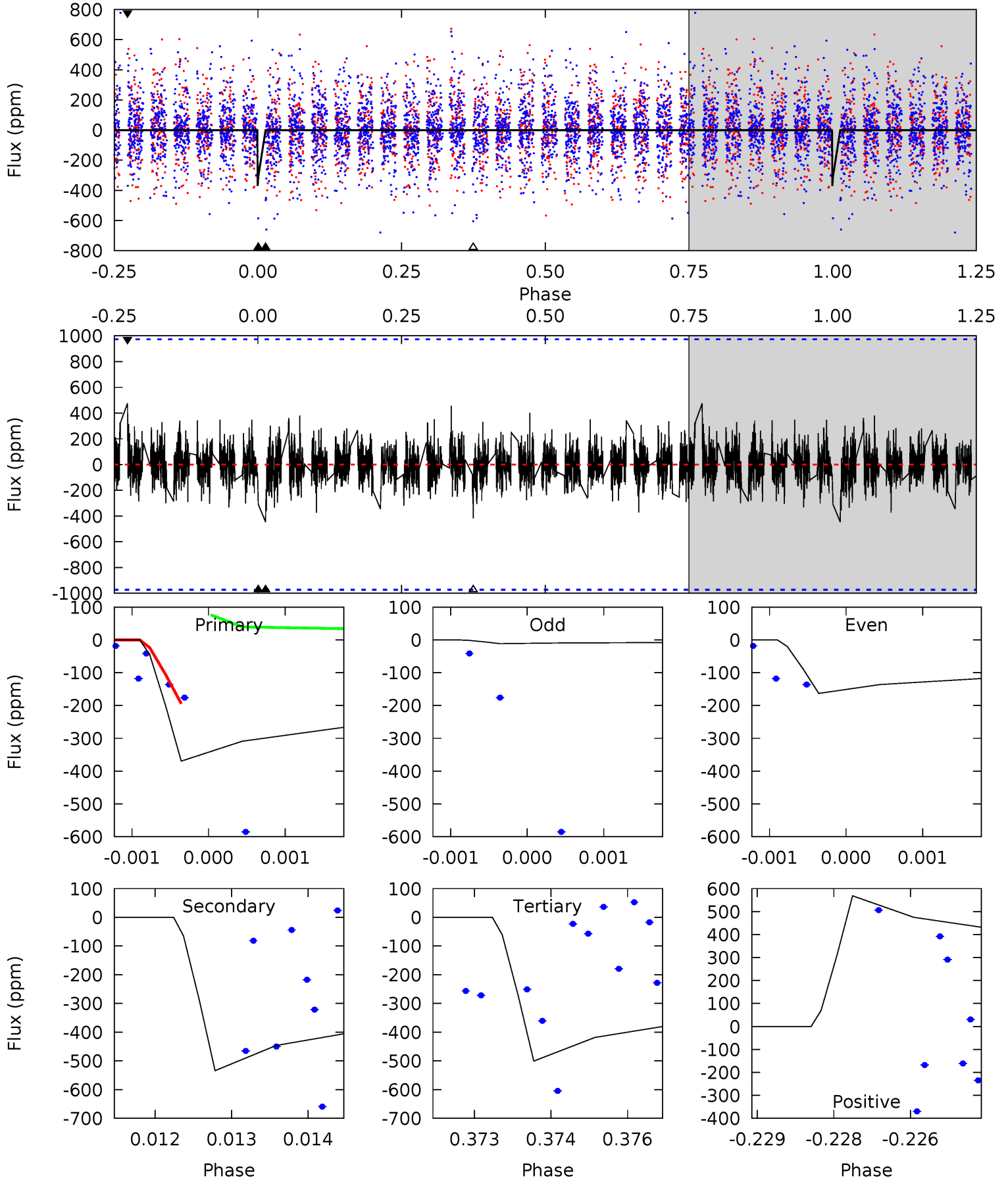
TCE 005370431-04   P= 19.537412 Days    $T_0=136.791372$  (BKJD)



# DV Model-Shift Uniqueness Test

005370431-04, P = 19.539904 Days, E = 117.041819 Days

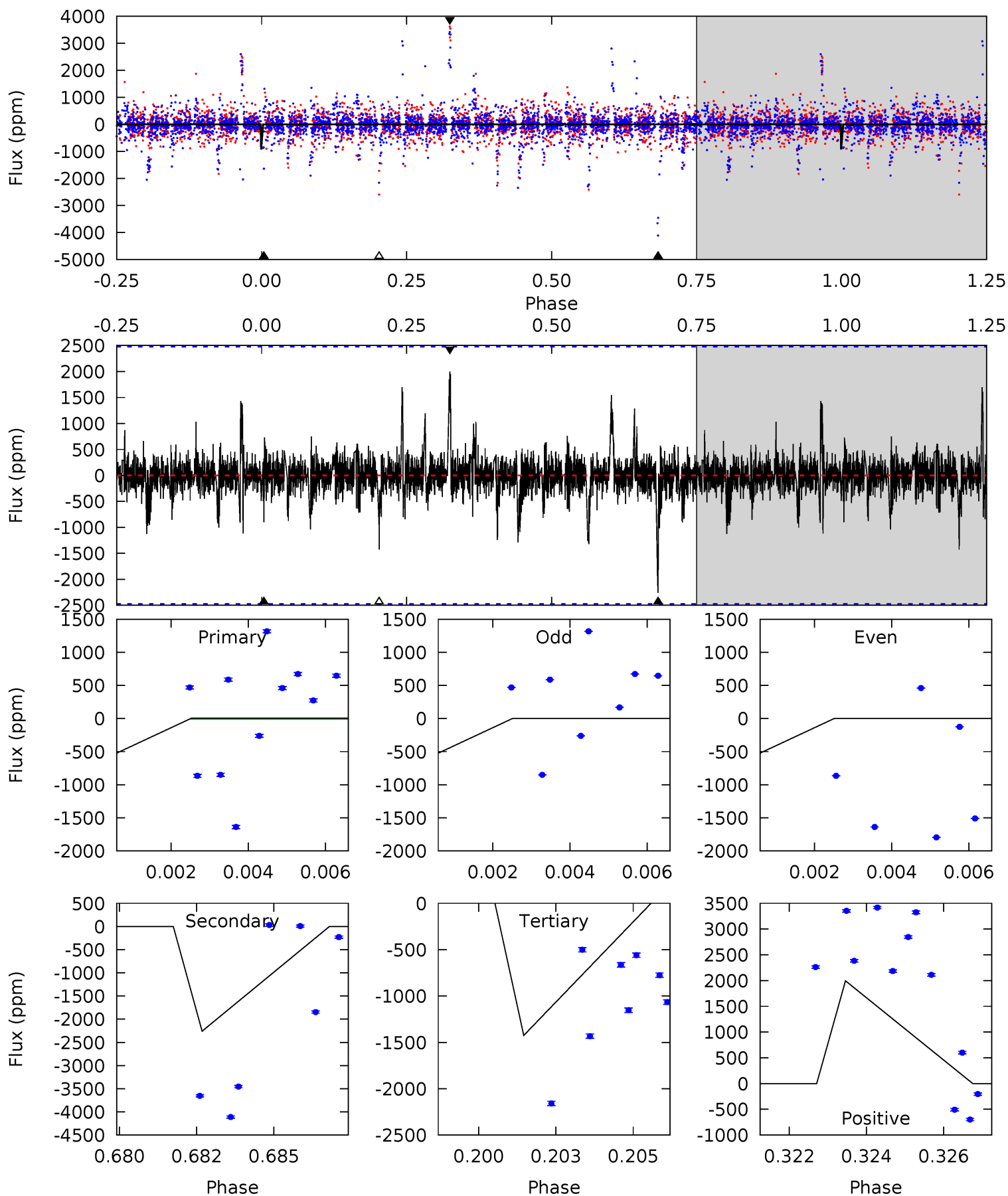
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
1.72	2.48	2.32	2.64	5.40	3.21	0.60	-0.61	-0.92	0.16	-0.16	0.70	1.00	0.52	0.47



# Alt Model-Shift Uniqueness Test

005370431-04, P = 19.537412 Days, E = 117.253960 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
1.93	4.85	3.06	4.28	5.32	3.07	0.55	-1.13	-2.35	1.79	0.57	0	0	0.47	0





### Stellar Parameters For KIC 005370431

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$7051^{+194}_{-315}$	$4.262^{+0.073}_{-0.218}$	$-0.020^{+0.200}_{-0.350}$	$1.454^{+0.524}_{-0.225}$	$1.409^{+0.222}_{-0.202}$	$0.645^{+0.254}_{-0.347}$
	+3%/-4%	+2%/-5%	+1000%/-1750%	+36%/-15%	+16%/-14%	+39%/-54%
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 005370431-04 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-446 \pm 180$	$67.48^{+74.29}_{-46.86}$	$1338^{+108}_{-81}$	$2358^{+1031}_{-4059}$	$1.259^{+13.566}_{-0.999}$
Alt.	$-2260 \pm 466$	$71.21^{+77.83}_{-51.30}$	$1335^{+101}_{-80}$	$2942^{+1632}_{-560}$	$5.956^{+68.322}_{-4.577}$

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

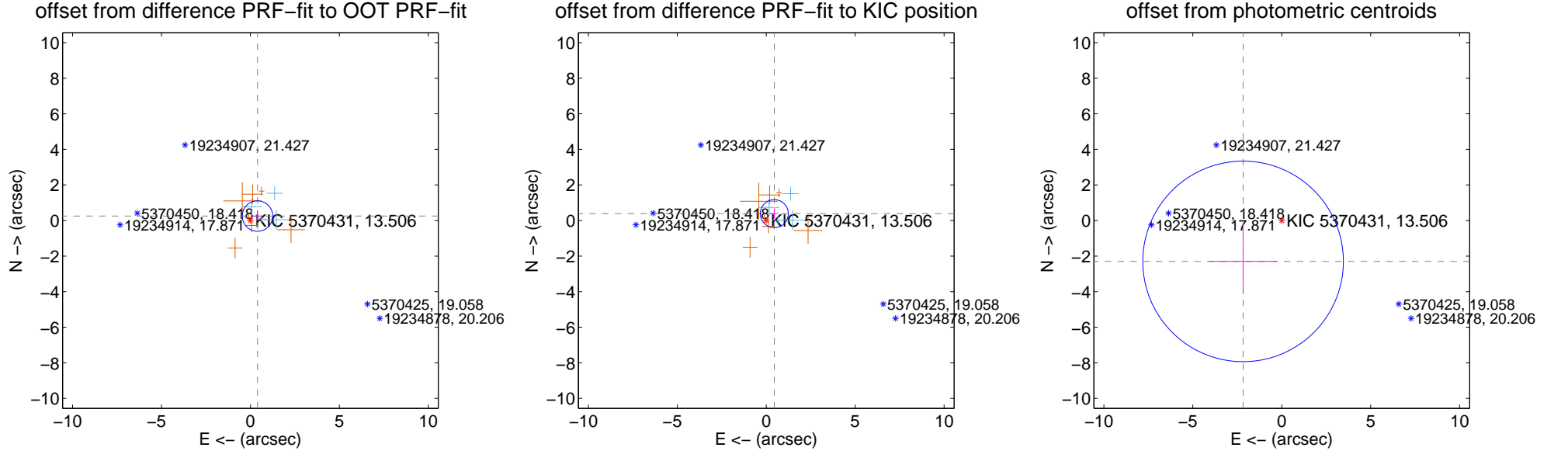
## DV Centroid Data

Supplemental centroid analysis for 005370431-04. Kepler magnitude: 13.51. Transit SNR 0.38

There are 4 quarters with good PRF difference image offsets

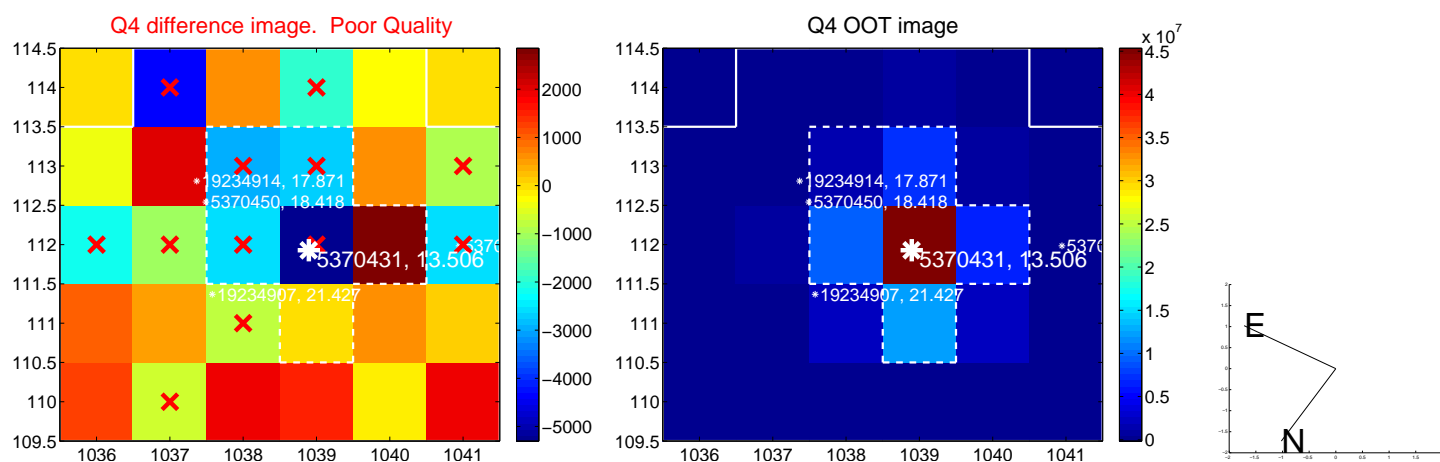
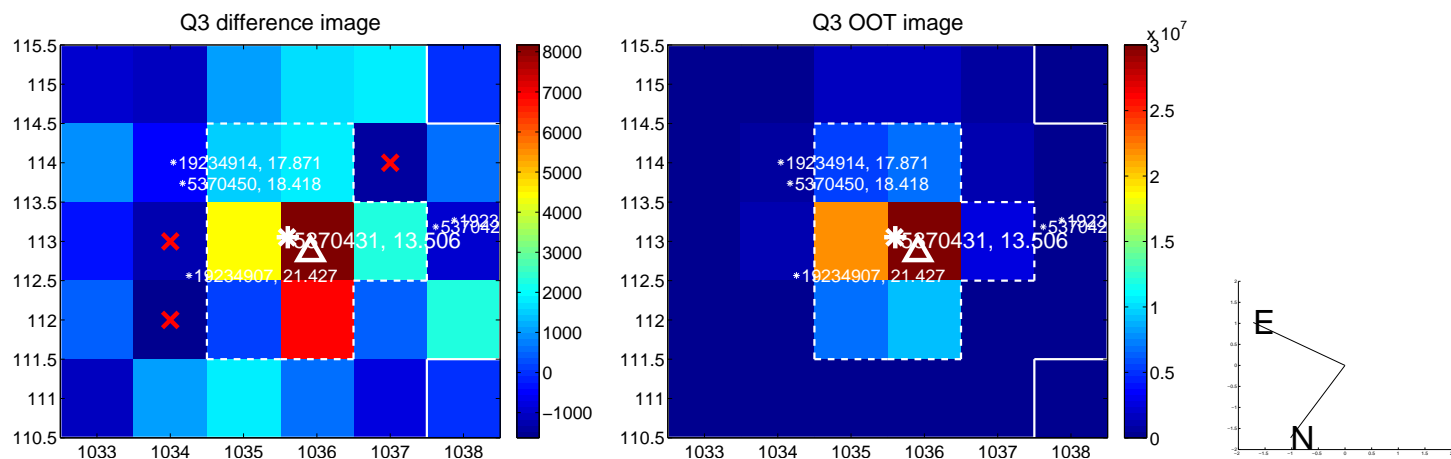
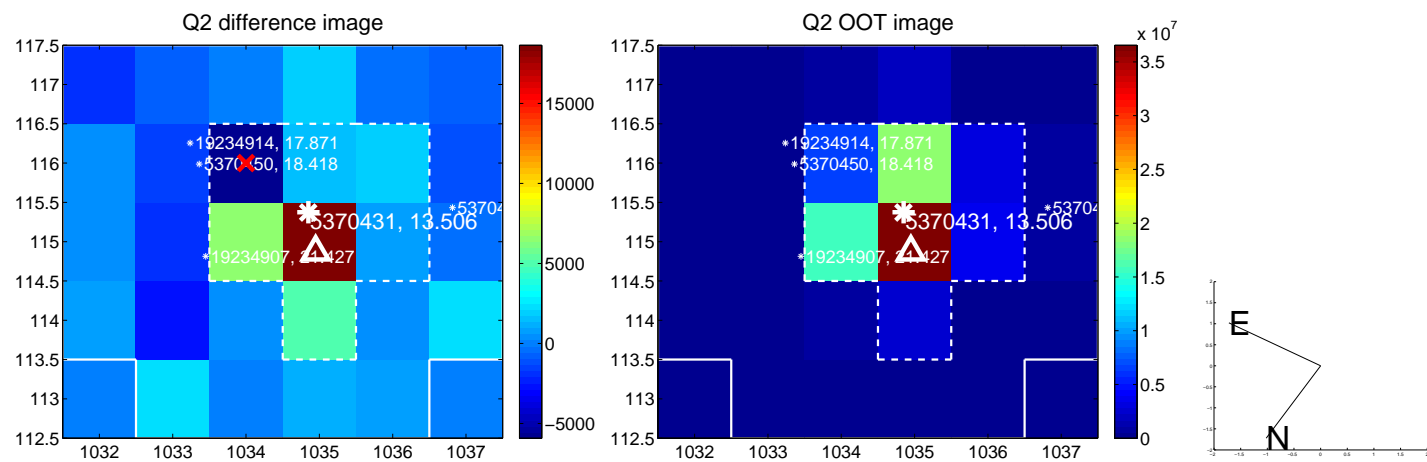
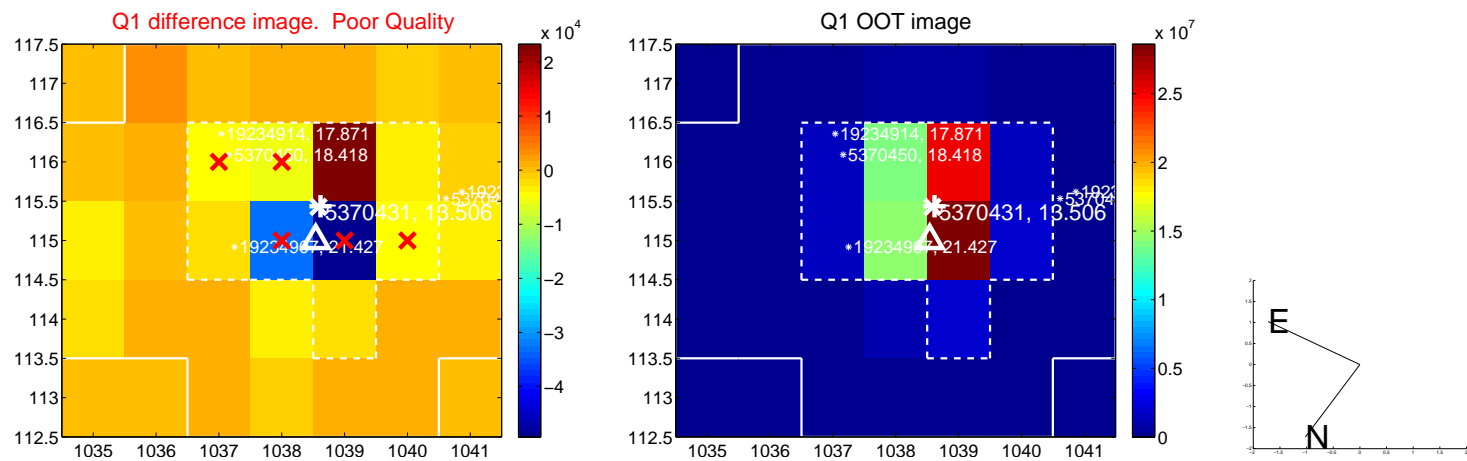
The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.469 \pm 0.285$	1.65	$-0.396 \pm 0.257$	$0.252 \pm 0.298$
PRF-fit source offset from KIC position	$0.596 \pm 0.262$	2.28	$-0.453 \pm 0.246$	$0.387 \pm 0.287$
photometric centroid source offset	$3.16 \pm 1.88$	1.68	$2.17 \pm 1.93$	$-2.30 \pm 1.83$

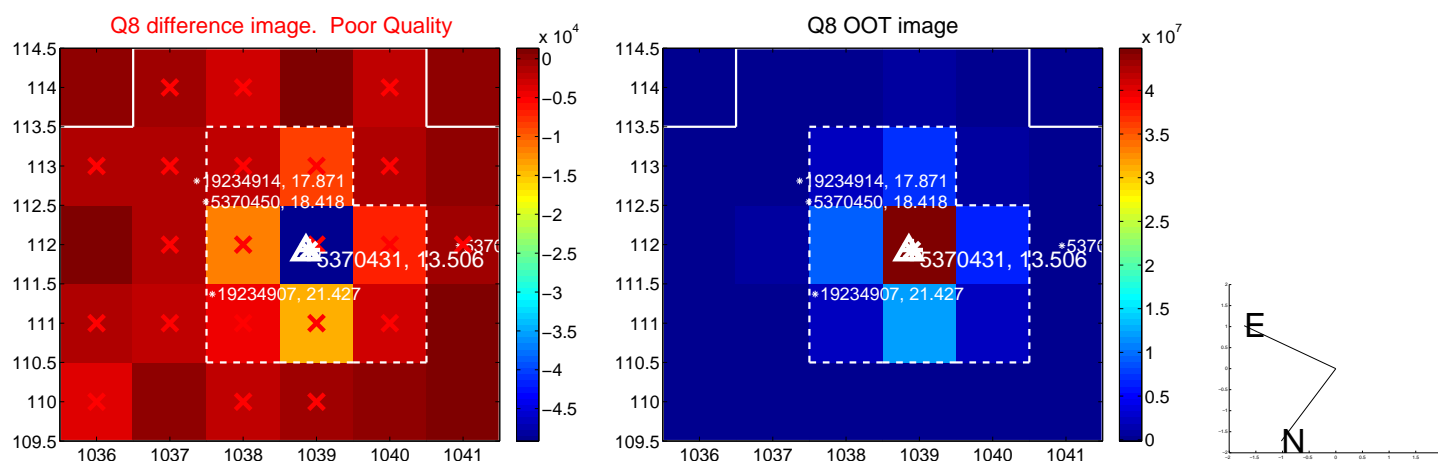
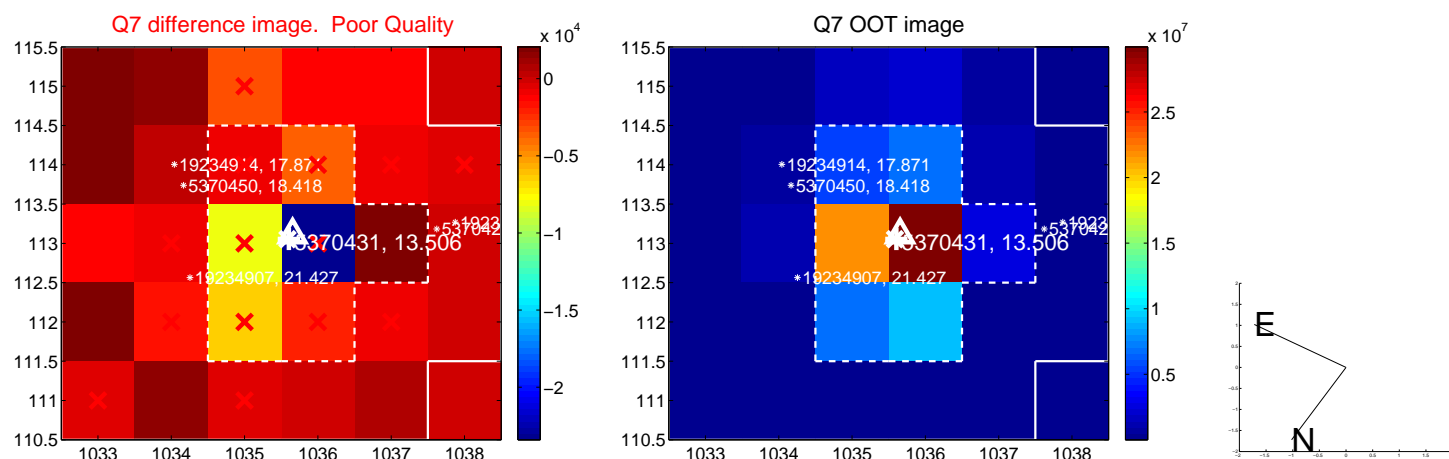
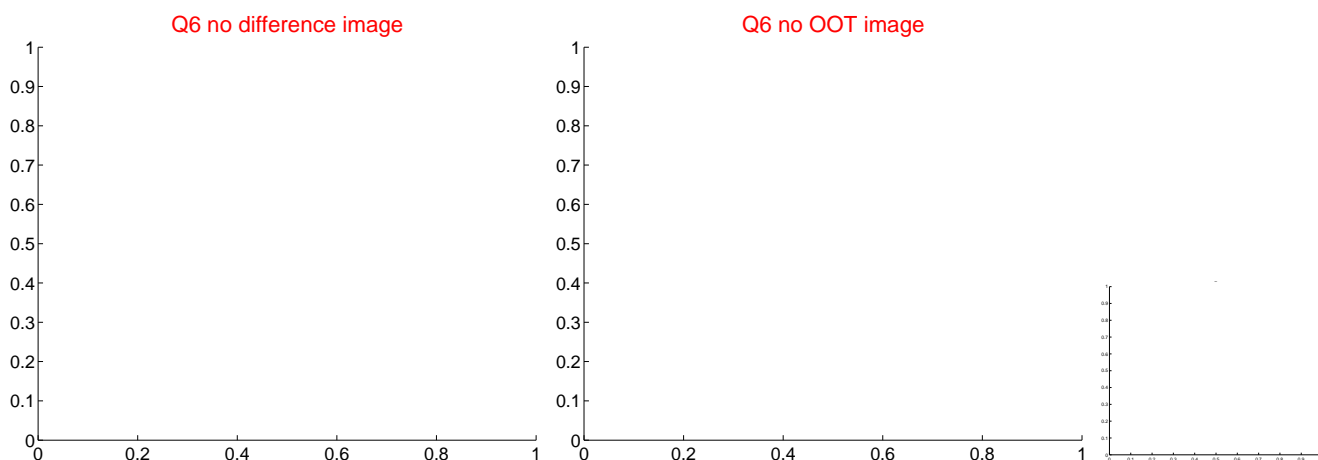
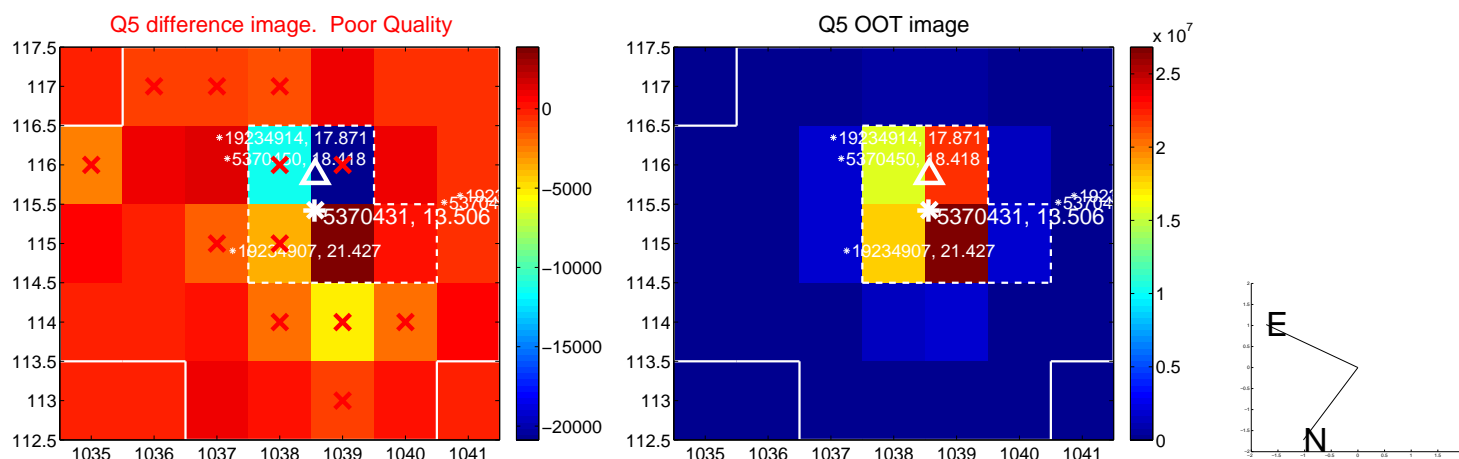


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

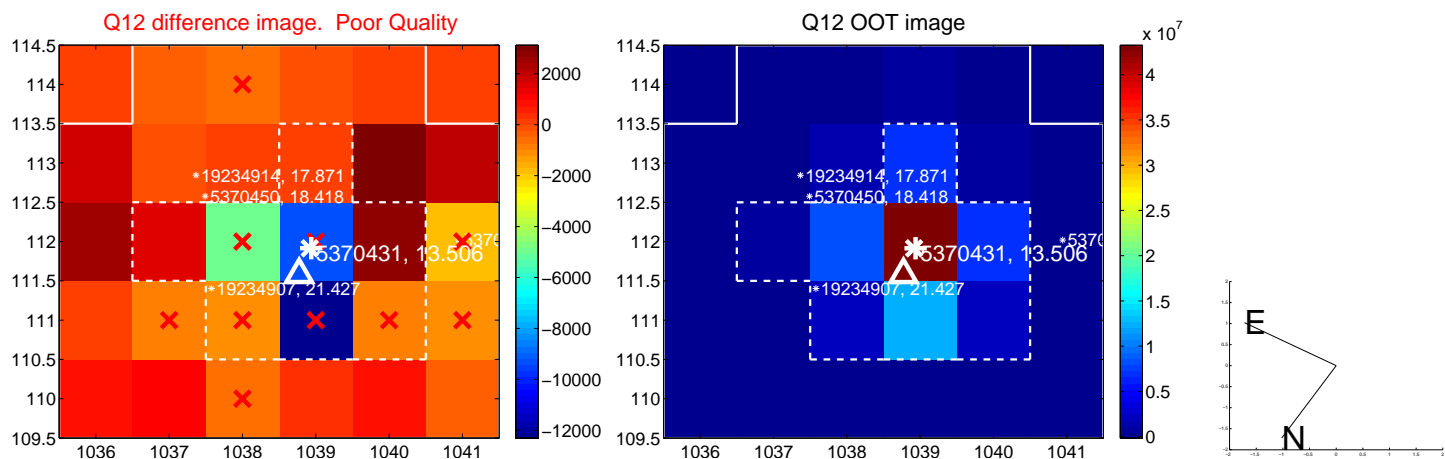
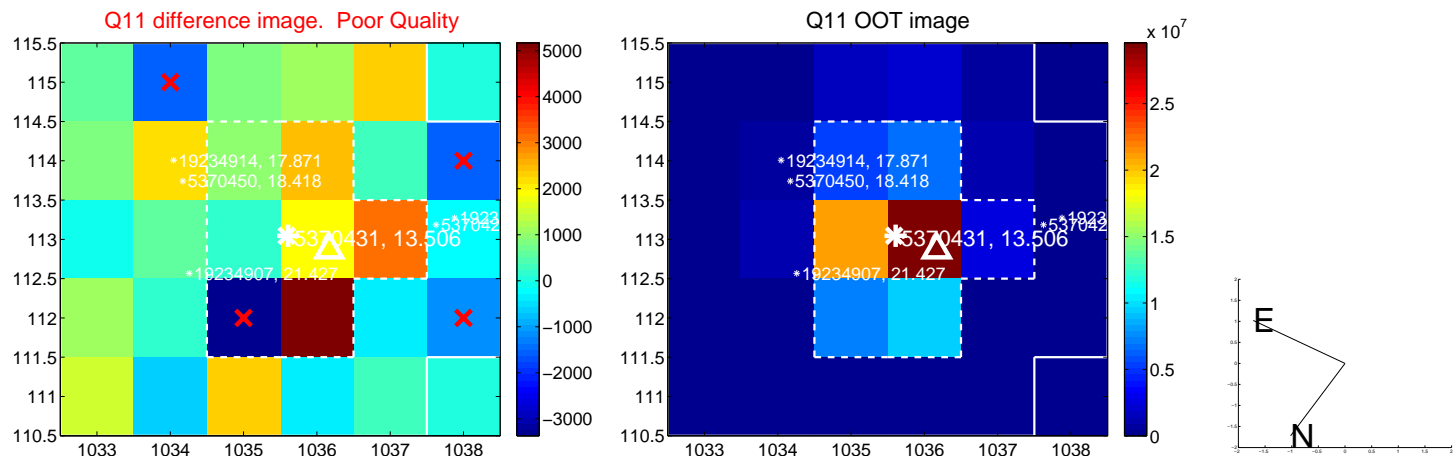
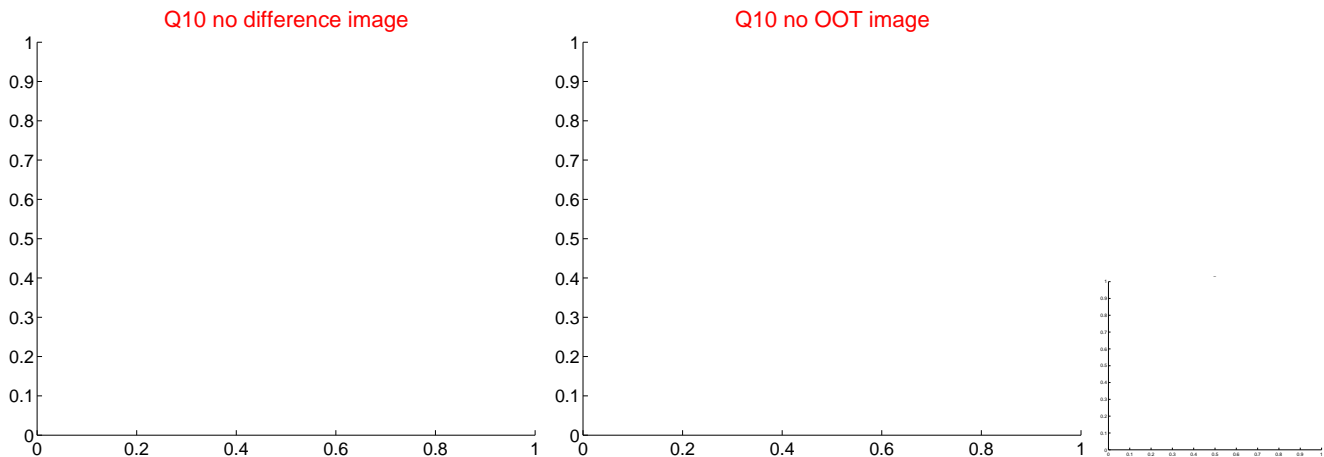
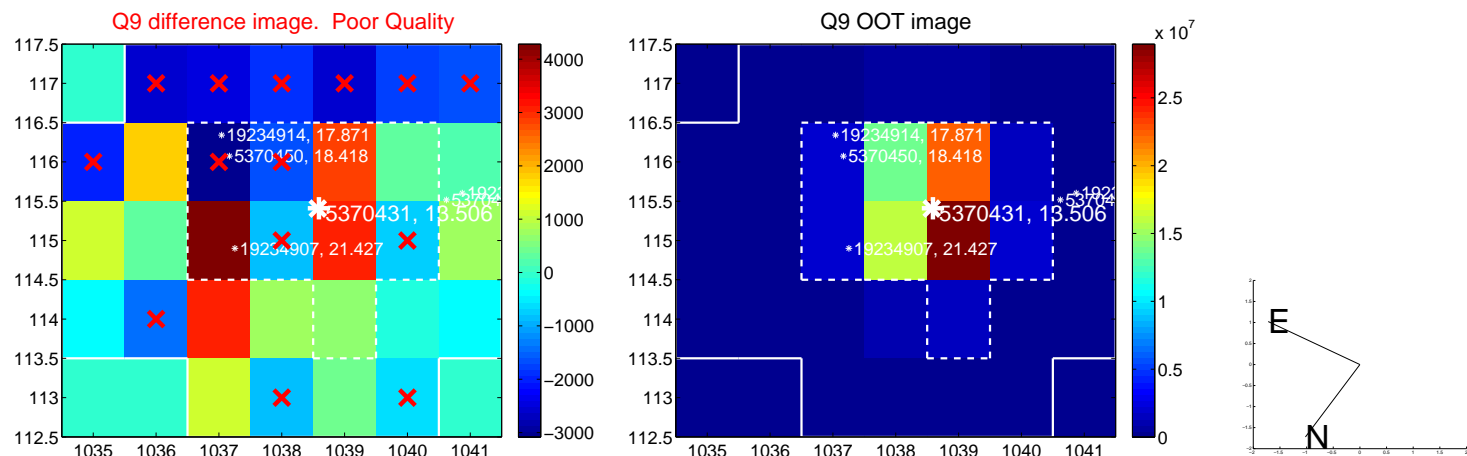
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



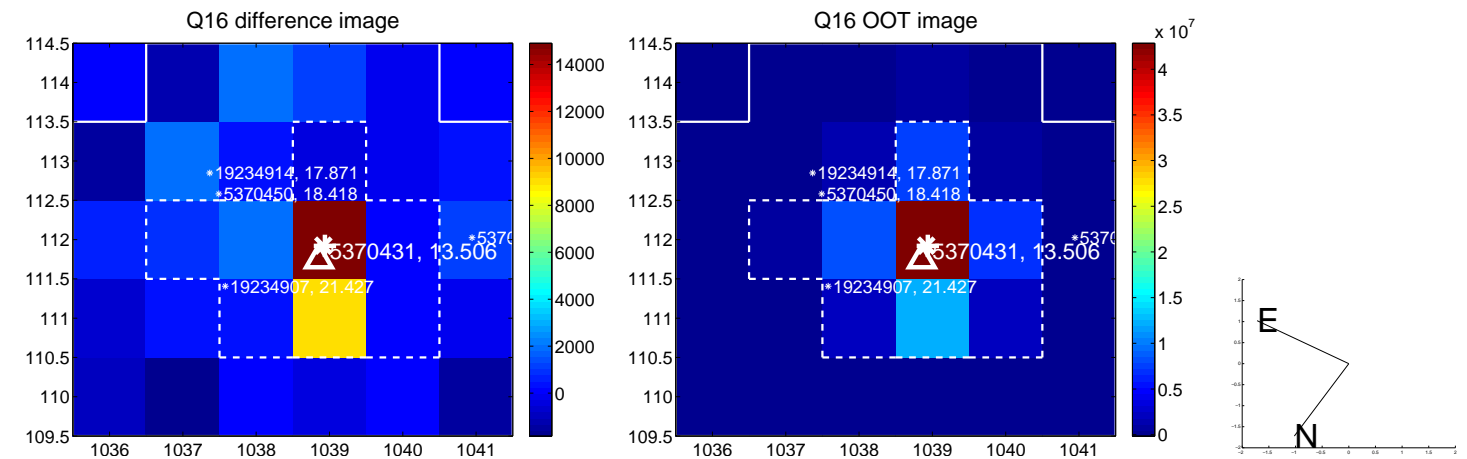
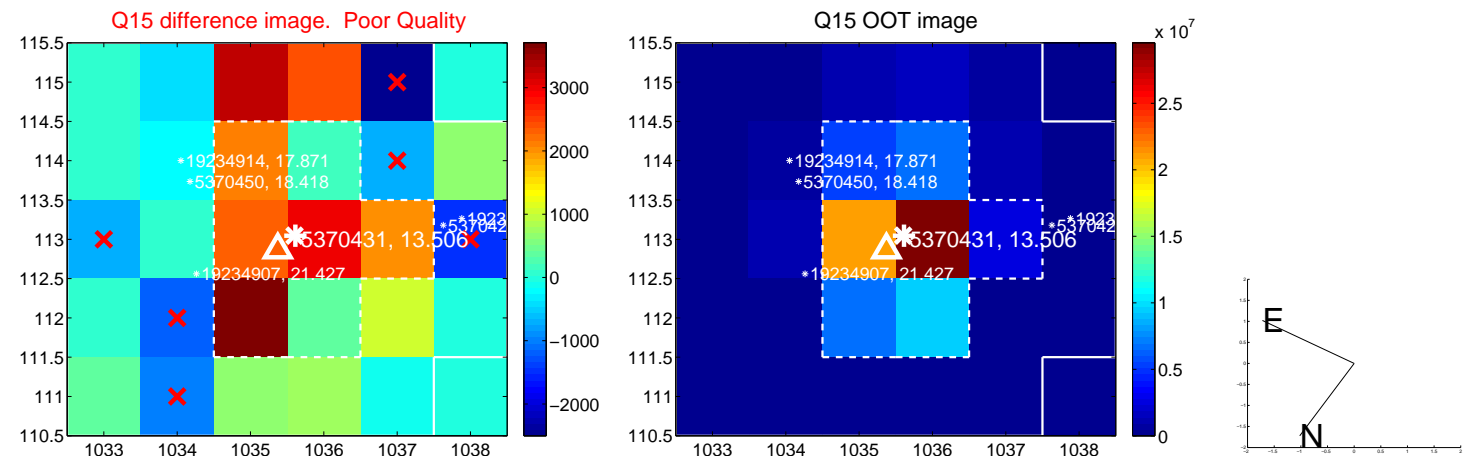
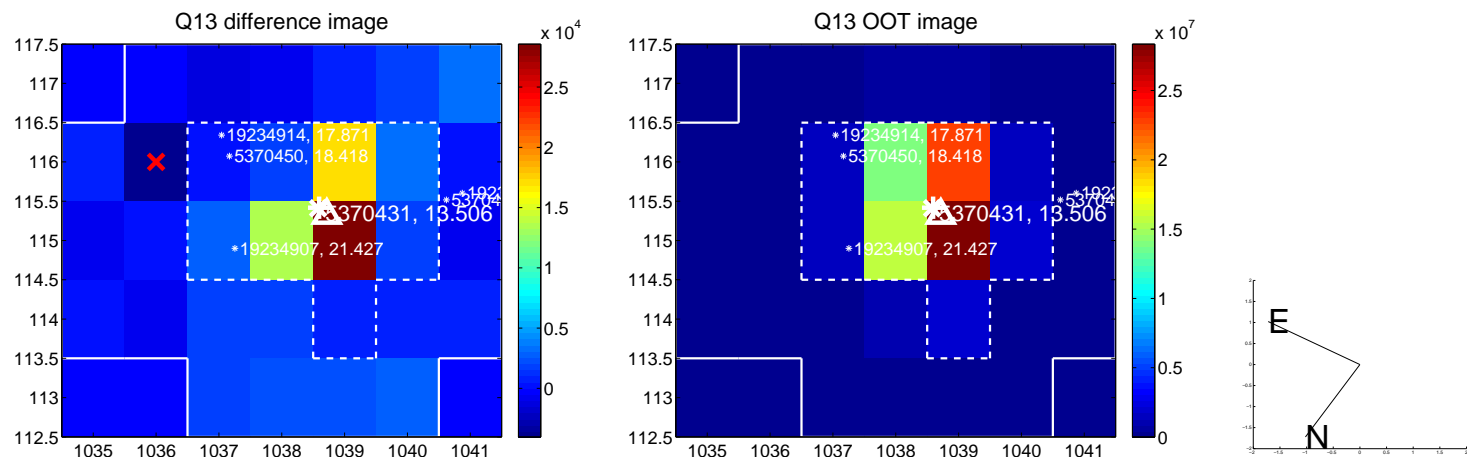
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



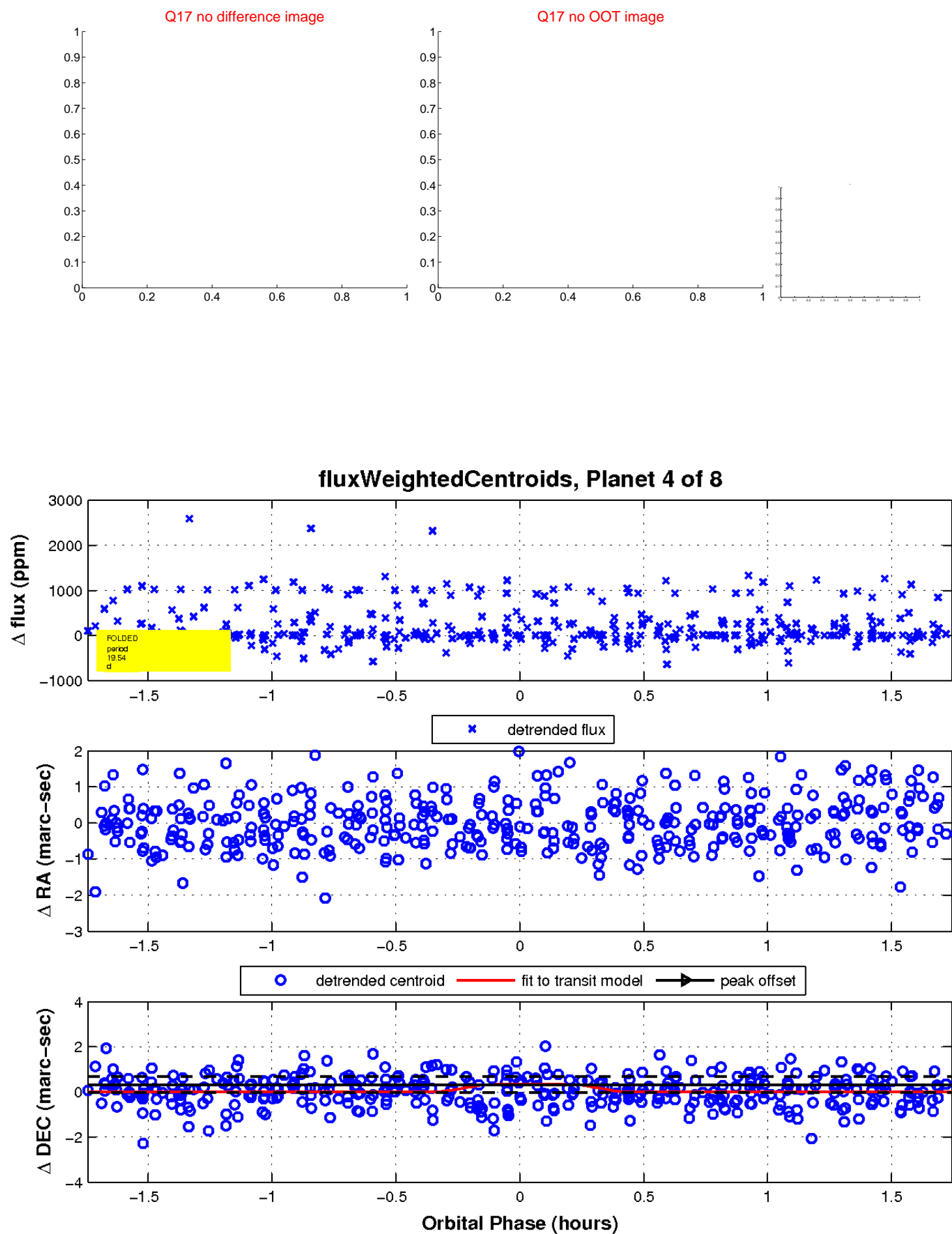
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

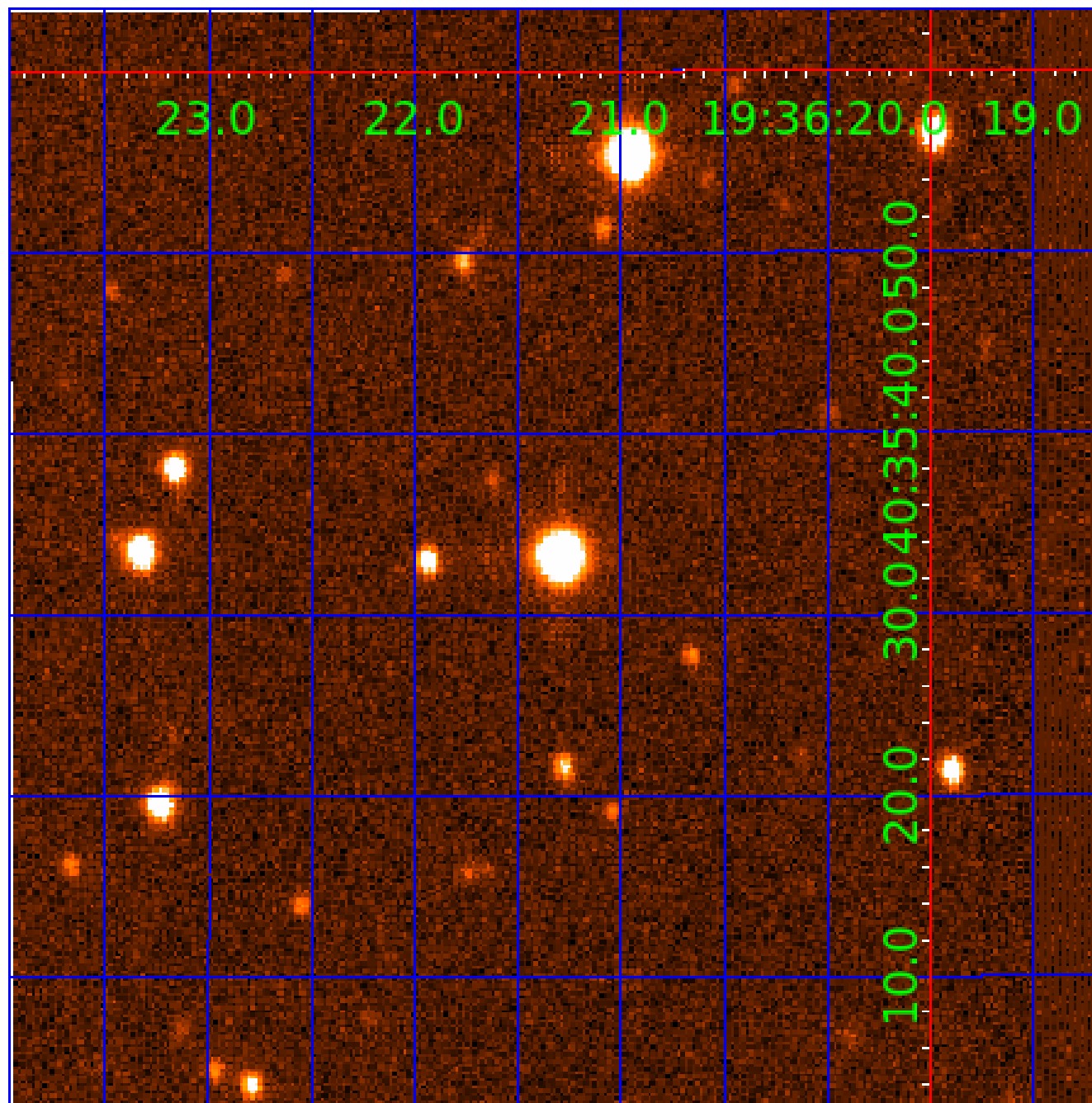


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 005370431

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
005370431-01	OBS	No	0.781860	131.783803	10.8	5.471	8.4	1.8	1.45	7051	0.51	13492.79
005370431-02	OBS	No	96.227075	222.050583	2395.4	3.148	18.8	12.0	1.45	7051	8.36	22.04
005370431-03	OBS	No	32.784515	133.747890	1183.7	1.555	17.4	7.2	1.45	7051	5.46	92.62
005370431-04	OBS	No	19.539904	136.581723	146.8	0.581	15.7	0.4	1.45	7051	1.84	184.66
005370431-05	OBS	No	19.533730	136.876849	1023.5	2.075	18.2	9.7	1.45	7051	5.07	184.74
005370431-08	OBS	No	19.553301	143.887382	967.7	5.353	12.9	8.7	1.45	7051	8.41	184.49

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
005370431-01	OBS	FP	0.00	1	0	0	0	LPP_DV
005370431-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS
005370431-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_POS_ALT
005370431-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
005370431-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—HALO_GHOST
005370431-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

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

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

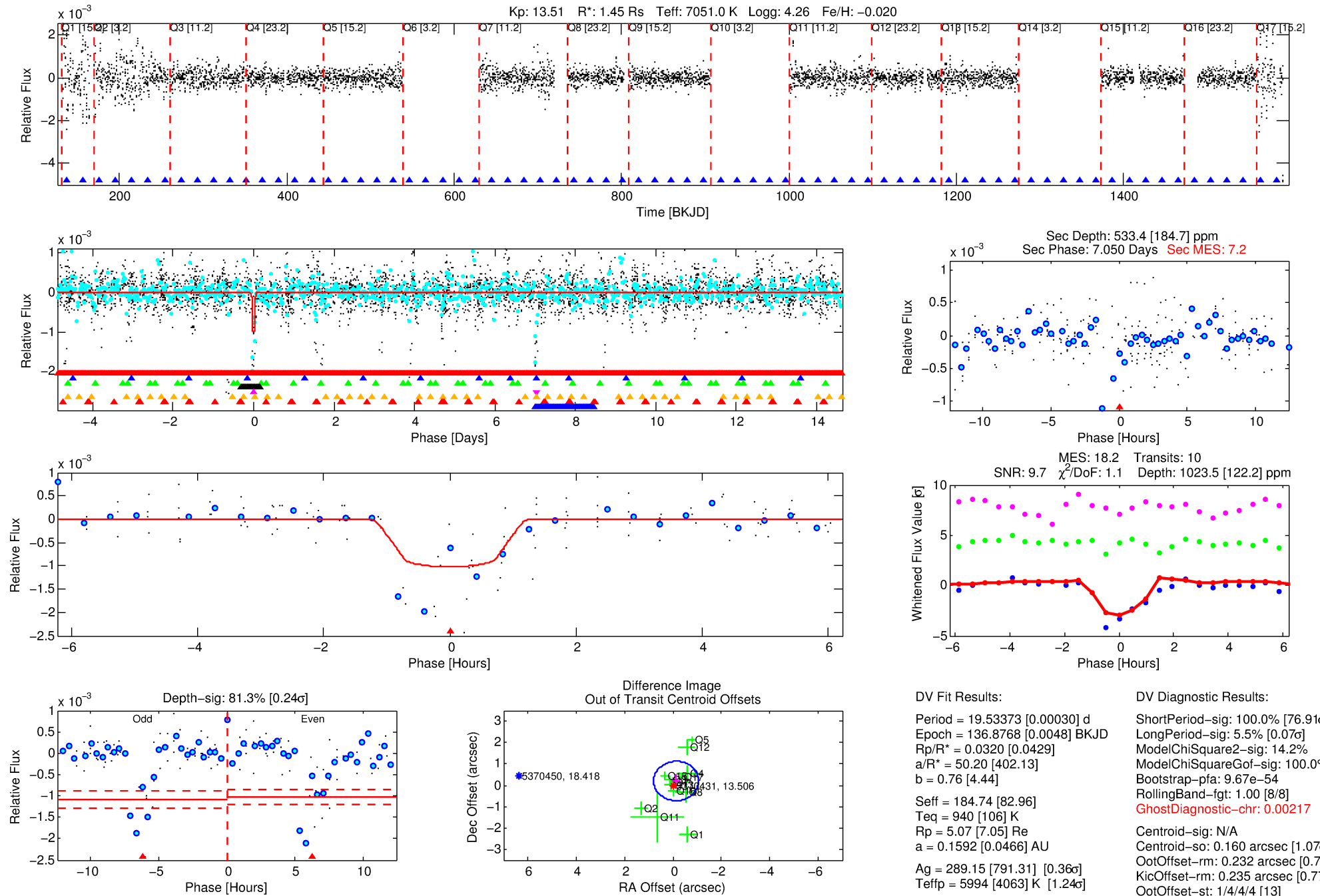
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 005370431-05

No Significant Match Found

# DV One-Page Summary

KIC: 5370431 Candidate: 5 of 8 Period: 19.534 d



## DV Fit Results:

Period = 19.53373 [0.00030] d  
Epoch = 136.8768 [0.0048] BKJD  
Rp/R\* = 0.0320 [0.0429]  
a/R\* = 50.20 [402.13]  
b = 0.76 [4.44]  
Seff = 184.74 [82.96]  
Teff = 940 [106] K  
Rp = 5.07 [7.05] Re  
a = 0.1592 [0.0466] AU  
Ag = 289.15 [791.31] [0.36 $\sigma$ ]  
Teffp = 5994 [4063] K [1.24 $\sigma$ ]

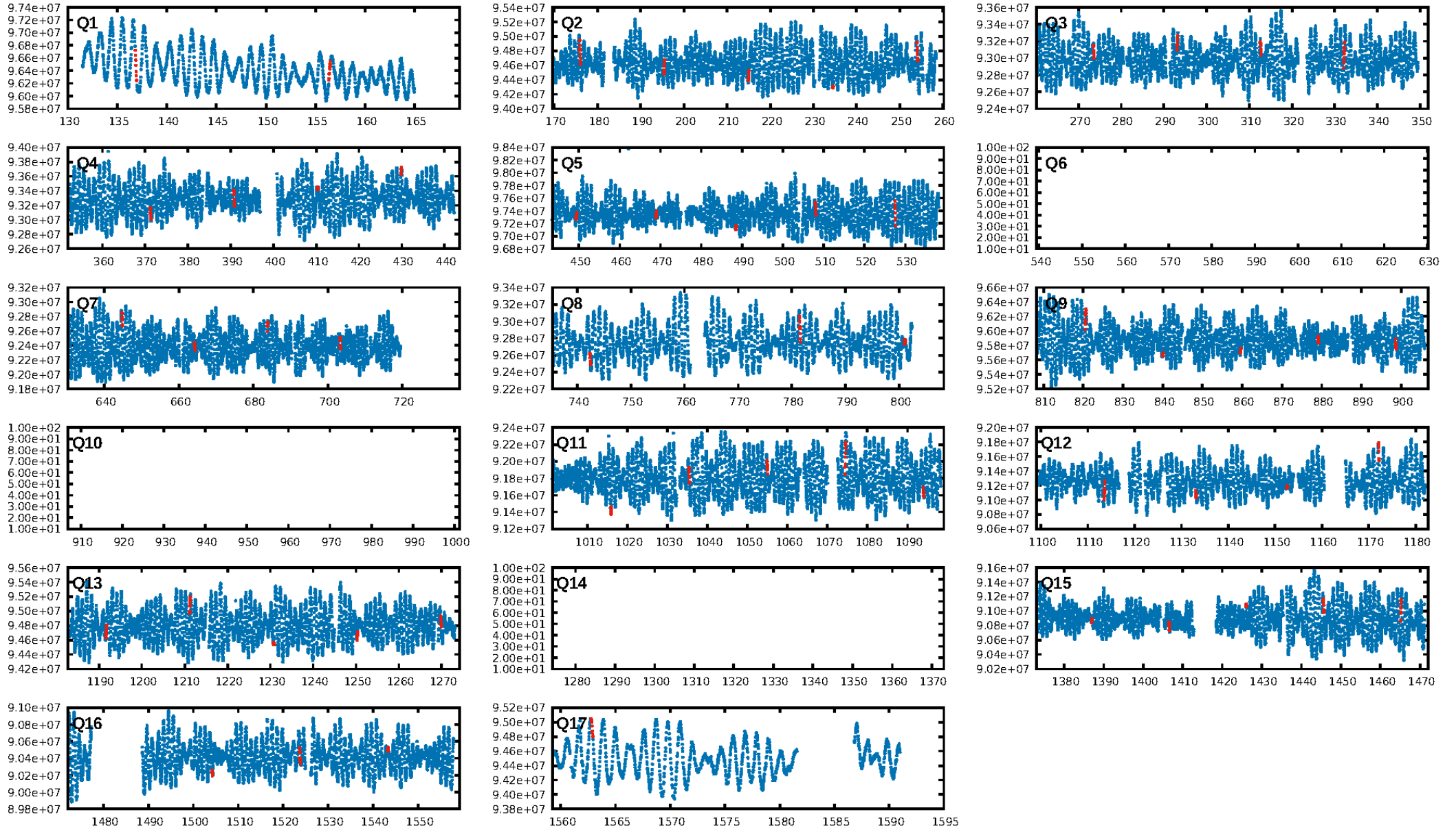
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [76.91 $\sigma$ ]  
LongPeriod-sig: 5.5% [0.07 $\sigma$ ]  
ModelChiSquare2-sig: 14.2%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 9.67e-54  
RollingBand-fgt: 1.00 [8/8]  
**GhostDiagnostic-chr: 0.00217**  
Centroid-sig: N/A  
Centroid-so: 0.160 arcsec [1.07 $\sigma$ ]  
OotOffset-rm: 0.232 arcsec [0.75 $\sigma$ ]  
KicOffset-rm: 0.235 arcsec [0.77 $\sigma$ ]  
OotOffset-st: 1/4/4/4 [13]  
KicOffset-st: 1/4/4/4 [13]  
DiffImageQuality-fgm: 0.38 [5/13]  
DiffImageOverlap-fno: 0.00 [0/14]

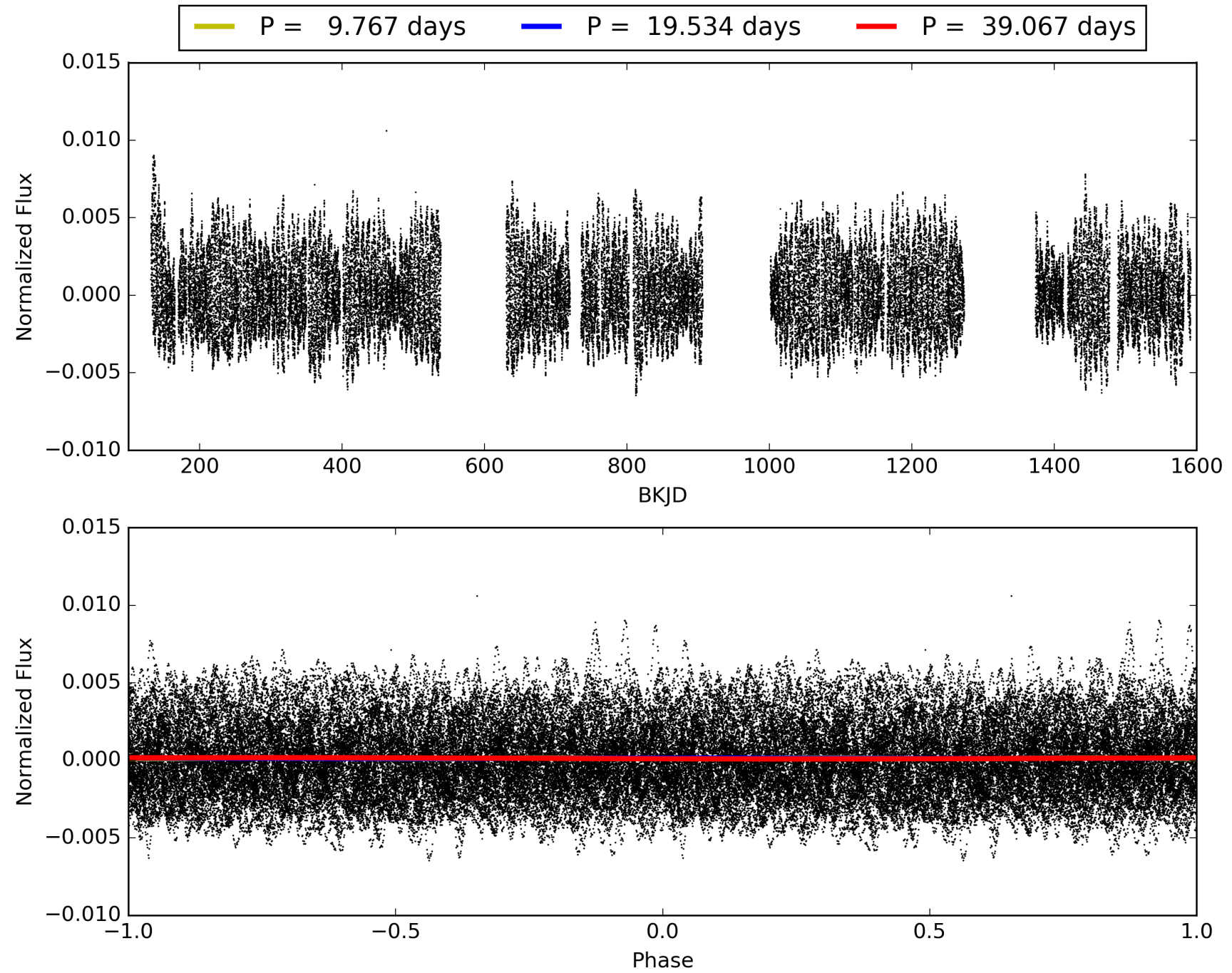
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 02:17:23 Z

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

# TCE 005370431-05, PDC Light Curves

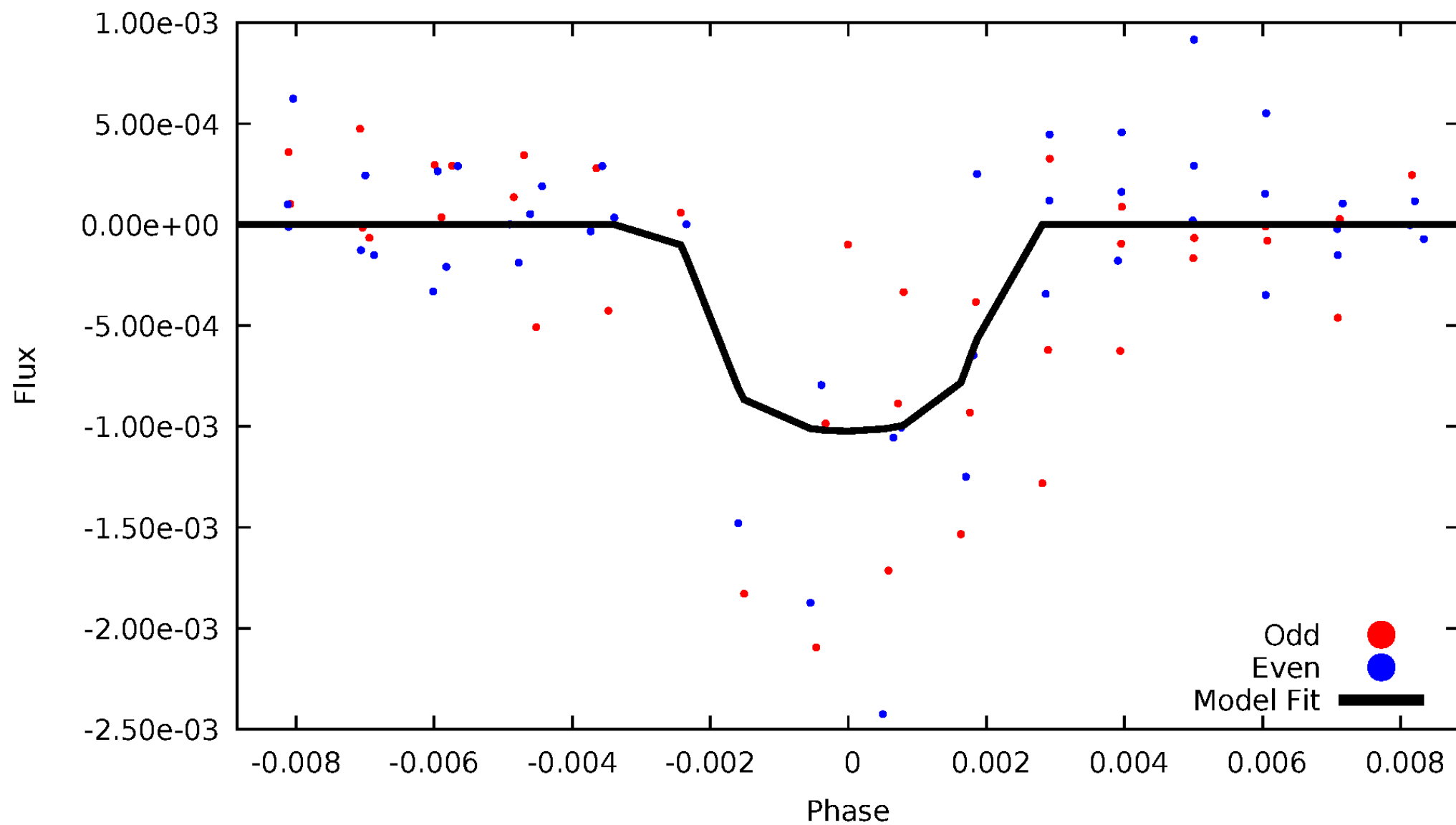


# TCE 005370431-05



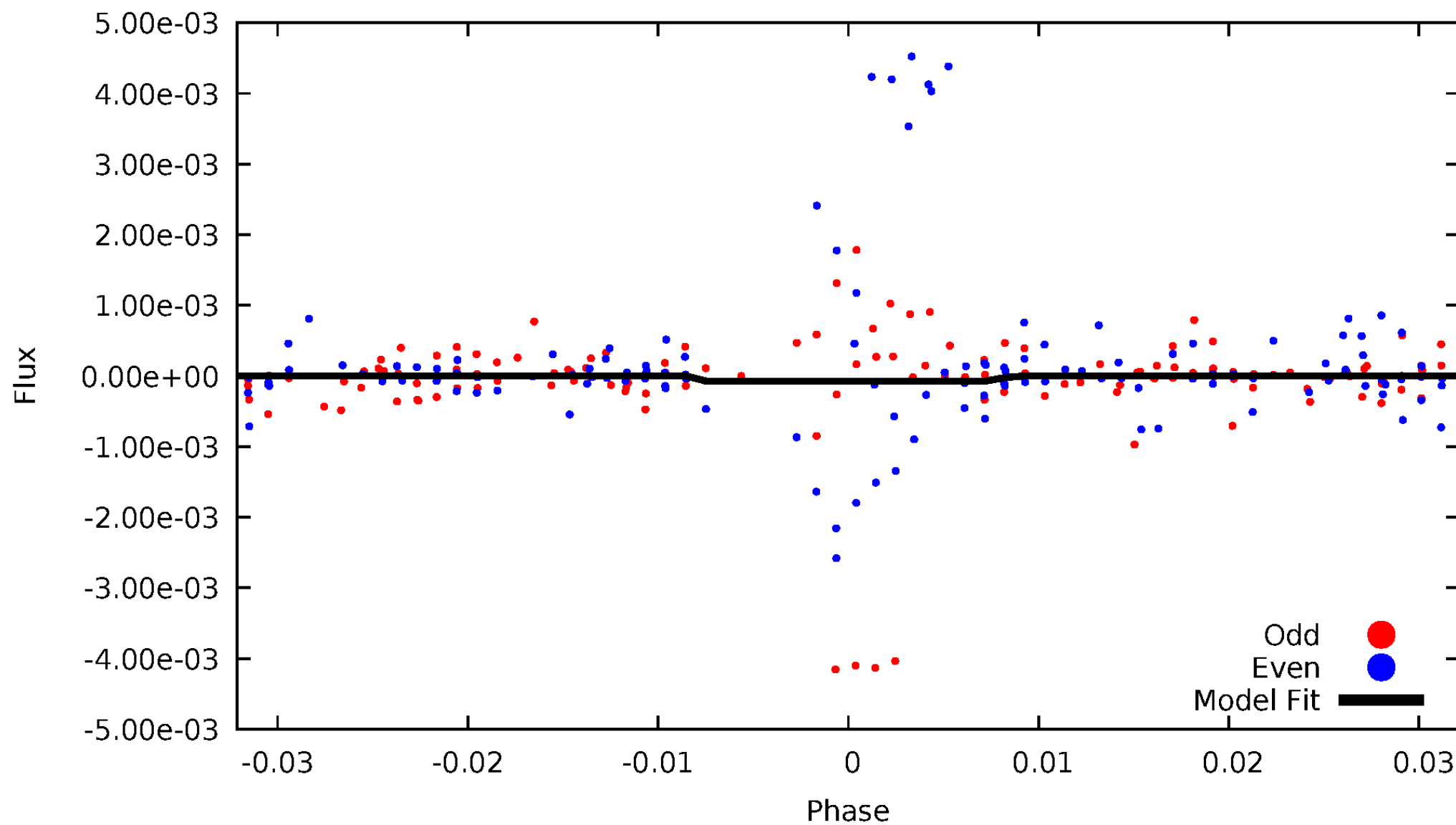
# DV Odd/Even

TCE 005370431-05



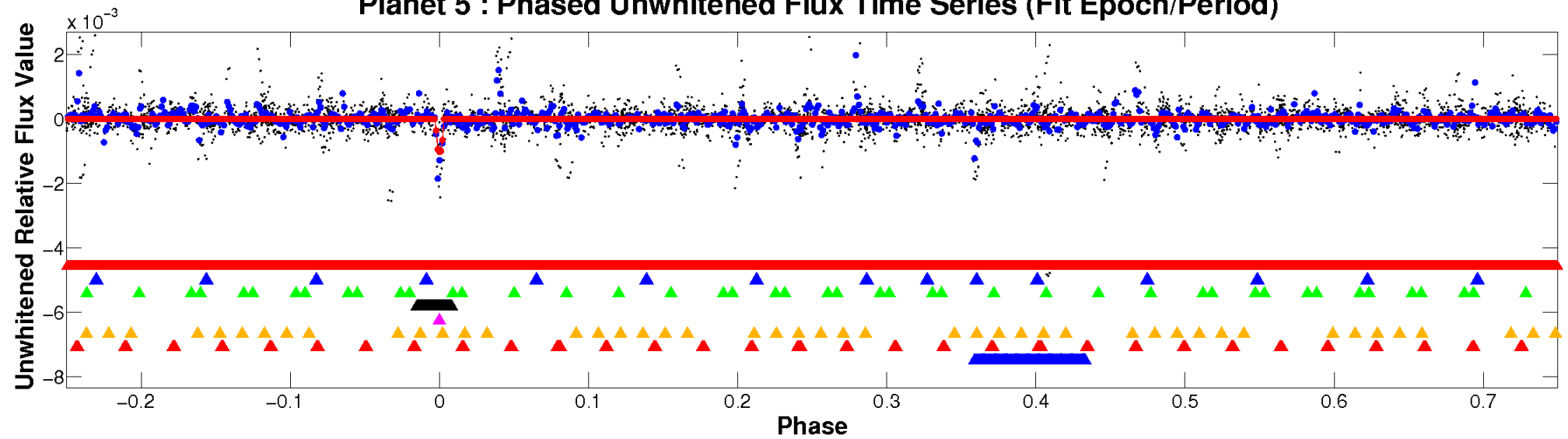
# ALT Odd/Even

TCE 005370431-05

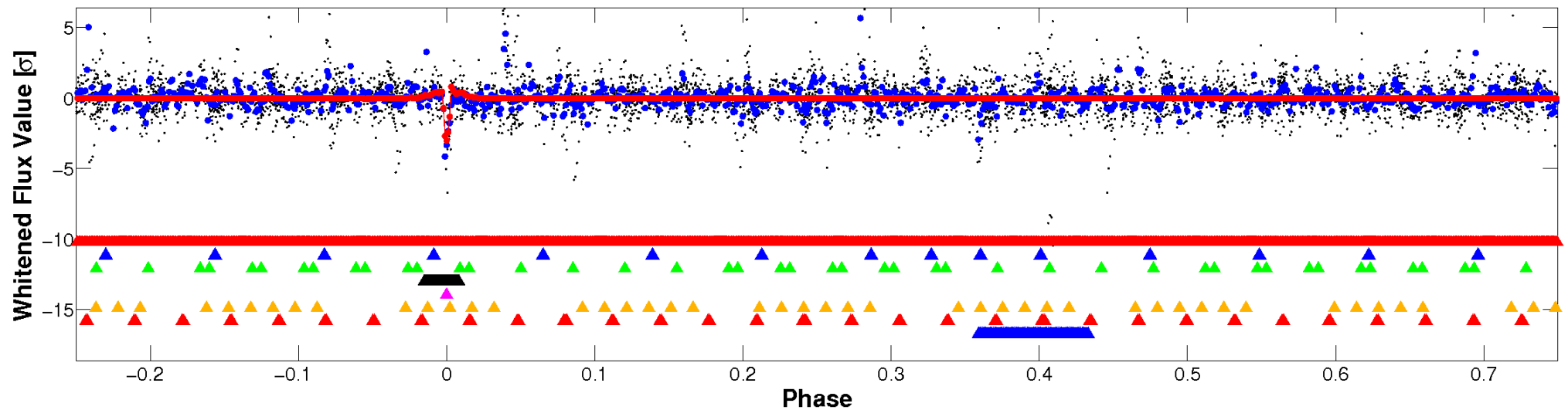


# Non-Whitened Vs. Whitened Light Curve

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



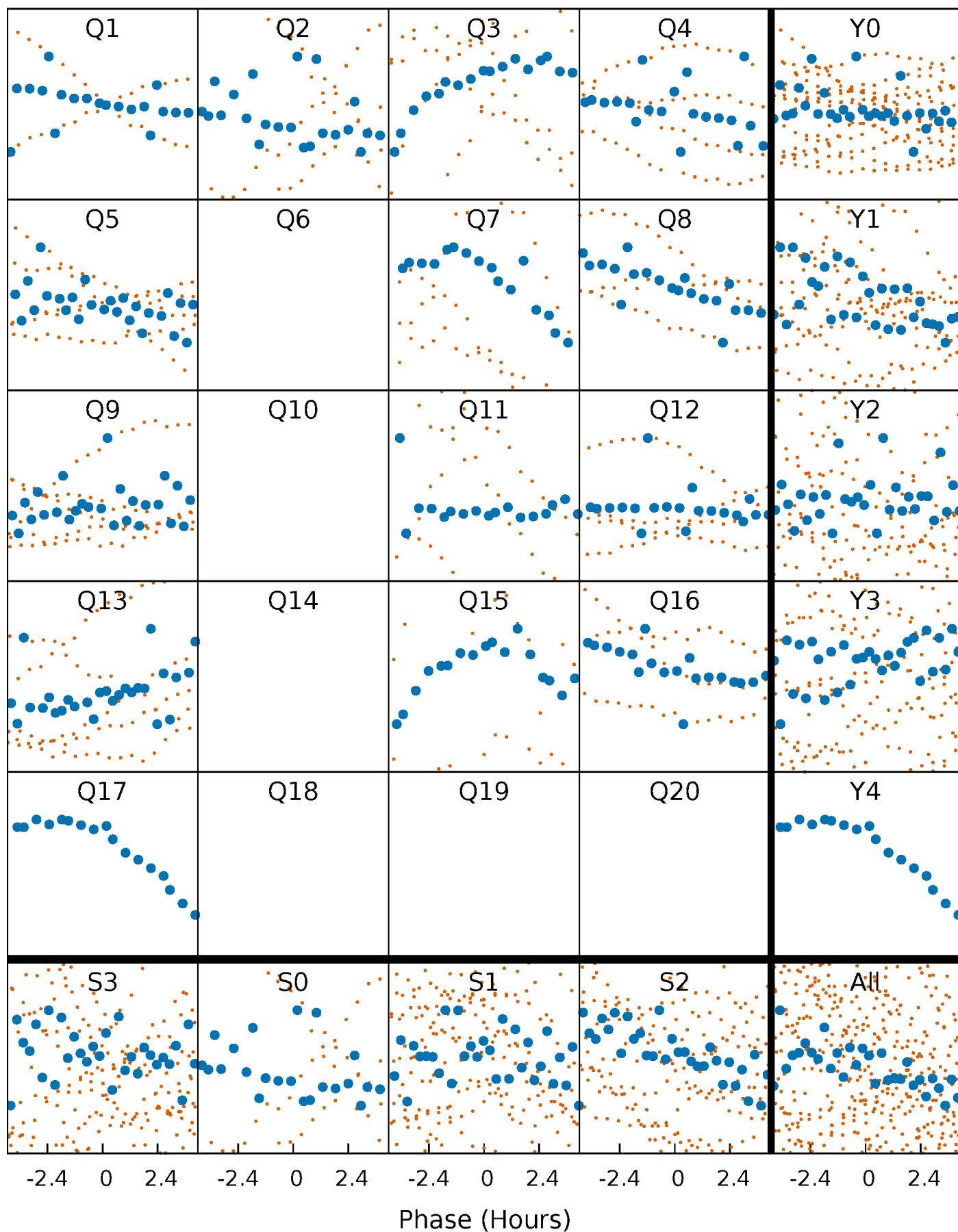
## Planet 5 : Phased Whitened Flux Time Series (Fit Epoch/Period)





# PDC Quarter-Phased Transit Curves

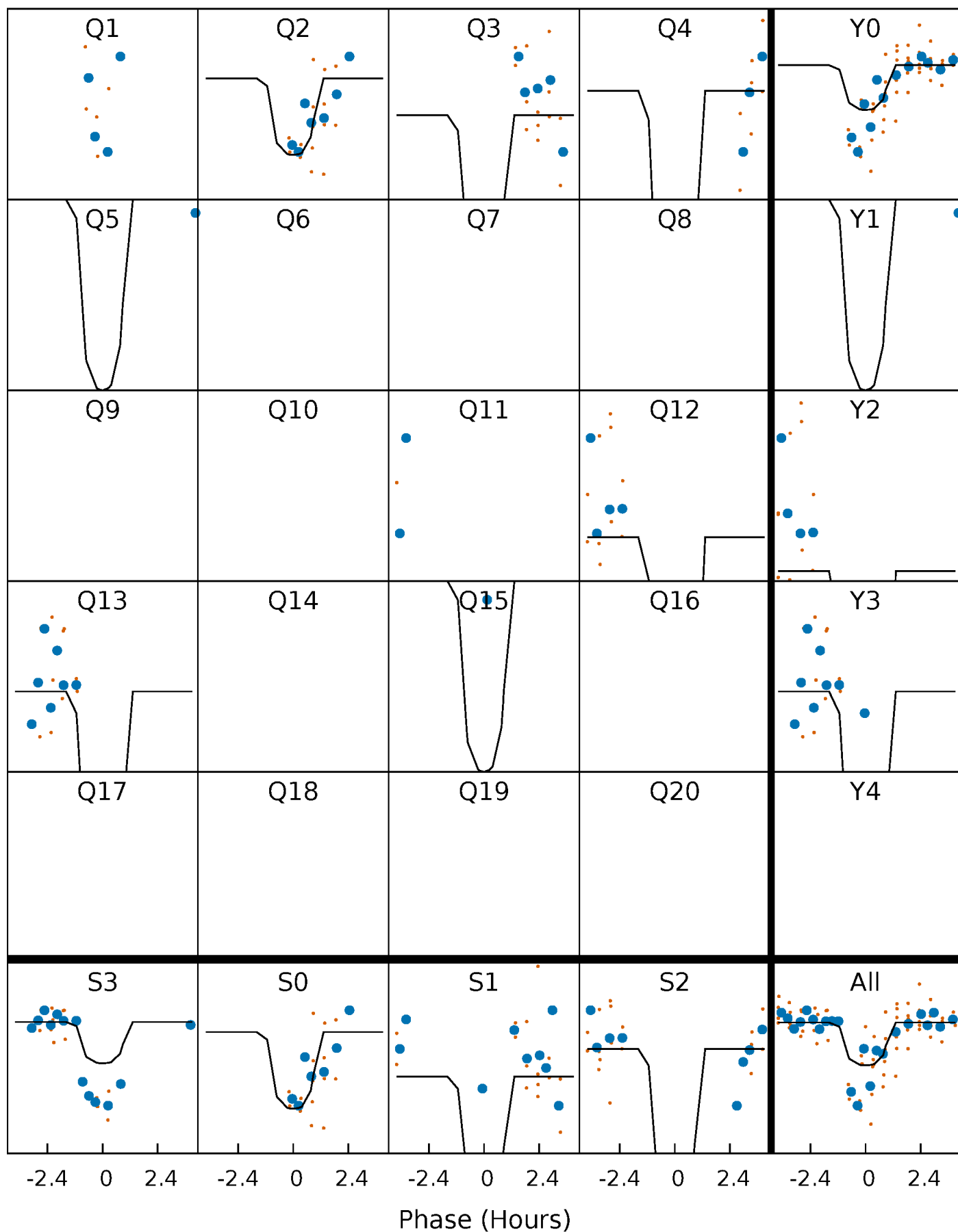
TCE 005370431-05     $P = 19.533730$  Days     $T_0 = 136.876849$  (BKJD)





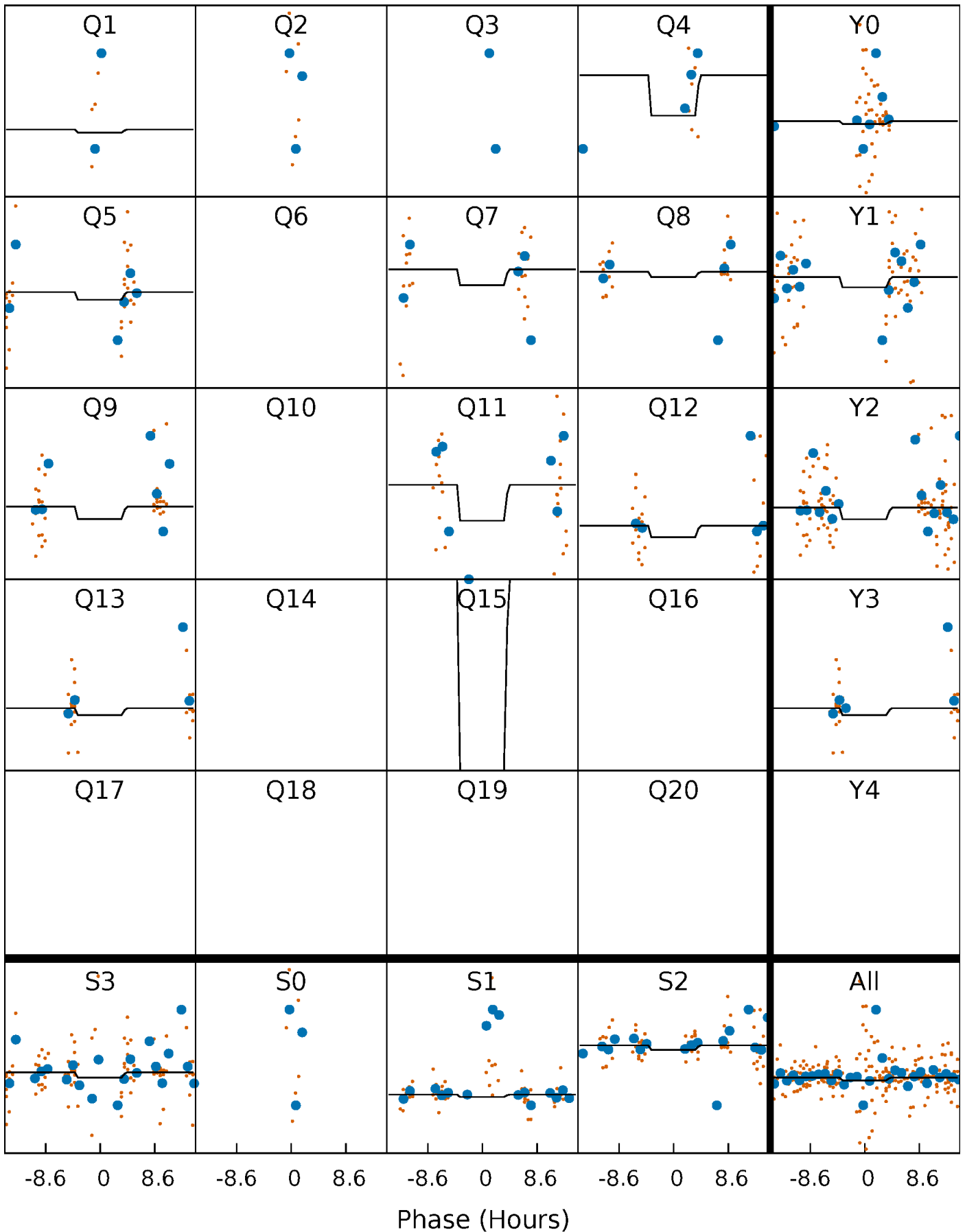
# DV Quarter-Phased Transit Curves

TCE 005370431-05   P= 19.533730 Days    $T_0=136.876849$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

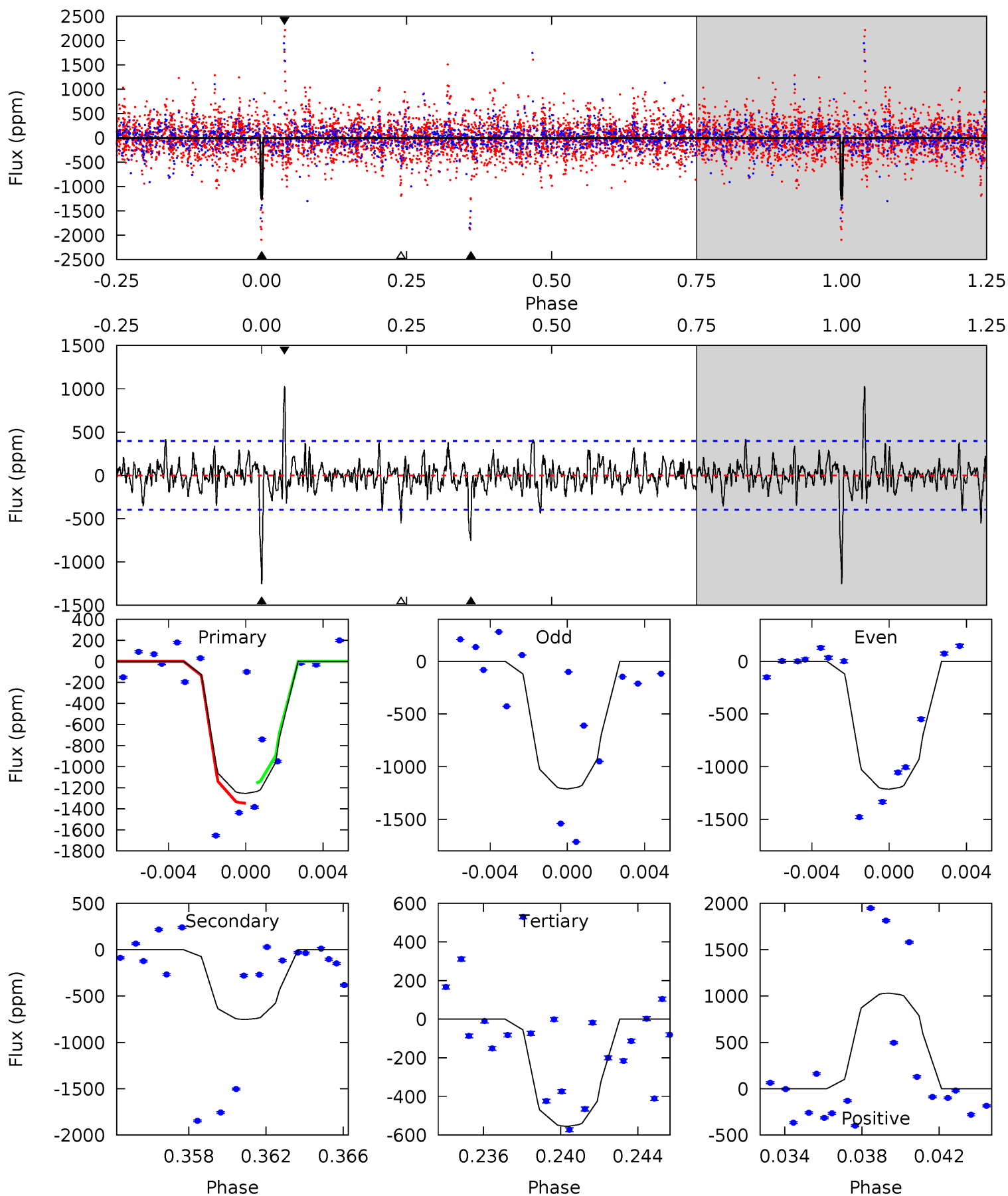
TCE 005370431-05   P= 19.535079 Days    $T_0=136.898932$  (BKJD)



# DV Model-Shift Uniqueness Test

005370431-05, P = 19.533730 Days, E = 117.343119 Days

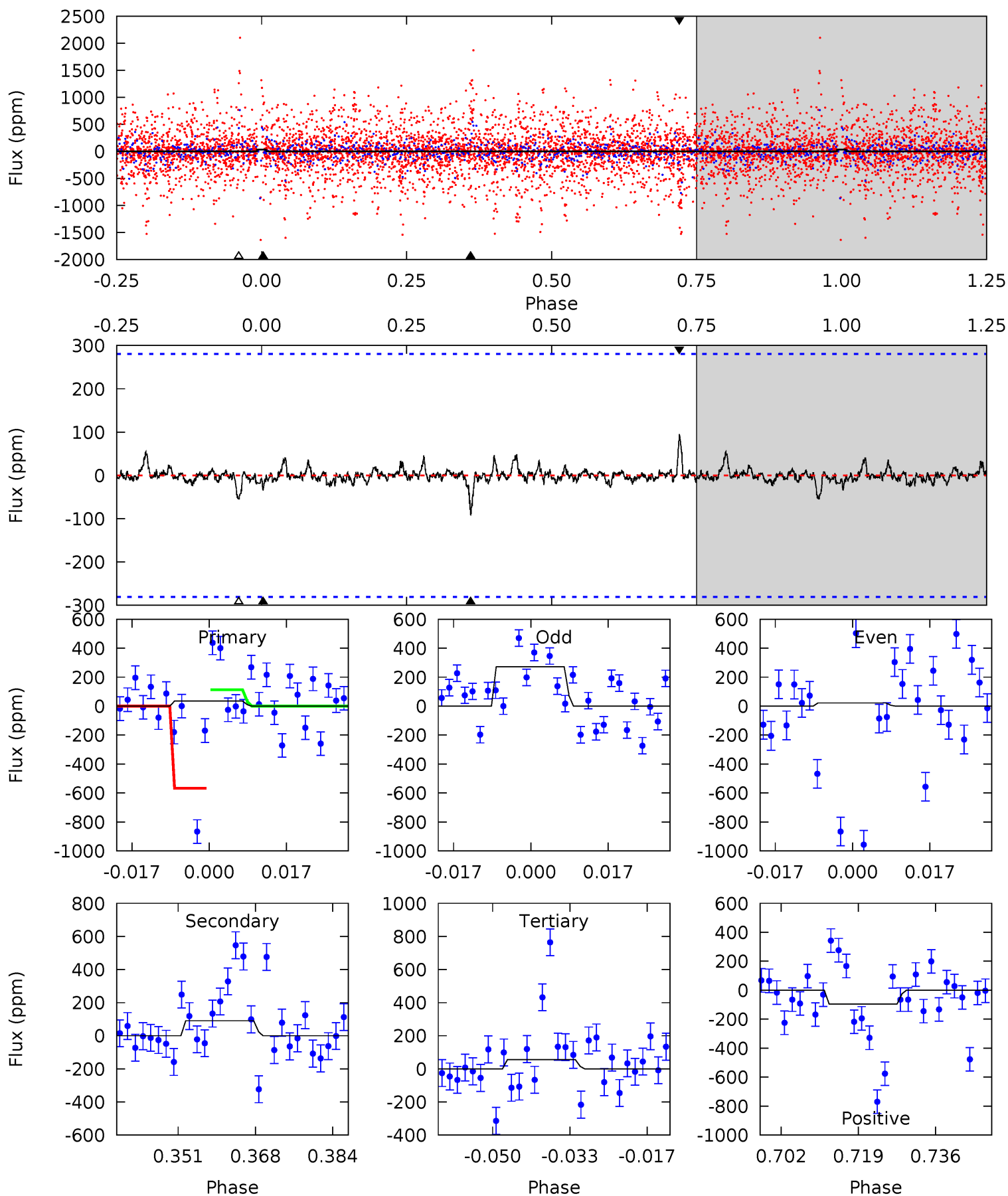
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
16.5	9.88	7.28	13.5	5.19	2.86	1.77	9.19	2.94	2.61	-3.64	0.02	1.19	0.45	1.28



# Alt Model-Shift Uniqueness Test

005370431-05, P = 19.535079 Days, E = 117.363853 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
0.61	1.60	0.98	1.67	4.93	2.39	0.27	-0.37	-1.06	0.62	-0.07	1.79	17.3	0.51	0



### Stellar Parameters For KIC 005370431

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$7051^{+194}_{-315}$	$4.262^{+0.073}_{-0.218}$	$-0.020^{+0.200}_{-0.350}$	$1.454^{+0.524}_{-0.225}$	$1.409^{+0.222}_{-0.202}$	$0.645^{+0.254}_{-0.347}$
	+3%/-4%	+2%/-5%	+1000%/-1750%	+36%/-15%	+16%/-14%	+39%/-54%
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 005370431-05 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-754 \pm 76$	$7.32^{+6.65}_{-4.74}$	$1345^{+106}_{-79}$	$5576^{+4609}_{-1316}$	$190^{+1426}_{-139}$
Alt.	$-91 \pm 57$	$5.21^{+5.92}_{-3.64}$	$1337^{+105}_{-78}$	$3973^{+2595}_{-1024}$	$35^{+374}_{-30}$

$T_{max}$  = Theoretical Maximum Planetary Temperature  
 $T_{obs}$  = Observed Planetary Temperature (Assuming  $A=0.3$ )  
 $A_{obs}$  = Observed Albedo (Assuming  $T=0$ )

If a secondary eclipse is present, the system is likely an EB if  $T_{obs} \gg T_{max}$  AND  $A_{obs} \gg 1.0$

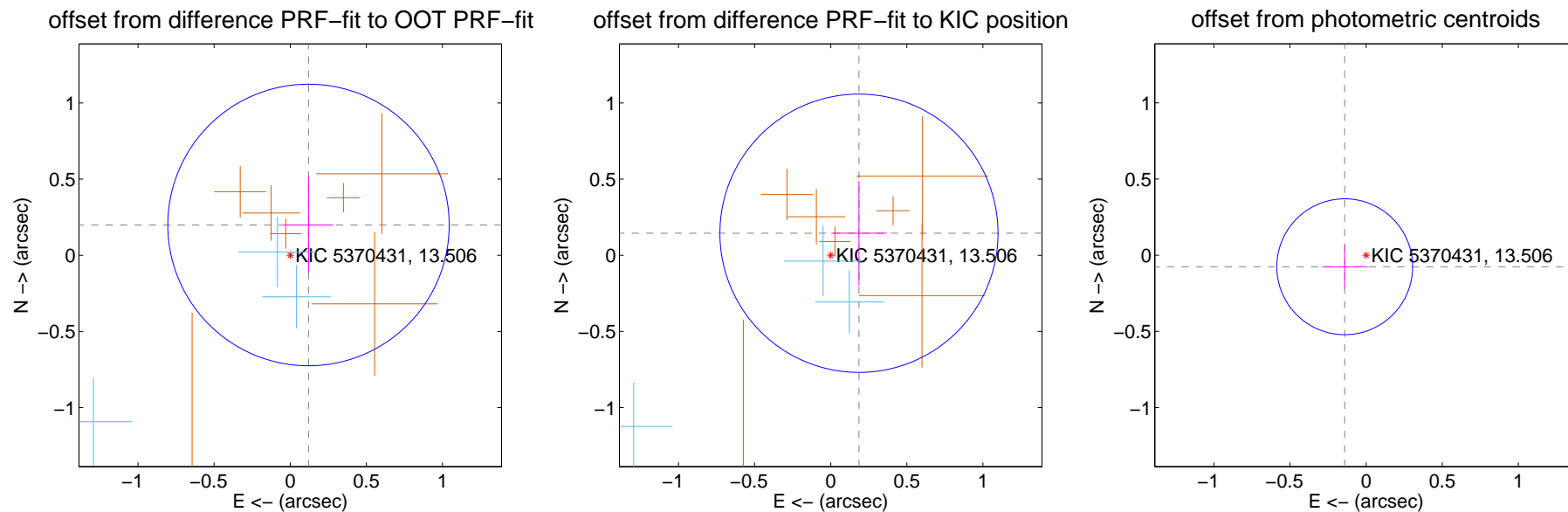
## DV Centroid Data

Supplemental centroid analysis for 005370431-05. Kepler magnitude: 13.51. Transit SNR 9.67

There are 5 quarters with good PRF difference image offsets

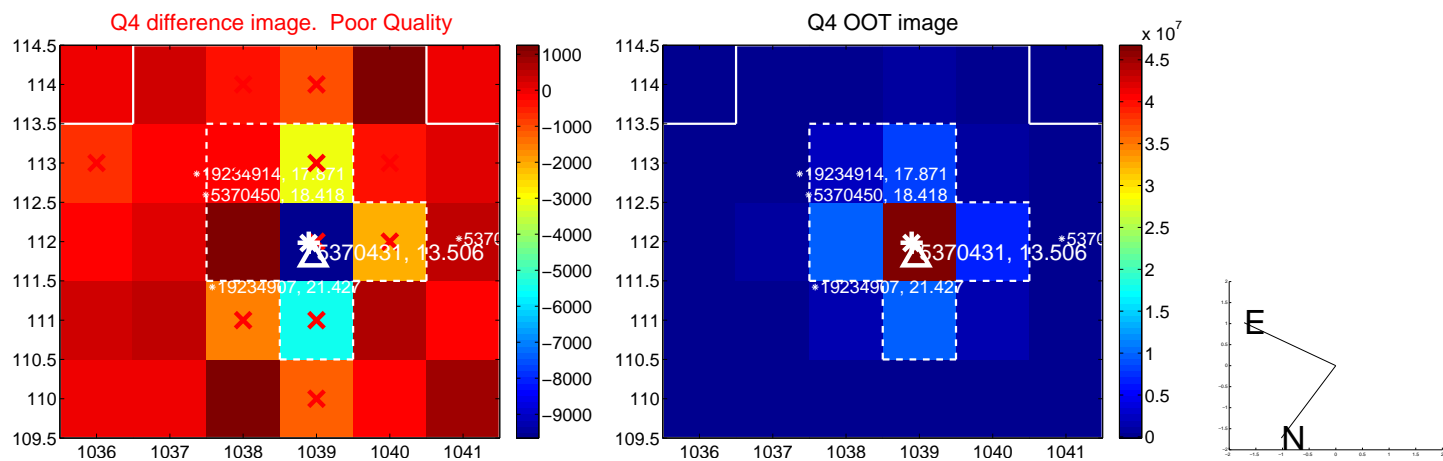
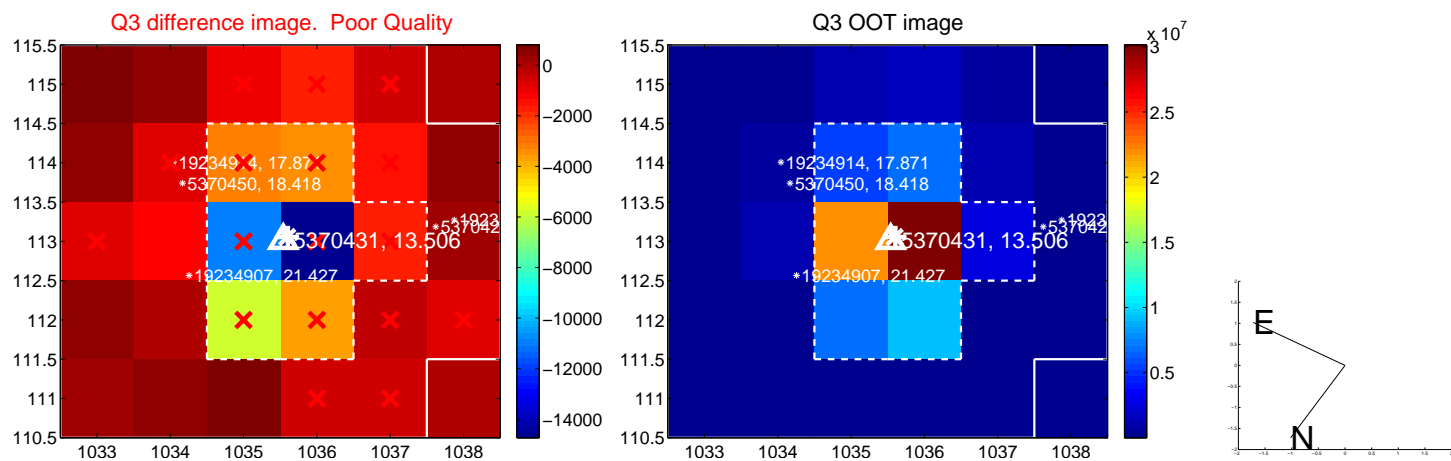
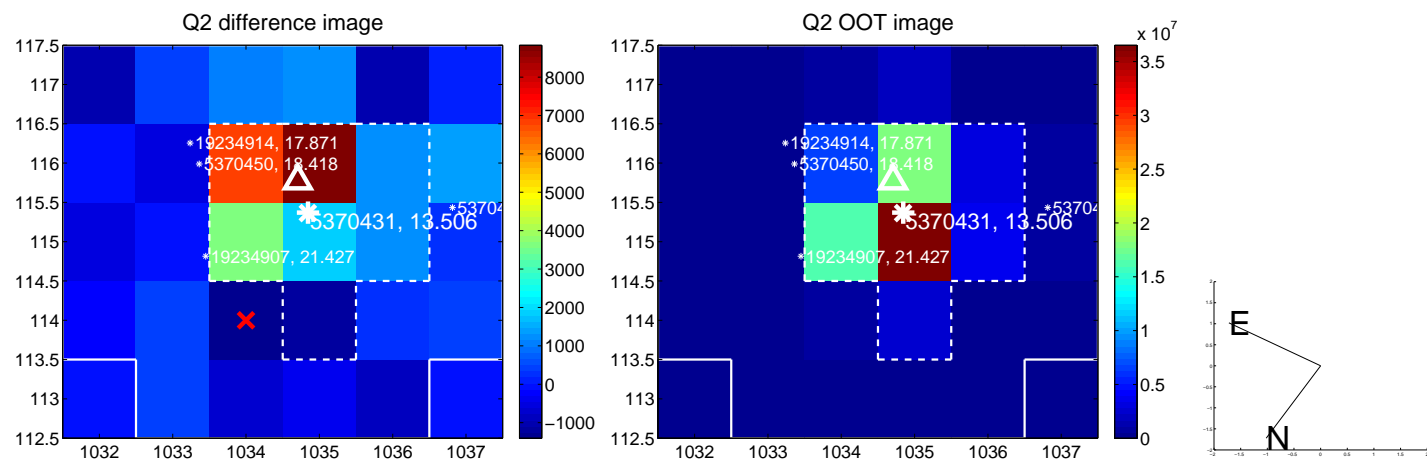
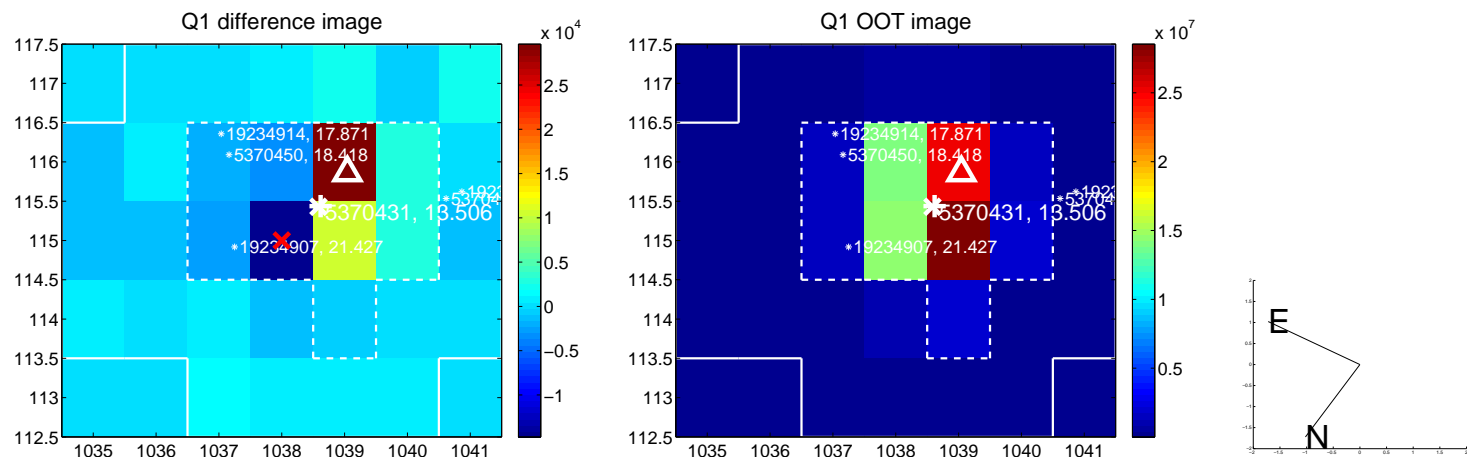
The direct PRF centroid is offset from the target star catalog position by about 0.10 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.232 \pm 0.308$	0.75	$-0.120 \pm 0.162$	$0.199 \pm 0.315$
PRF-fit source offset from KIC position	$0.235 \pm 0.304$	0.77	$-0.186 \pm 0.182$	$0.145 \pm 0.344$
photometric centroid source offset	$0.16 \pm 0.15$	1.07	$0.14 \pm 0.15$	$-0.08 \pm 0.14$

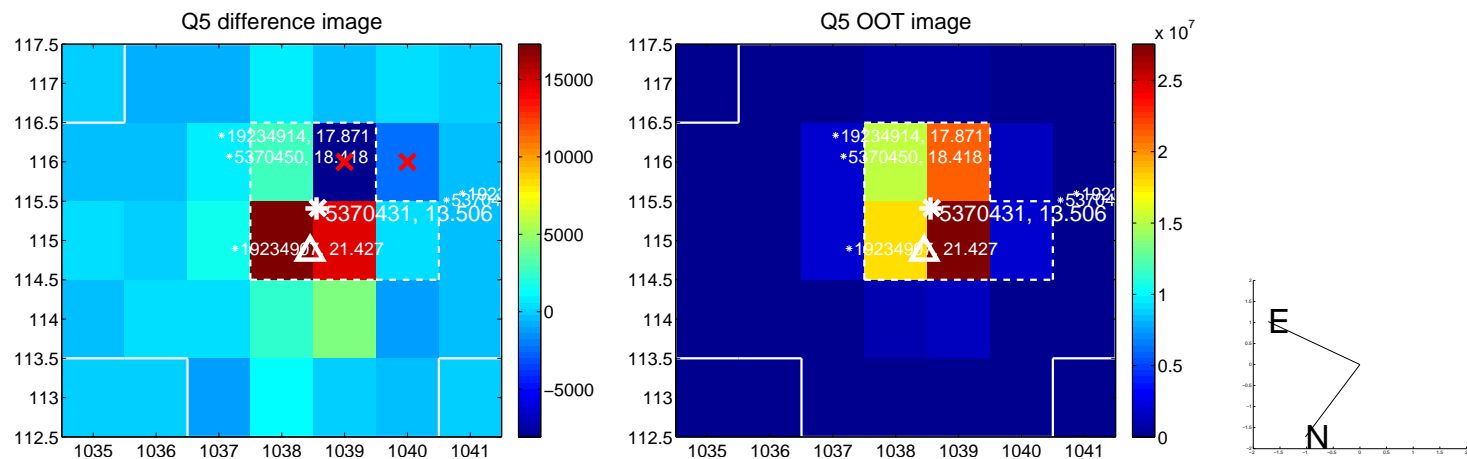


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

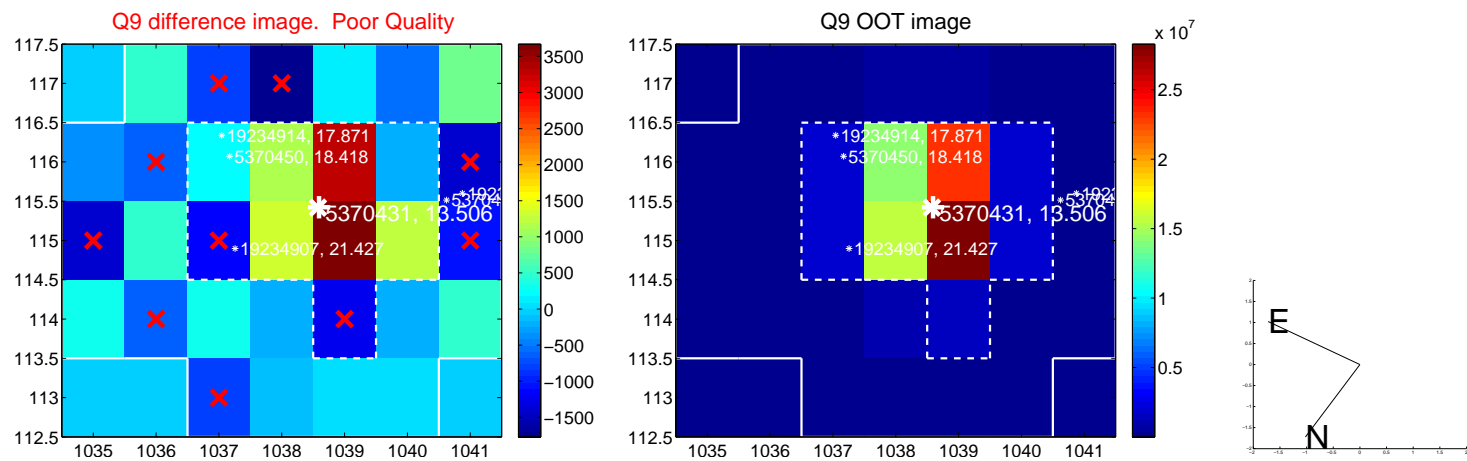


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

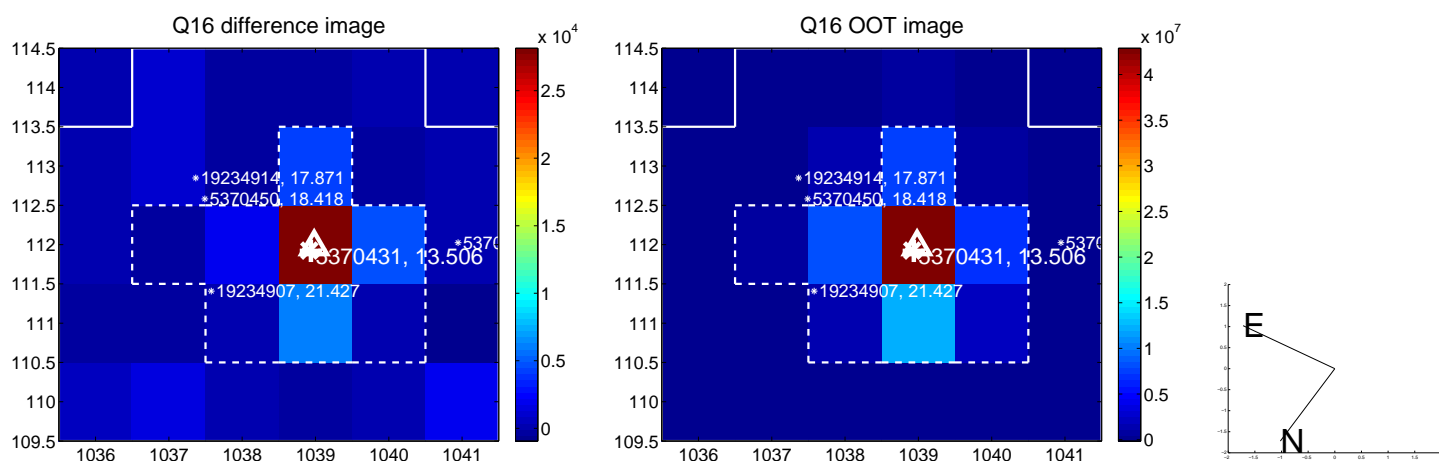
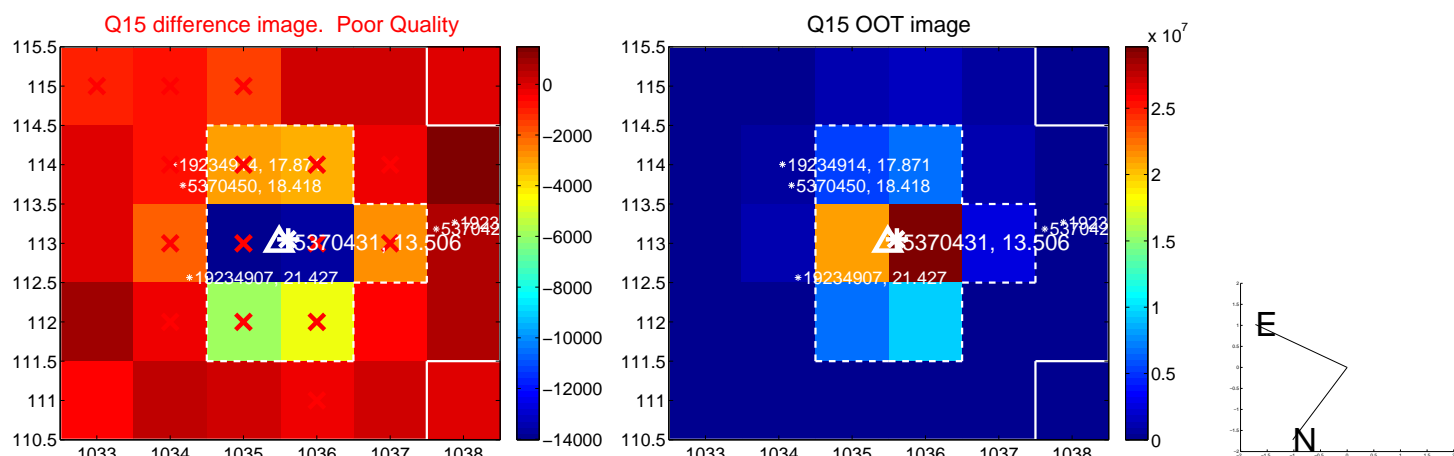
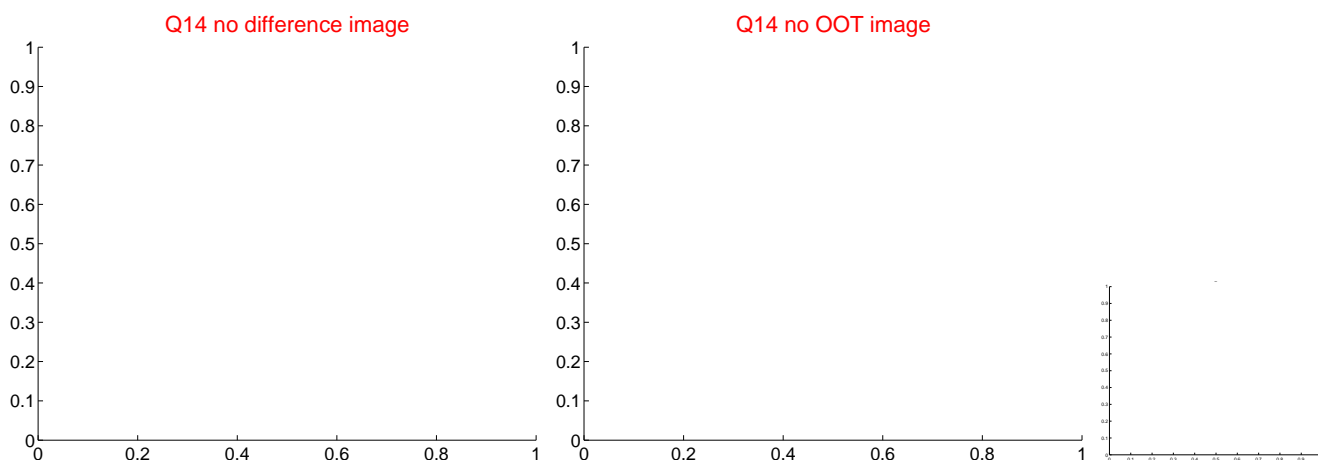
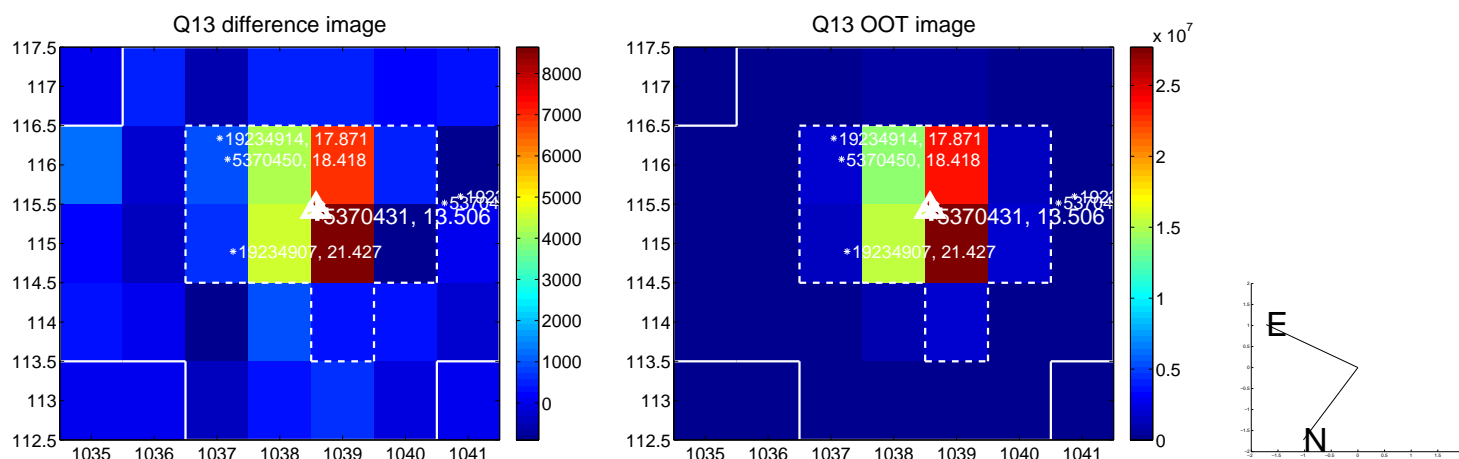




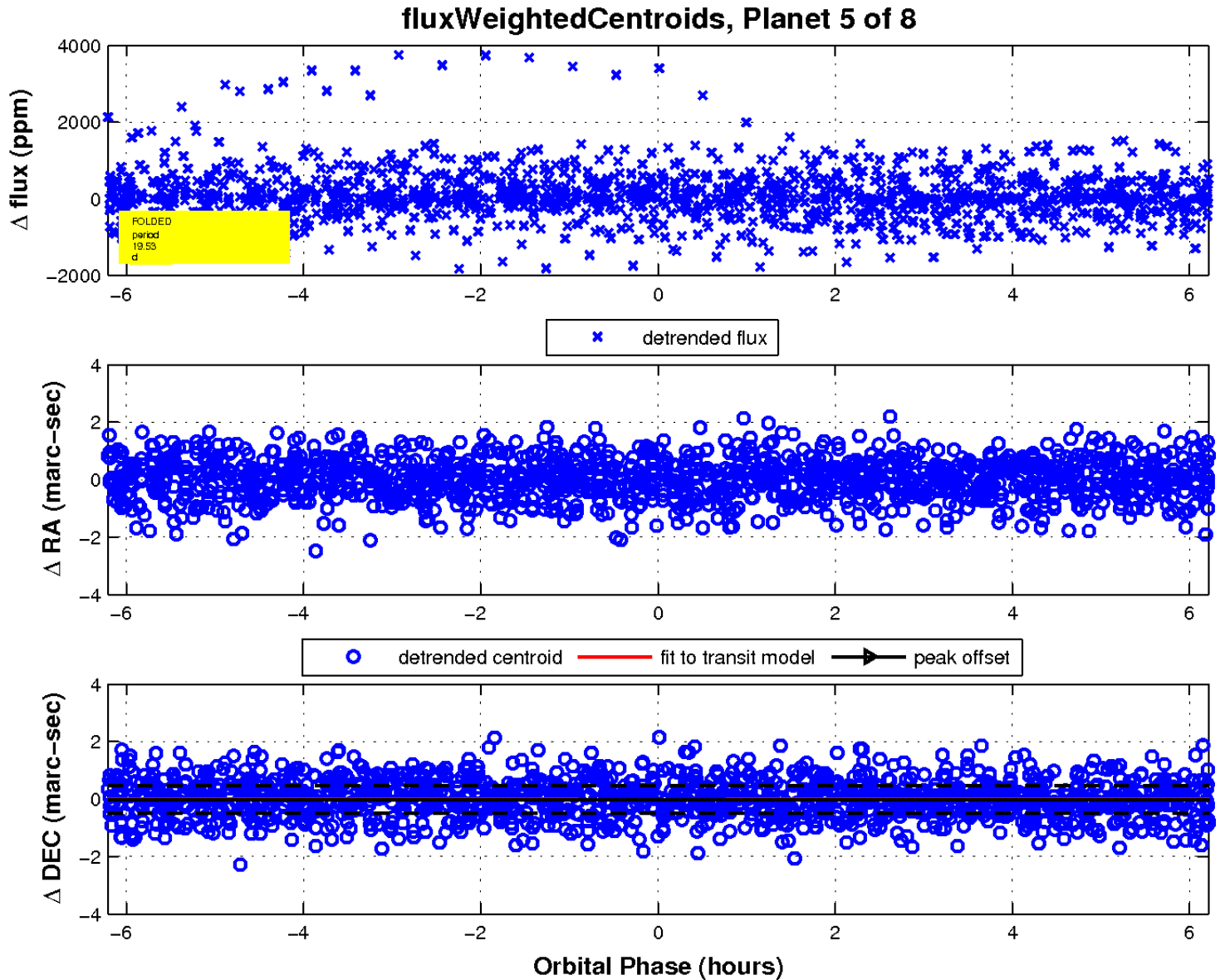
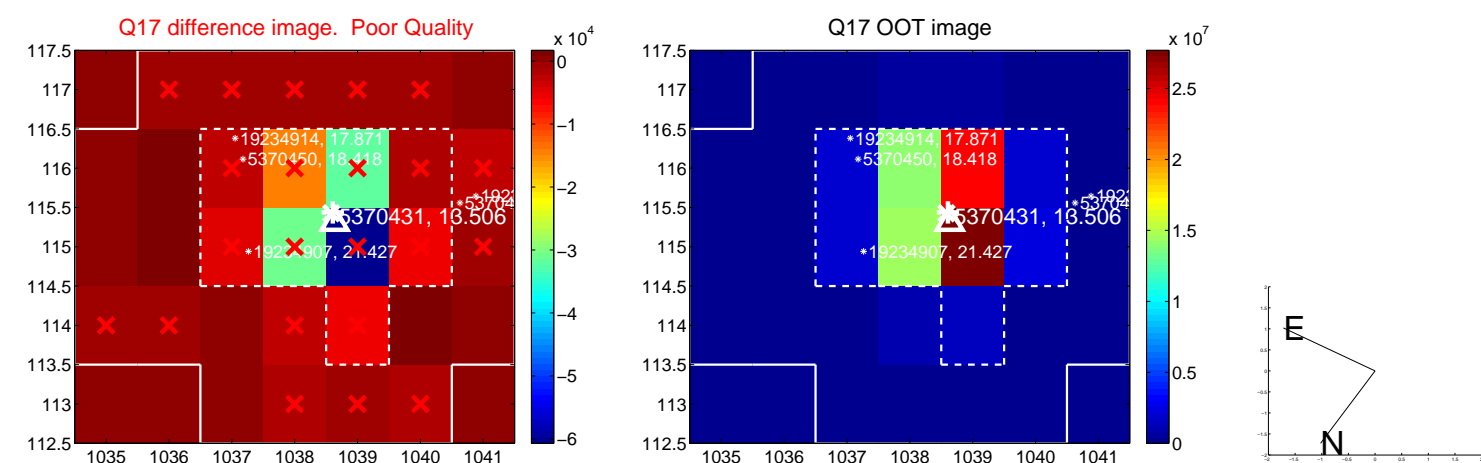
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

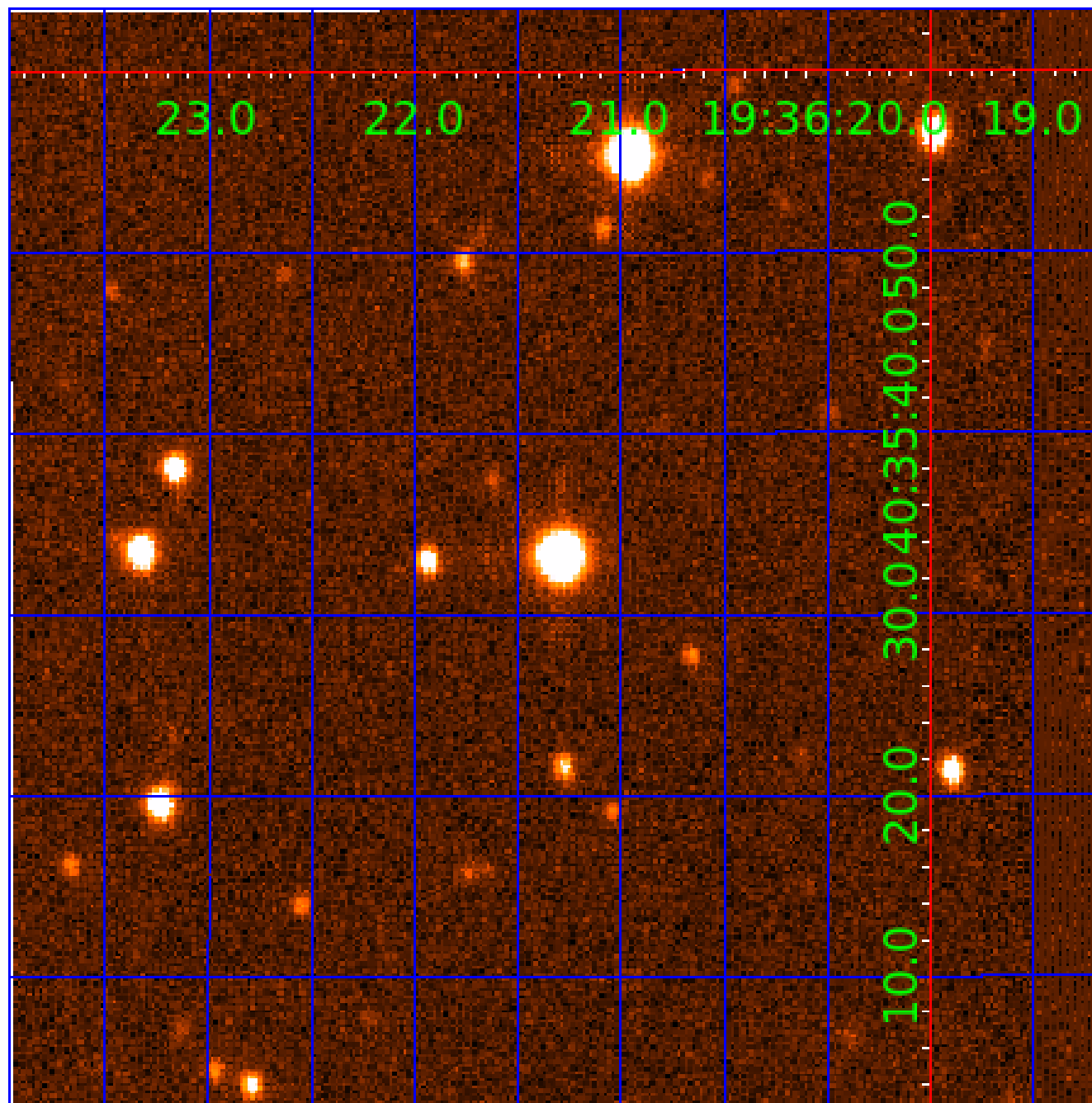


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 005370431

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
005370431-01	OBS	No	0.781860	131.783803	10.8	5.471	8.4	1.8	1.45	7051	0.51	13492.79
005370431-02	OBS	No	96.227075	222.050583	2395.4	3.148	18.8	12.0	1.45	7051	8.36	22.04
005370431-03	OBS	No	32.784515	133.747890	1183.7	1.555	17.4	7.2	1.45	7051	5.46	92.62
005370431-04	OBS	No	19.539904	136.581723	146.8	0.581	15.7	0.4	1.45	7051	1.84	184.66
005370431-05	OBS	No	19.533730	136.876849	1023.5	2.075	18.2	9.7	1.45	7051	5.07	184.74
005370431-08	OBS	No	19.553301	143.887382	967.7	5.353	12.9	8.7	1.45	7051	8.41	184.49

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
005370431-01	OBS	FP	0.00	1	0	0	0	LPP_DV
005370431-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS
005370431-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_POS_ALT
005370431-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
005370431-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—HALO_GHOST
005370431-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

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

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

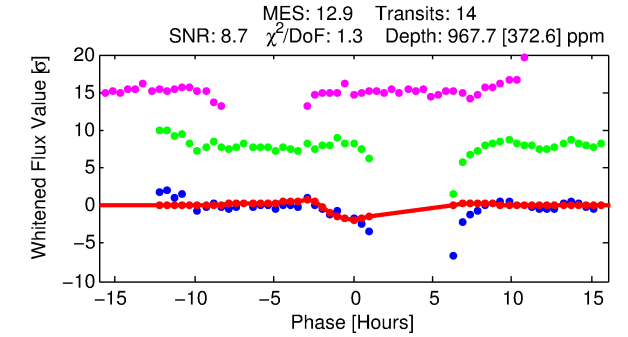
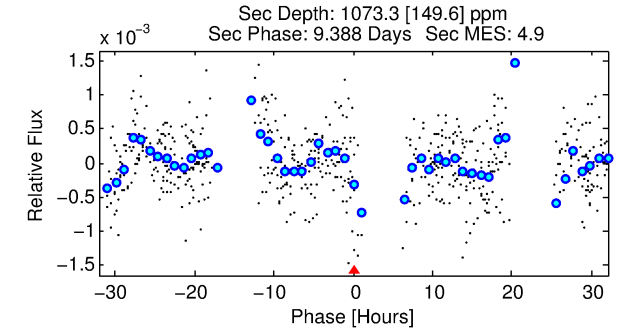
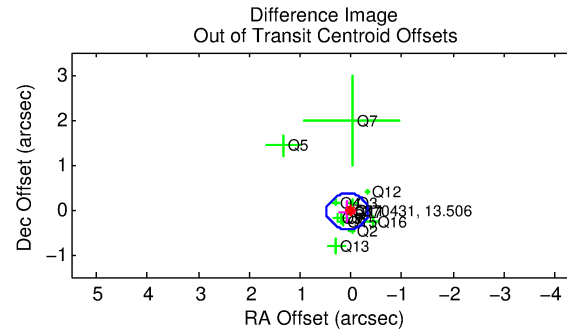
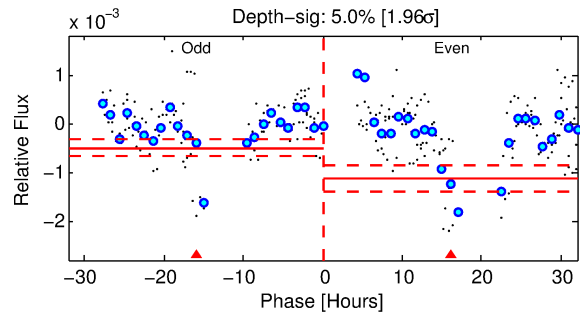
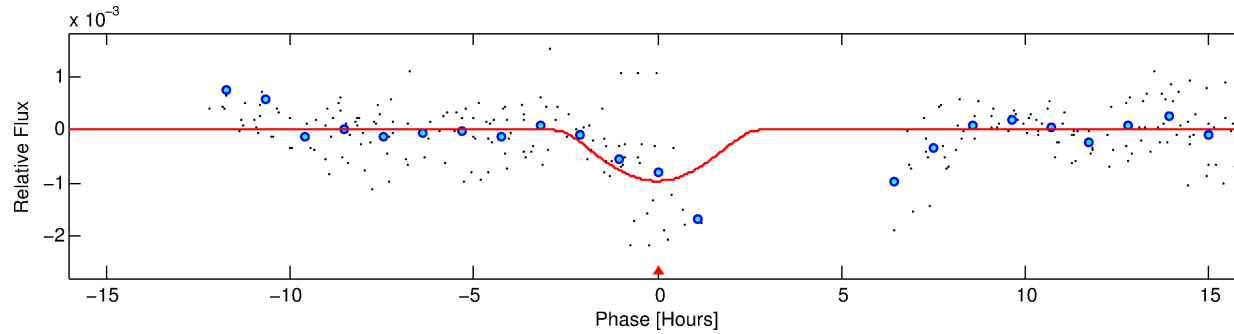
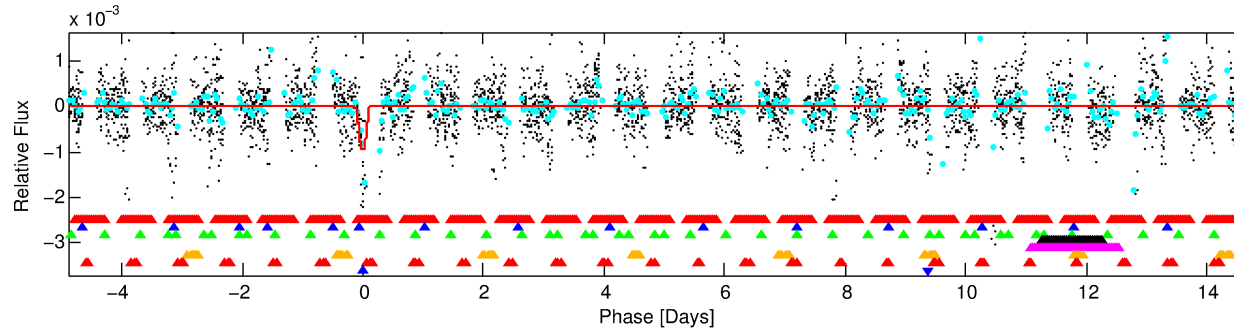
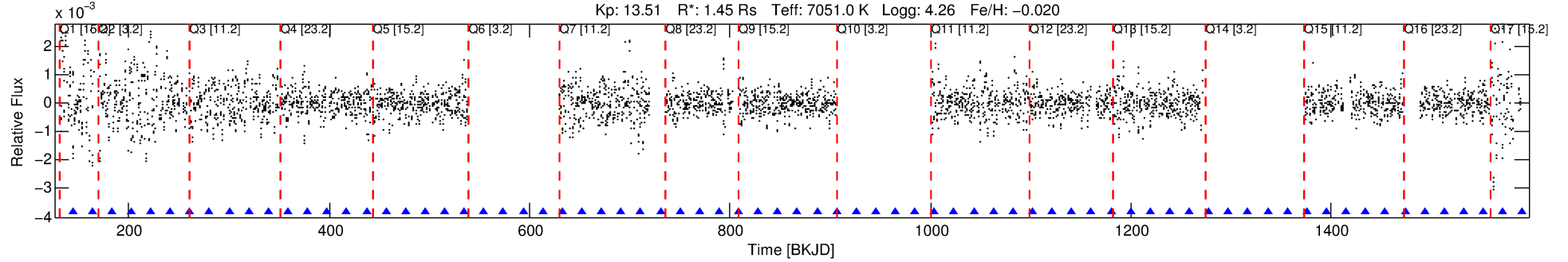
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 005370431-08

No Significant Match Found

# DV One-Page Summary

KIC: 5370431 Candidate: 8 of 8 Period: 19.553 d



## DV Fit Results:

Period = 19.55330 [0.00168] d  
Epoch = 143.8874 [0.0182] BKJD  
Rp/R\* = 0.0530 [0.2067]  
a/R\* = 9.29 [9.04]  
b = 1.00 [0.31]  
Seff = 184.49 [82.85]  
Teq = 940 [105] K  
Rp = 8.41 [32.93] Re  
a = 0.1593 [0.0466] AU  
Ag = 211.70 [1652.93] [0.13 $\sigma$ ]  
Teffp = 5542 [10806] K [0.43 $\sigma$ ]

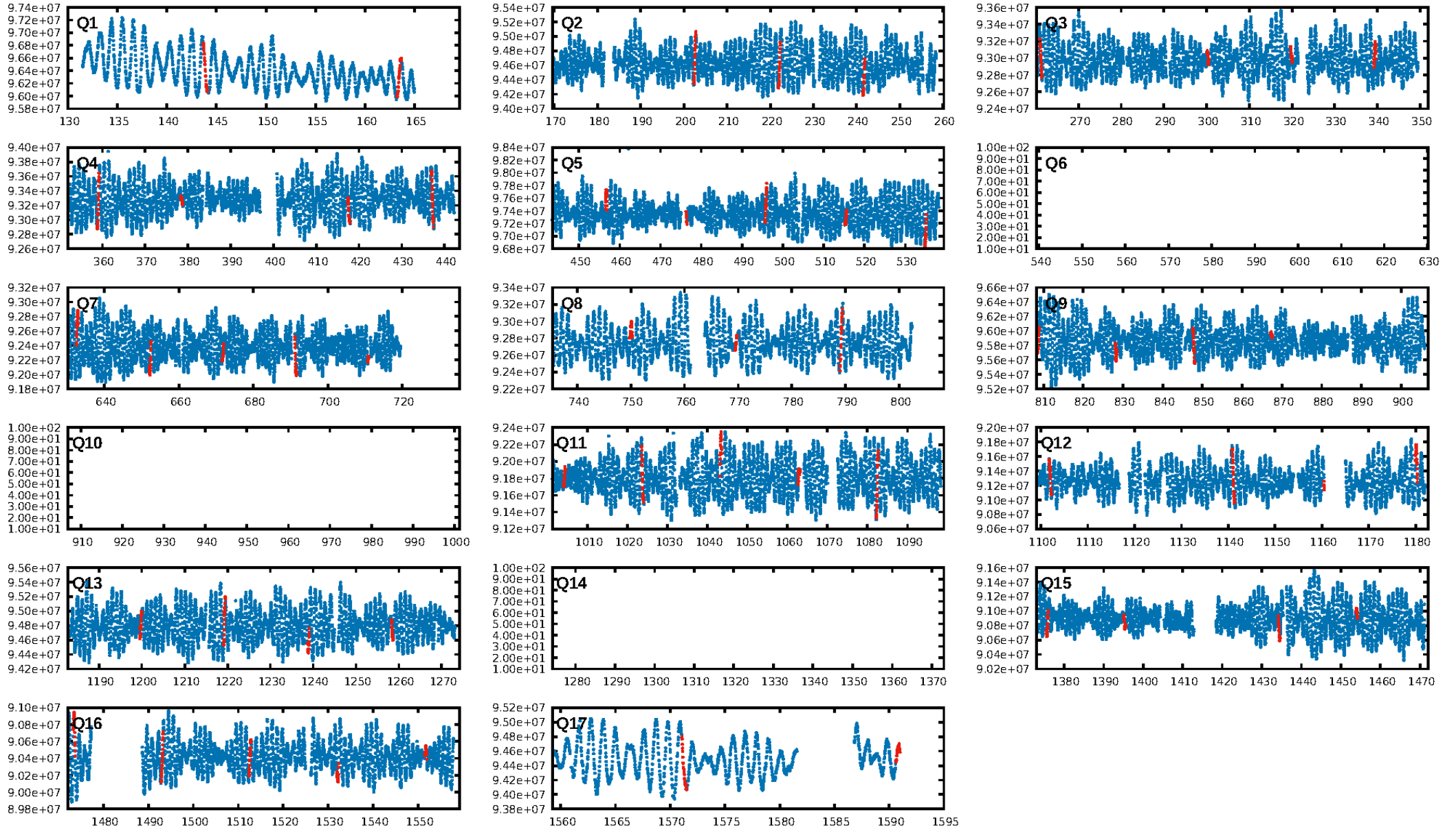
## DV Diagnostic Results:

ShortPeriod-sig: 4.8% [0.06 $\sigma$ ]  
LongPeriod-sig: 100.0% [5.66 $\sigma$ ]  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 4.69e-28  
RollingBand-fgt: 1.00 [12/12]  
GhostDiagnostic-chr: -1.531  
Centroid-sig: N/A  
Centroid-so: 0.043 arcsec [0.32 $\sigma$ ]  
OotOffset-rm: 0.083 arcsec [0.62 $\sigma$ ]  
OotOffset-st: 1/4/4/4 [13]  
KicOffset-rm: 0.134 arcsec [0.69 $\sigma$ ]  
KicOffset-st: 1/4/4/4 [13]  
DiffImageQuality-fgm: 0.54 [7/13]  
DiffImageOverlap-fno: 0.00 [0/14]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 02:17:32 Z

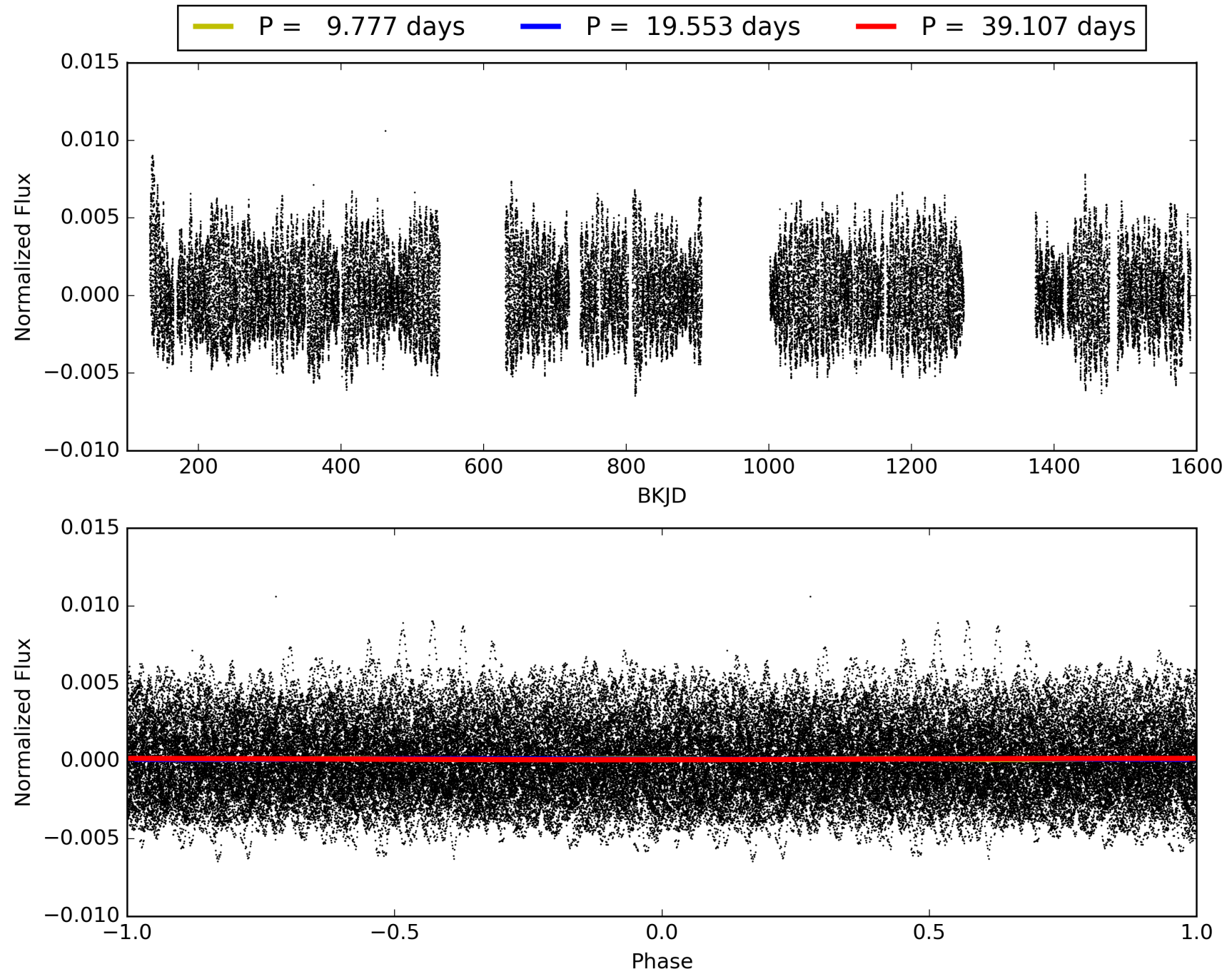
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 005370431-08, PDC Light Curves





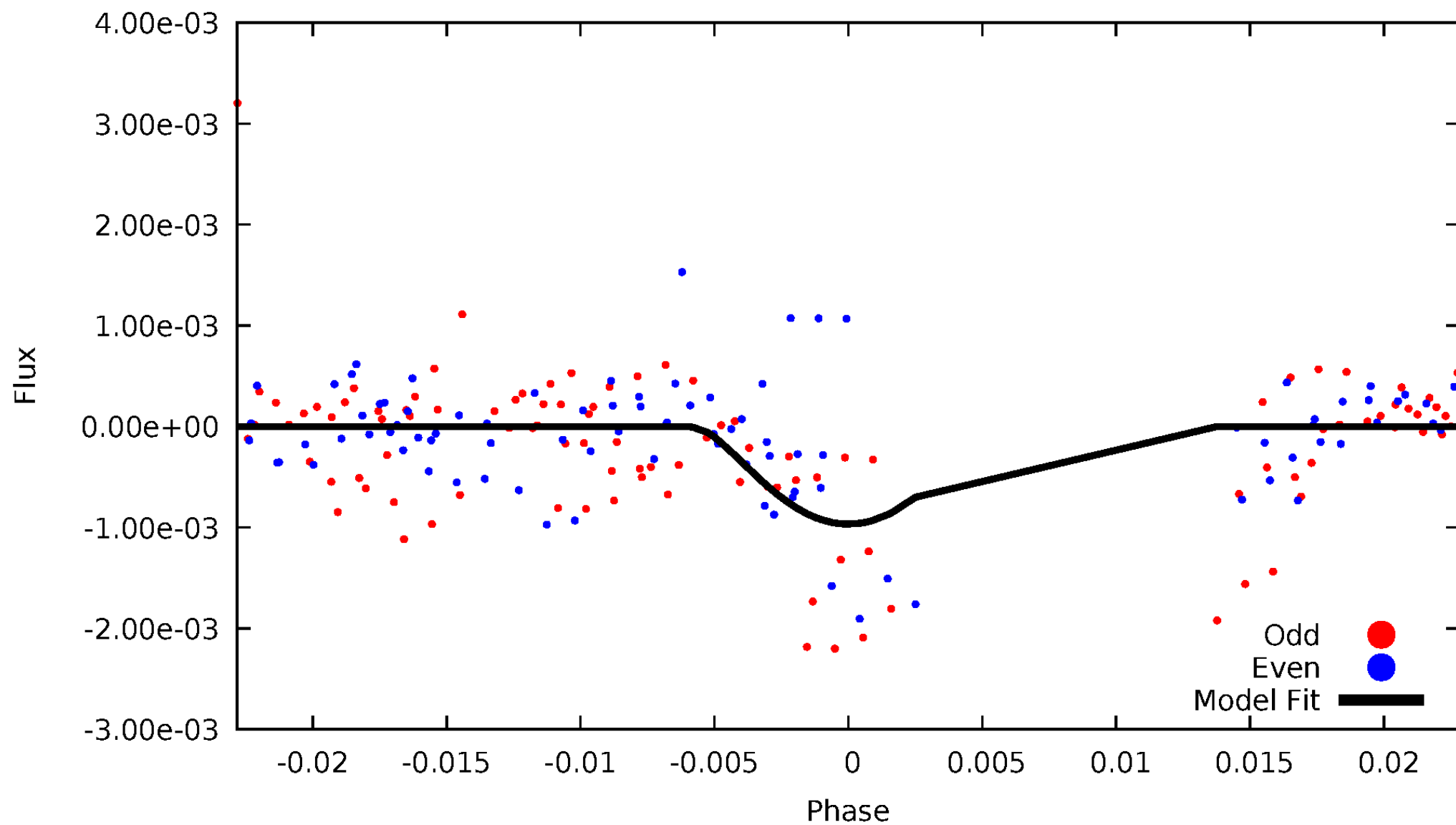
# TCE 005370431-08





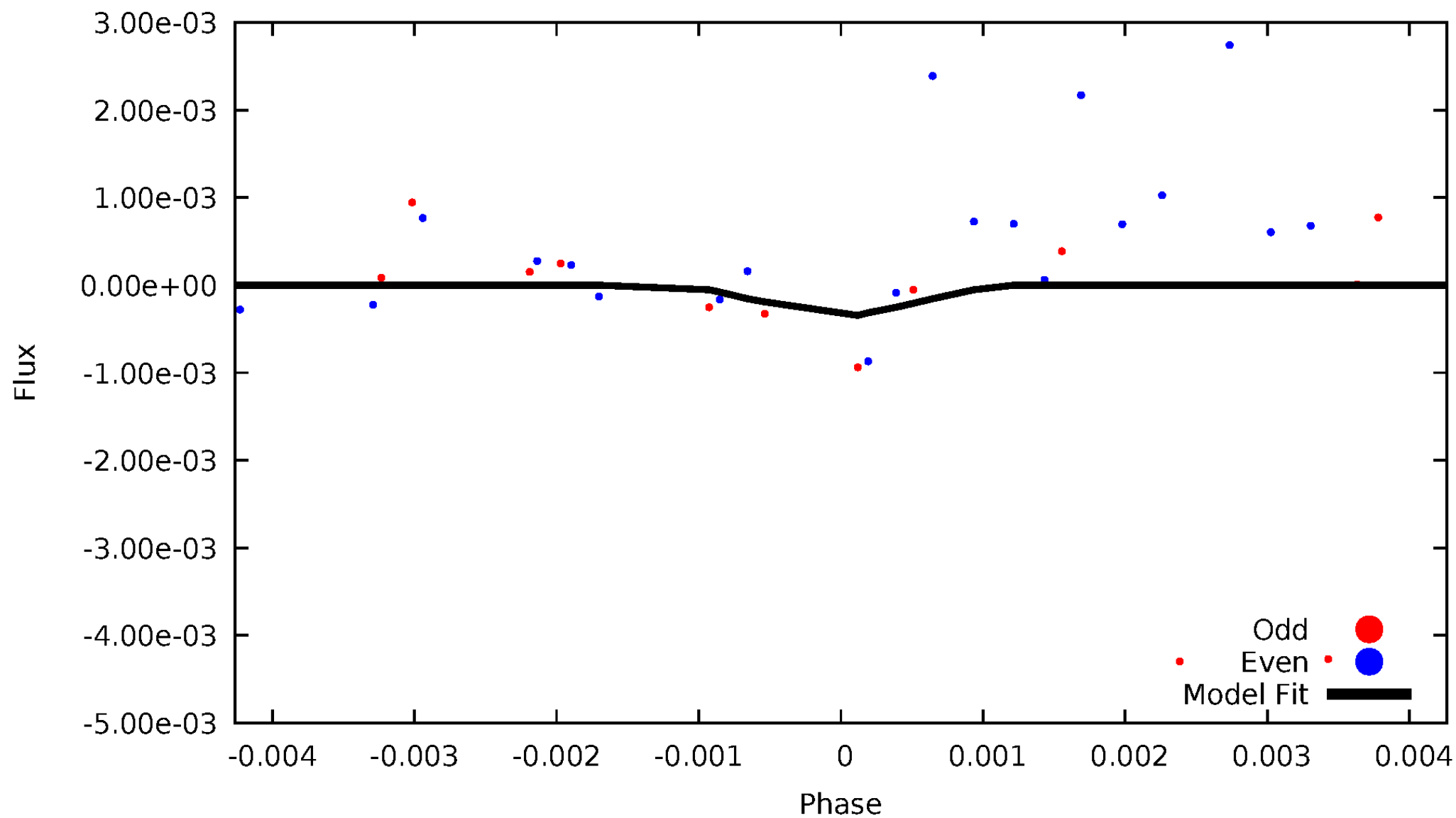
# DV Odd/Even

TCE 005370431-08



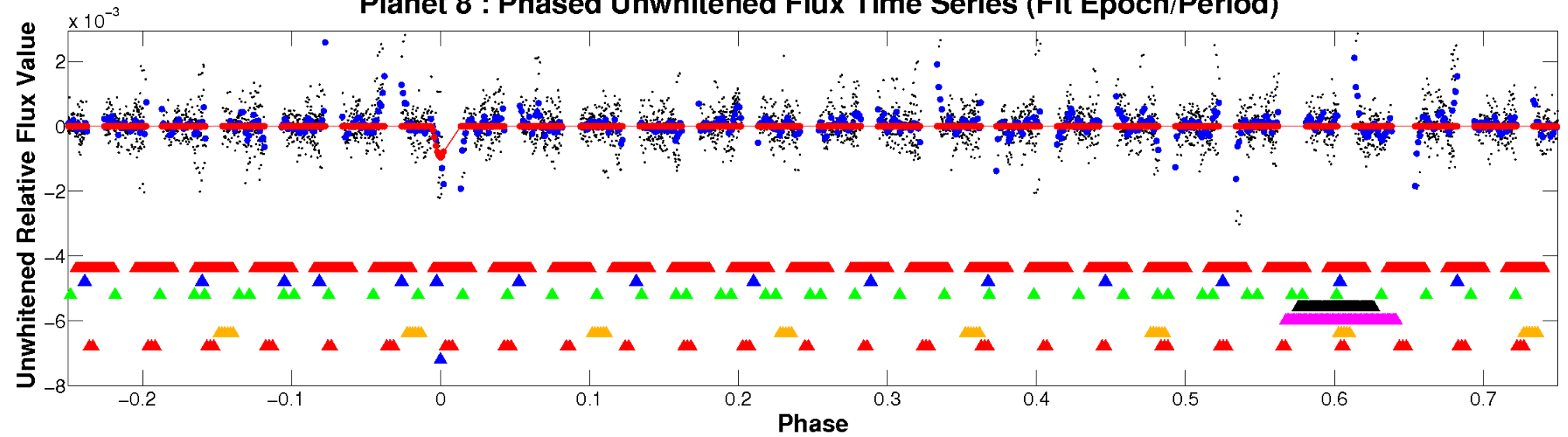
# ALT Odd/Even

TCE 005370431-08

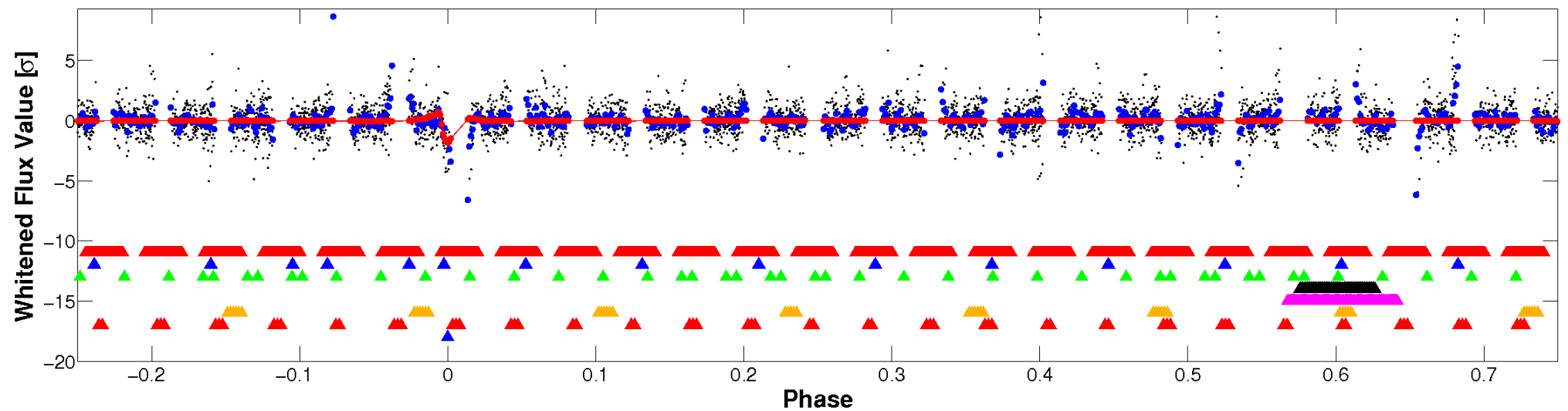


# Non-Whitened Vs. Whitened Light Curve

## Planet 8 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

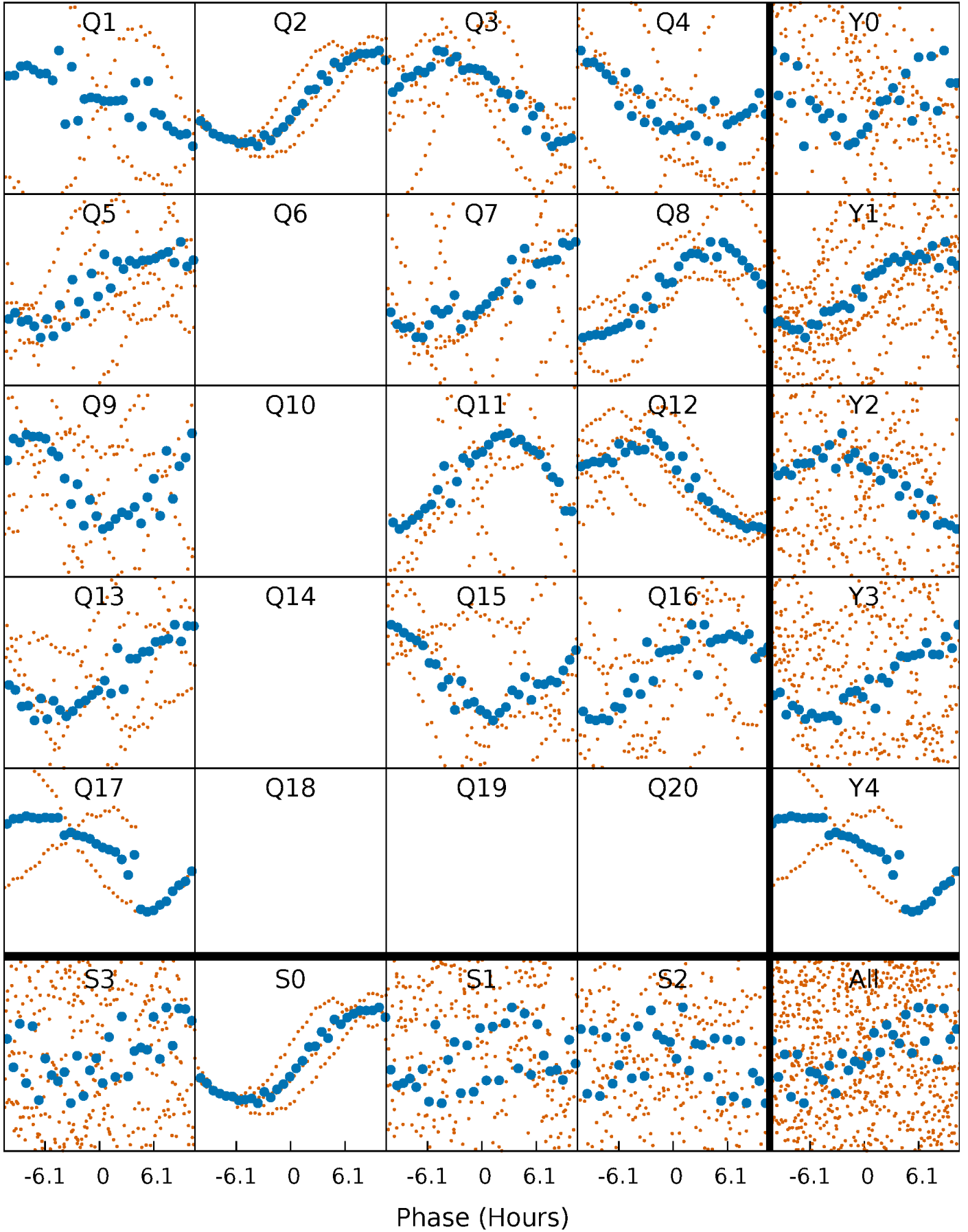


## Planet 8 : Phased Whitened Flux Time Series (Fit Epoch/Period)



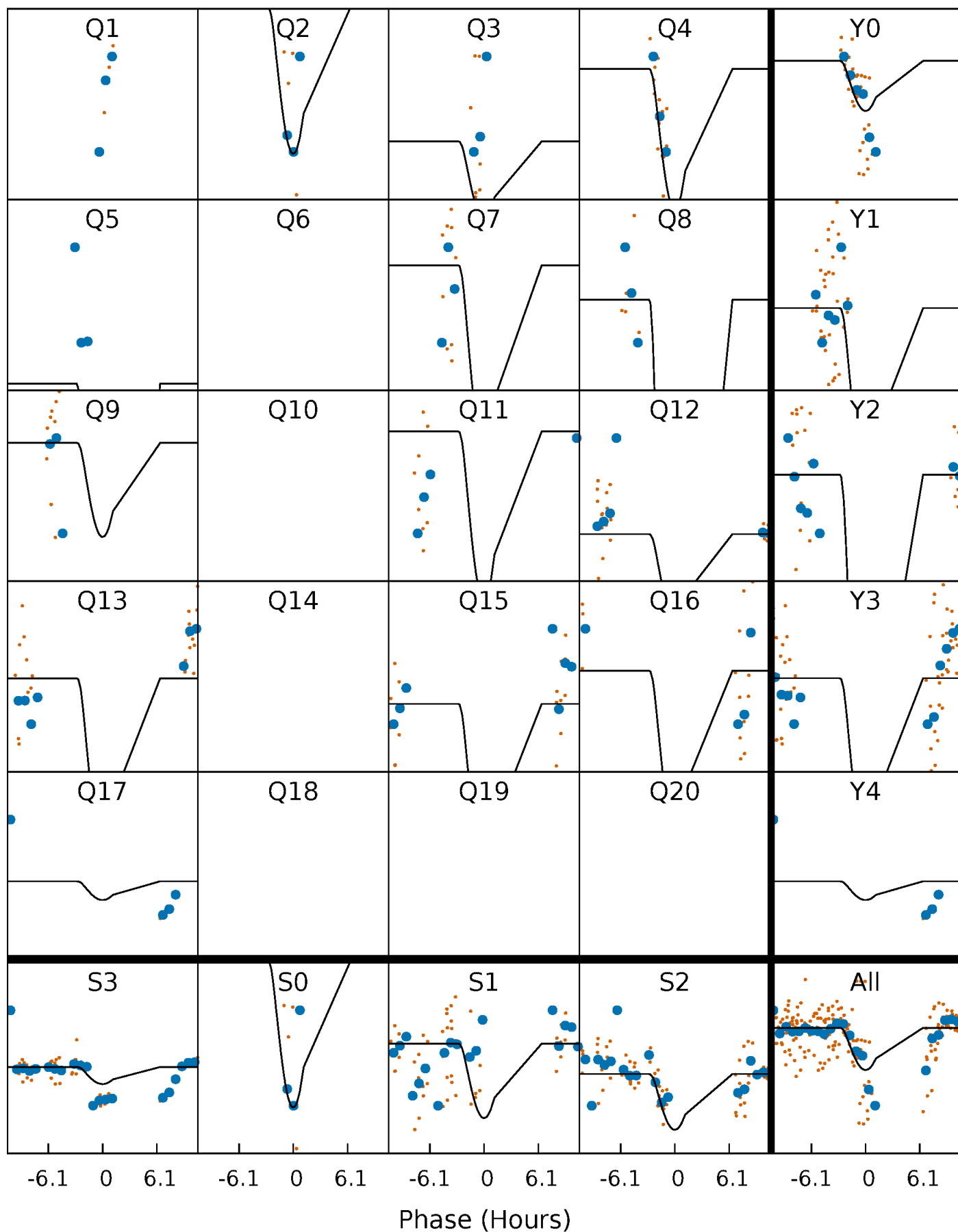
# PDC Quarter-Phased Transit Curves

TCE 005370431-08 P= 19.553301 Days  $T_0=143.887382$  (BKJD)



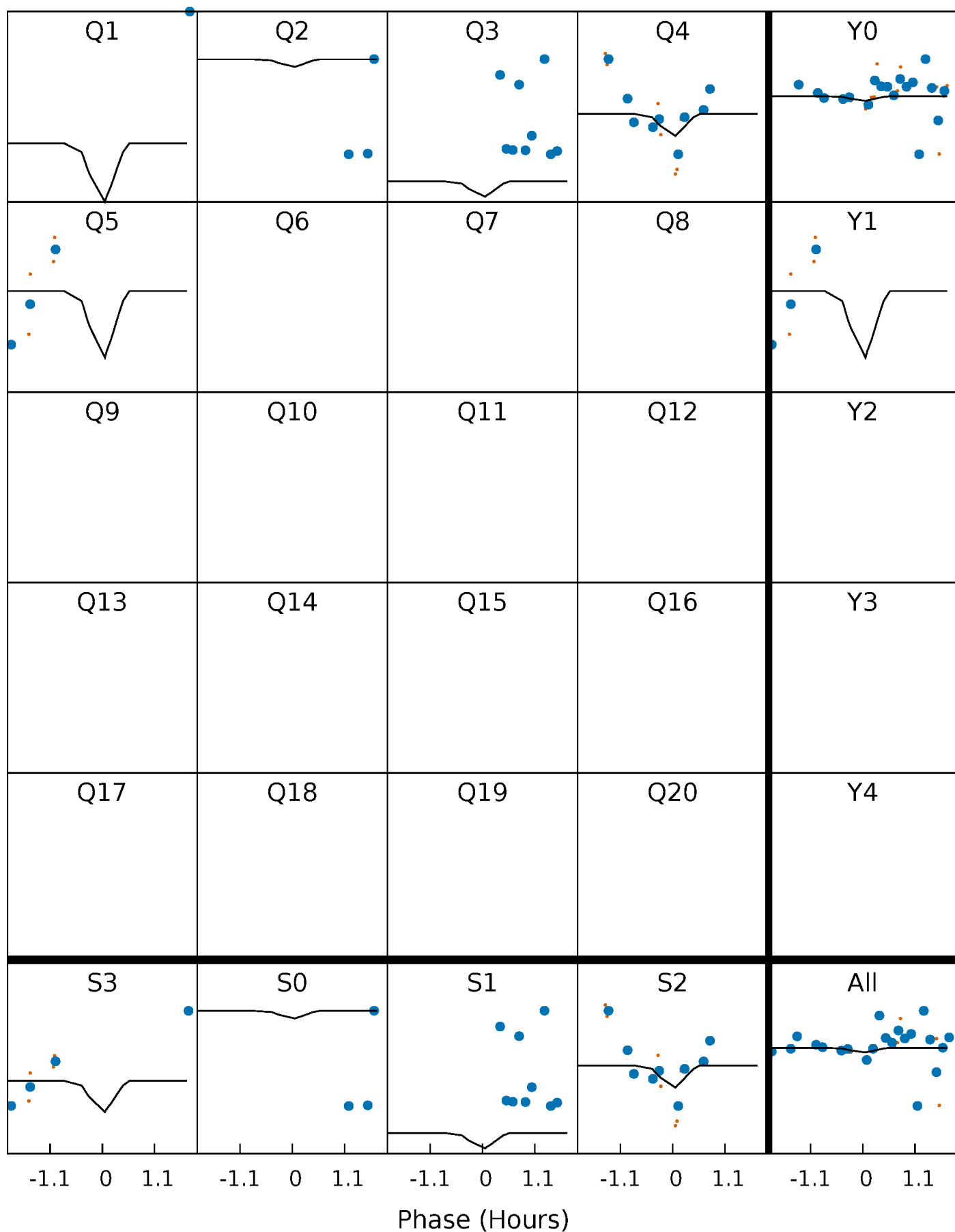
# DV Quarter-Phased Transit Curves

TCE 005370431-08 P= 19.553301 Days  $T_0=143.887382$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

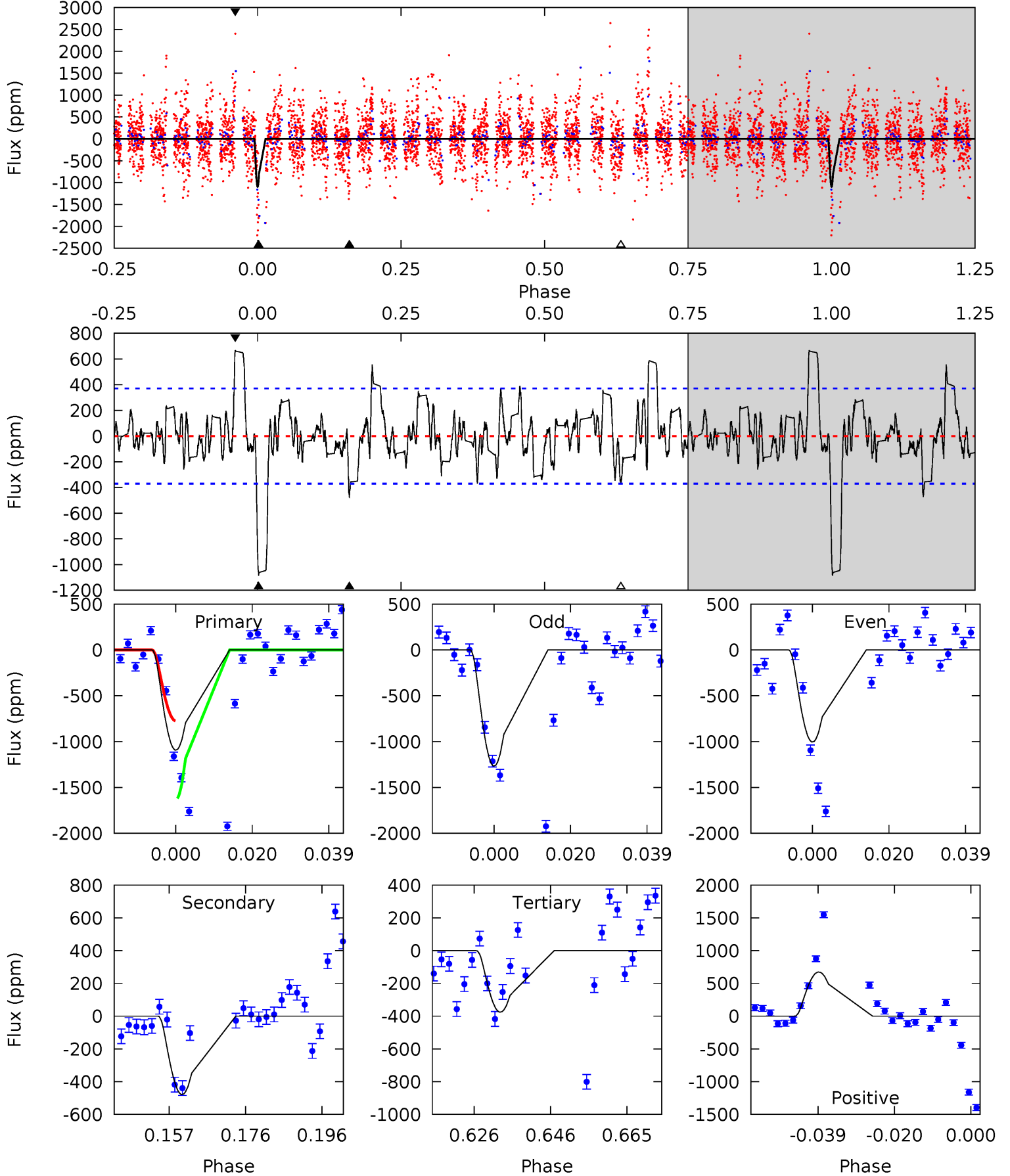
TCE 005370431-08 P= 19.556857 Days  $T_0=143.779714$  (BKJD)



# DV Model-Shift Uniqueness Test

005370431-08, P = 19.553301 Days, E = 124.334081 Days

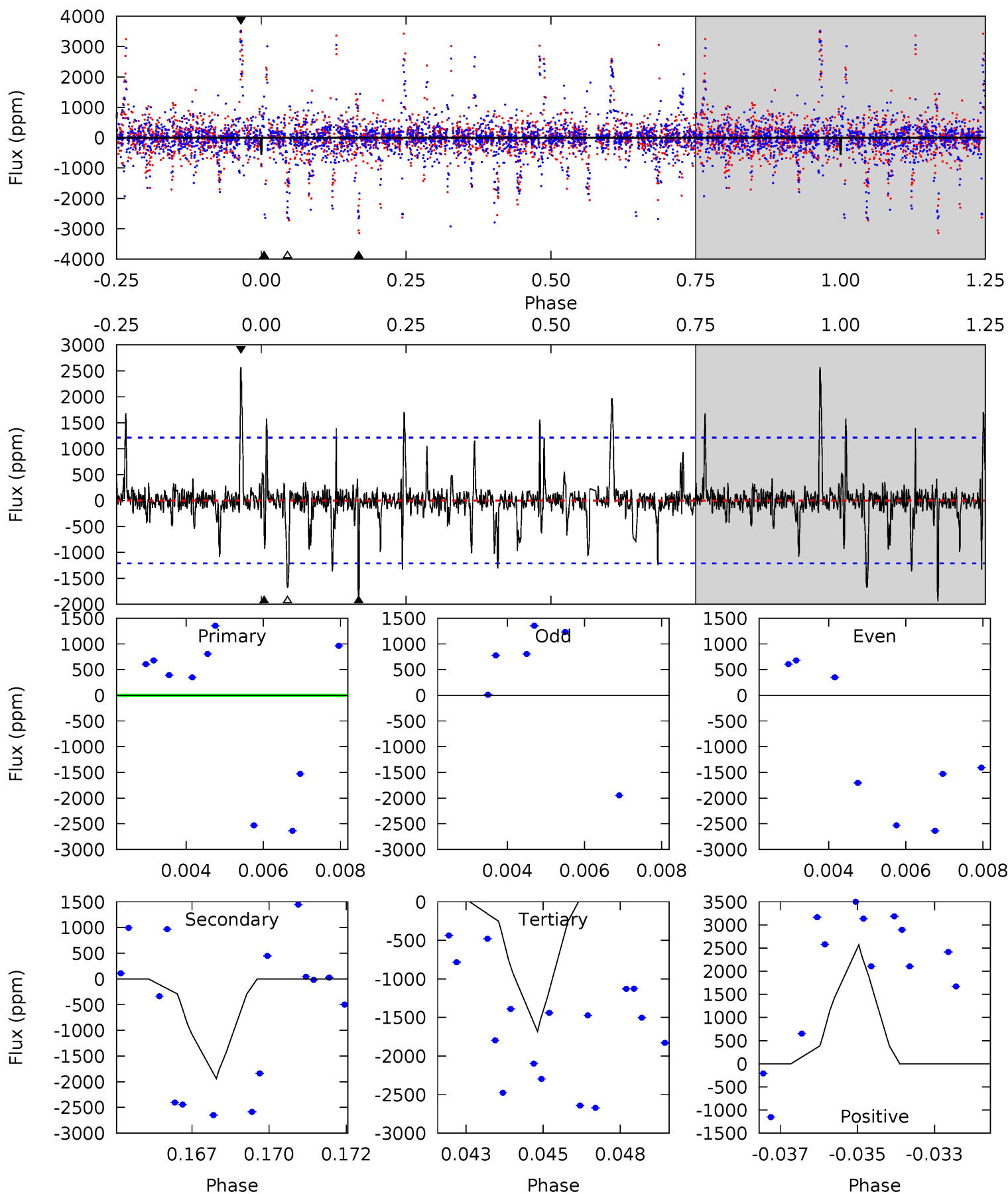
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
14.4	6.28	4.93	8.83	4.90	2.33	1.95	9.42	5.52	1.35	-2.55	1.68	0.97	0.38	0



# Alt Model-Shift Uniqueness Test

005370431-08, P = 19.556857 Days, E = 124.222857 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
2.50	8.52	7.39	11.3	5.32	3.08	1.45	-4.89	-8.79	1.13	-2.77	0.47	0.88	0.57	0.93





### Stellar Parameters For KIC 005370431

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7051^{+194}_{-315}$	$4.262^{+0.073}_{-0.218}$	$-0.020^{+0.200}_{-0.350}$	$1.454^{+0.524}_{-0.225}$	$1.409^{+0.222}_{-0.202}$	$0.645^{+0.254}_{-0.347}$
	+3%/-4%	+2%/-5%	+1000%/-1750%	+36%/-15%	+16%/-14%	+39%/-54%
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 005370431-08 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-475 \pm 76$	$26.79^{+25.93}_{-18.23}$	$1332^{+108}_{-68}$	$3147^{+1498}_{-566}$	$8.896^{+80.925}_{-6.579}$
Alt.	$-1940 \pm 228$	$25.59^{+25.95}_{-18.59}$	$1334^{+111}_{-79}$	$4023^{+3171}_{-807}$	$41^{+498}_{-31}$

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

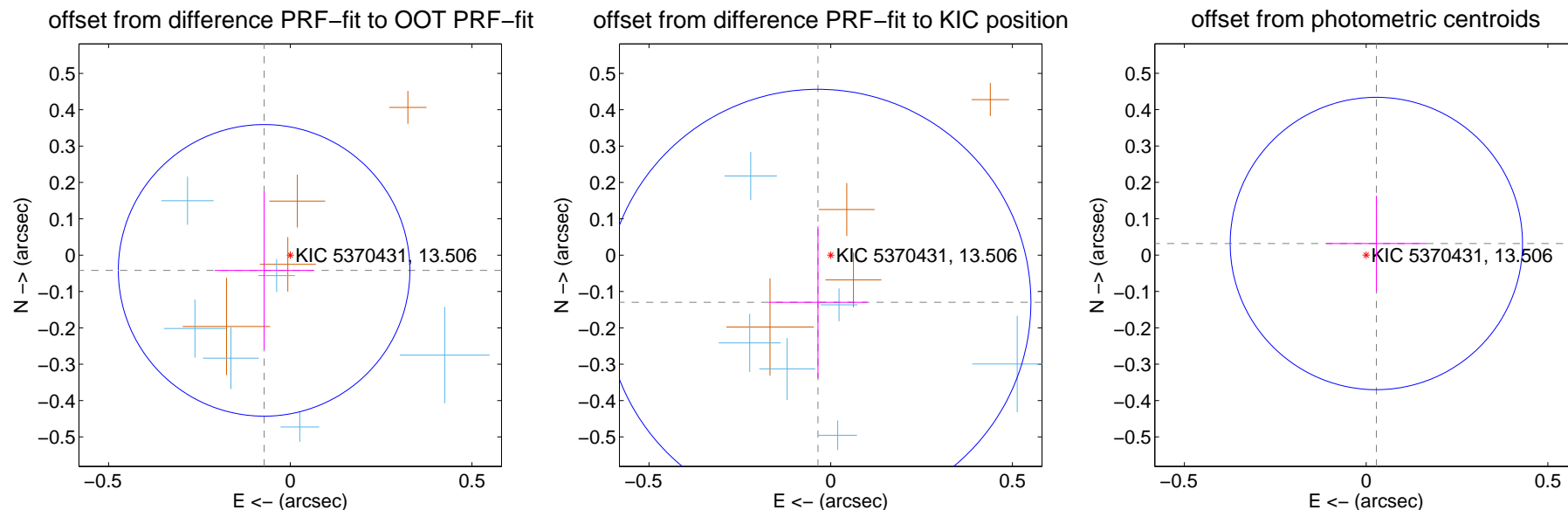
## DV Centroid Data

Supplemental centroid analysis for 005370431-08. Kepler magnitude: 13.51. Transit SNR 8.70

There are 7 quarters with good PRF difference image offsets

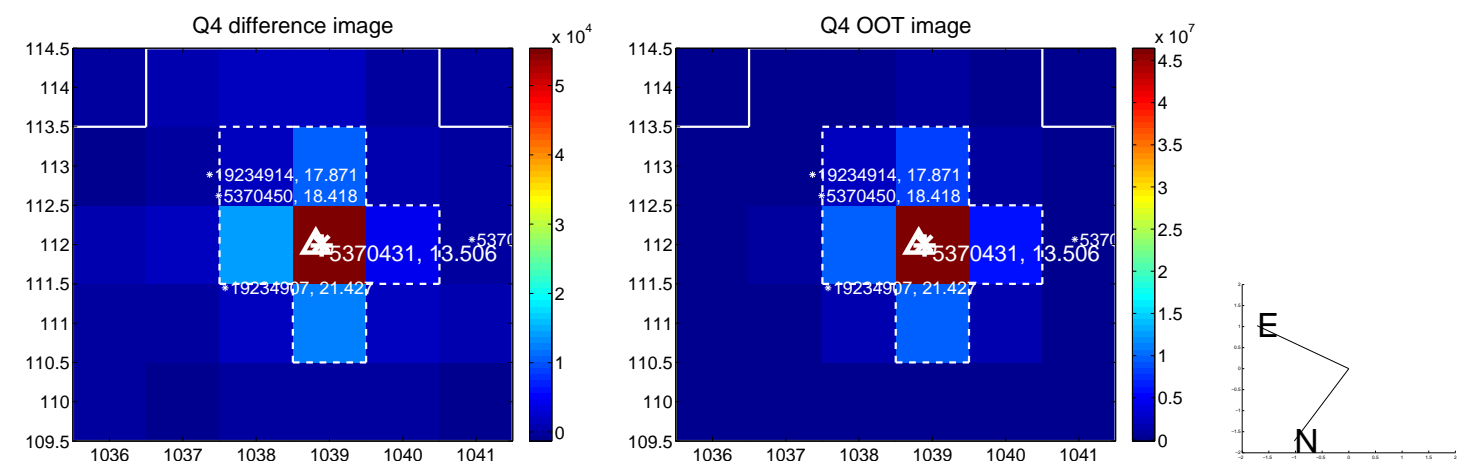
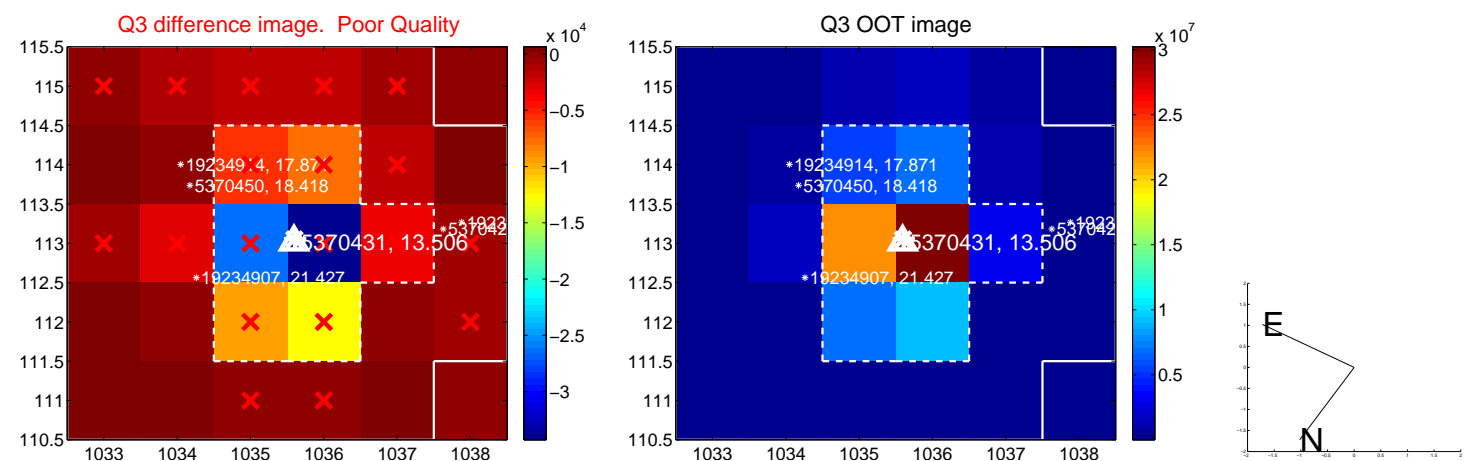
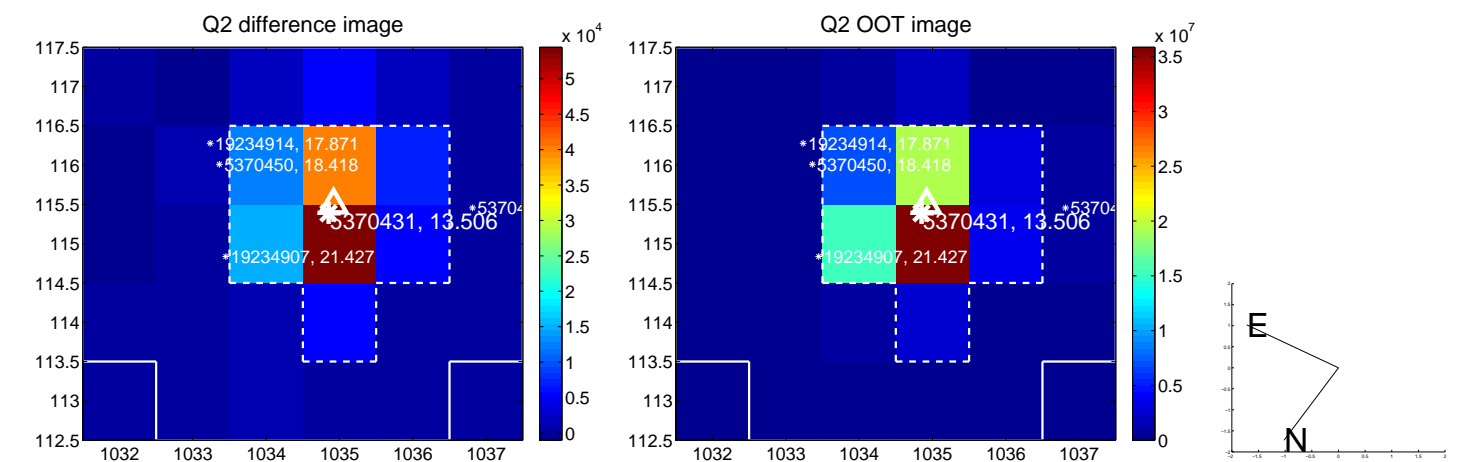
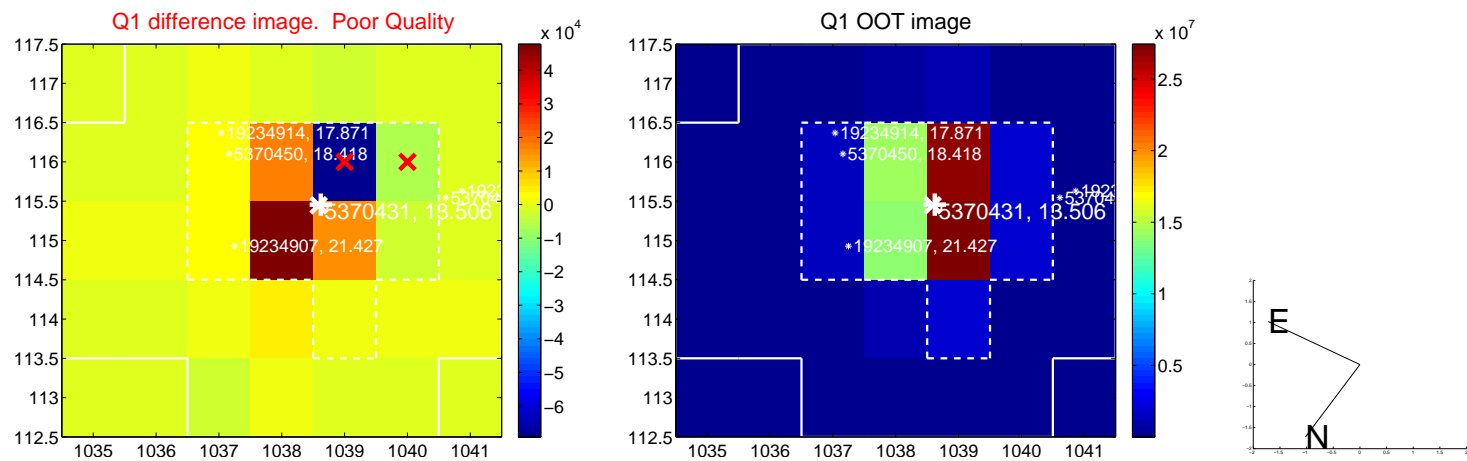
The direct PRF centroid is offset from the target star catalog position by about 0.10 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.083 \pm 0.134$	0.62	$0.072 \pm 0.136$	$-0.042 \pm 0.217$
PRF-fit source offset from KIC position	$0.134 \pm 0.195$	0.69	$0.035 \pm 0.136$	$-0.130 \pm 0.209$
photometric centroid source offset	$0.04 \pm 0.13$	0.32	$-0.03 \pm 0.14$	$0.03 \pm 0.13$

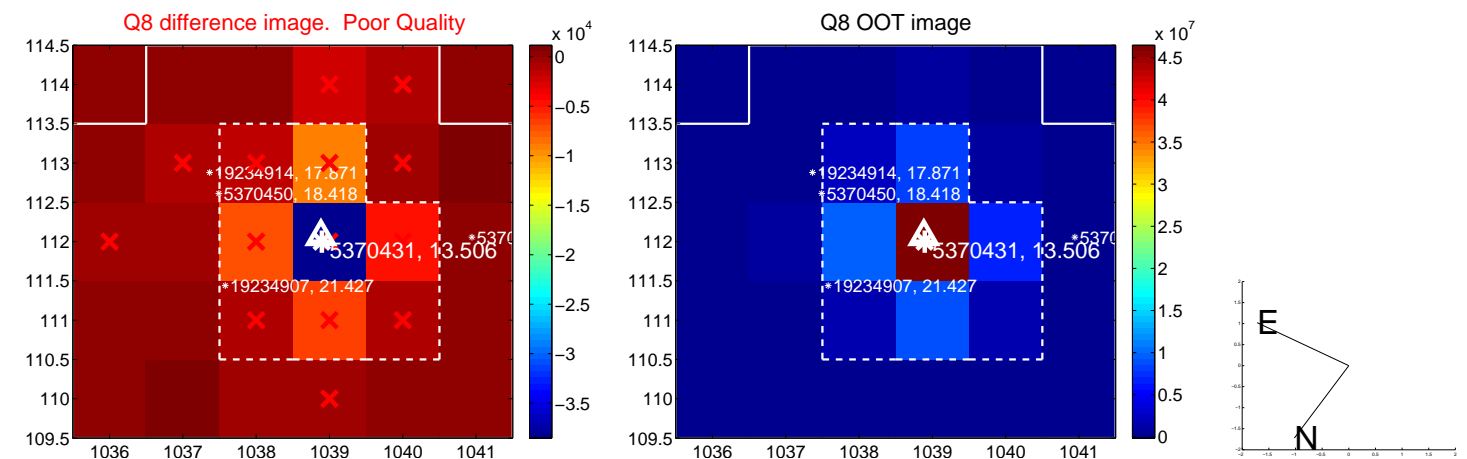
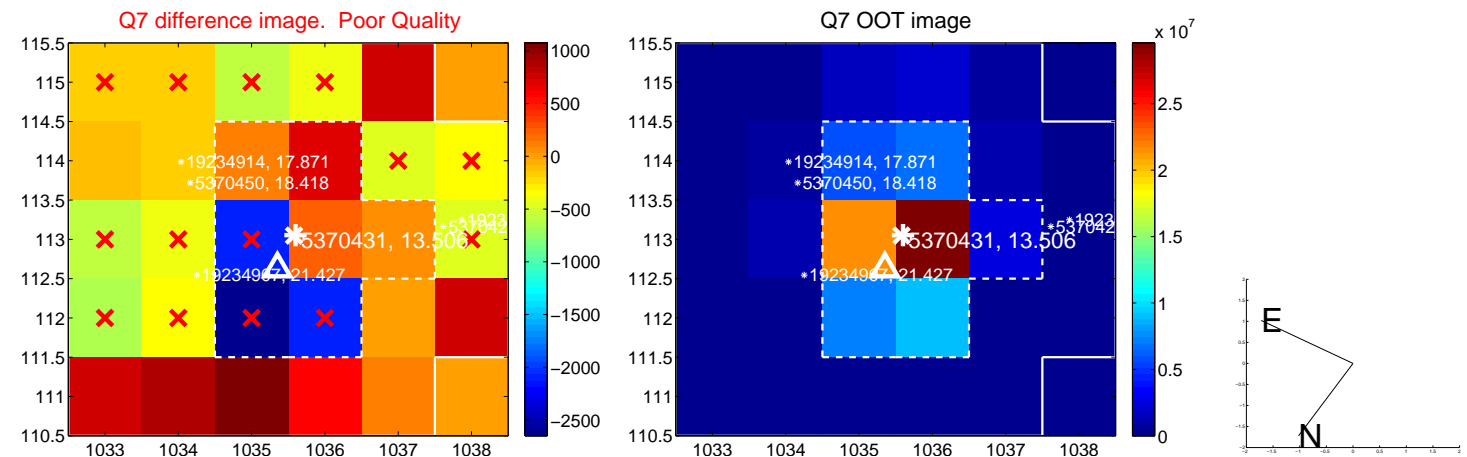
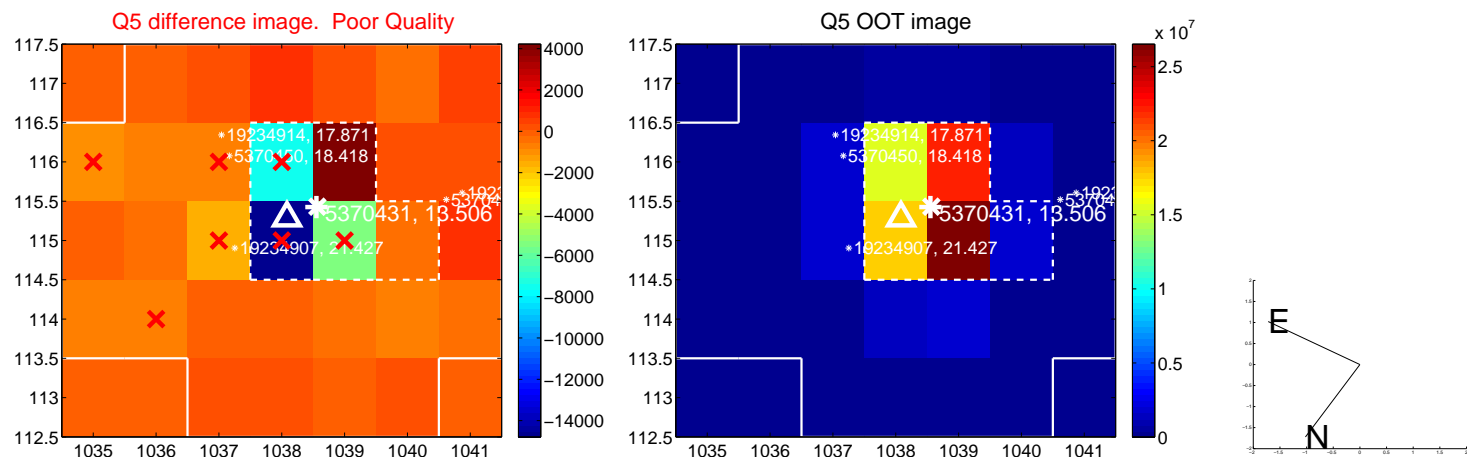


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

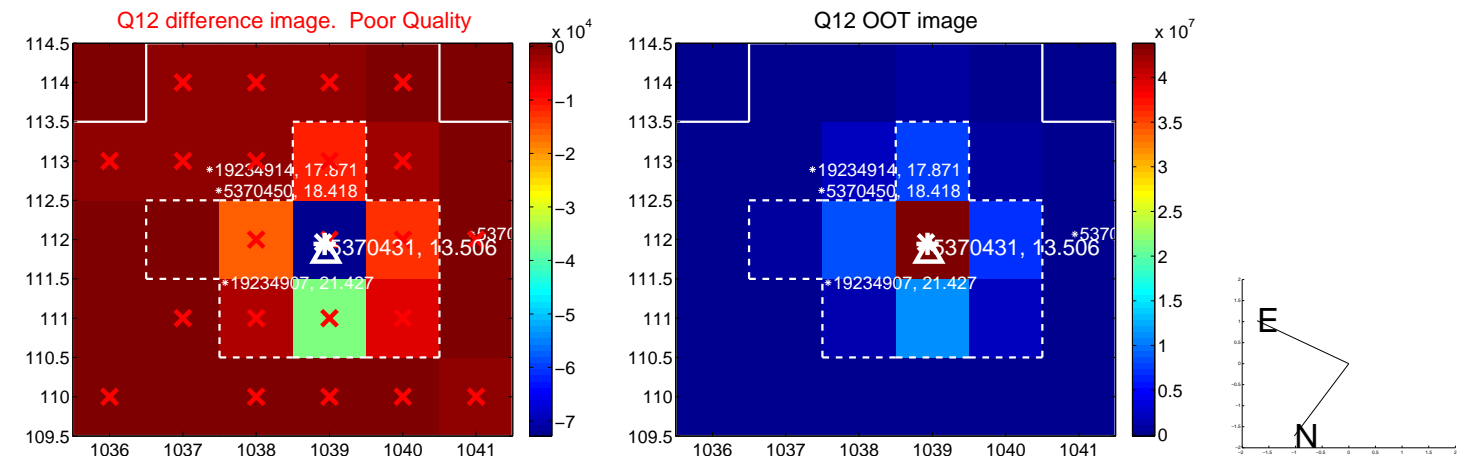
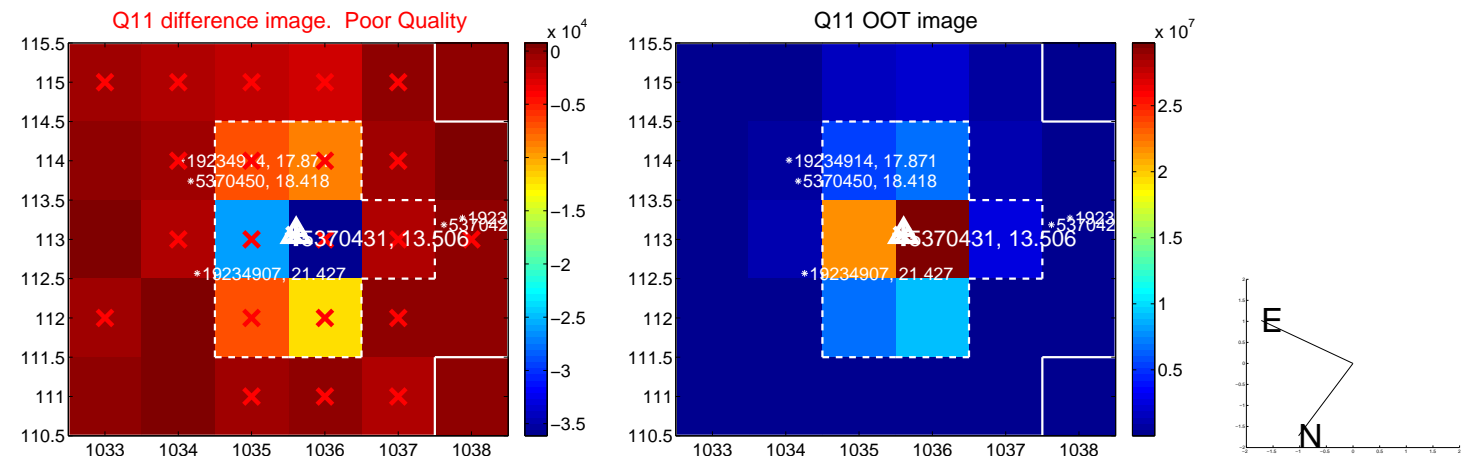
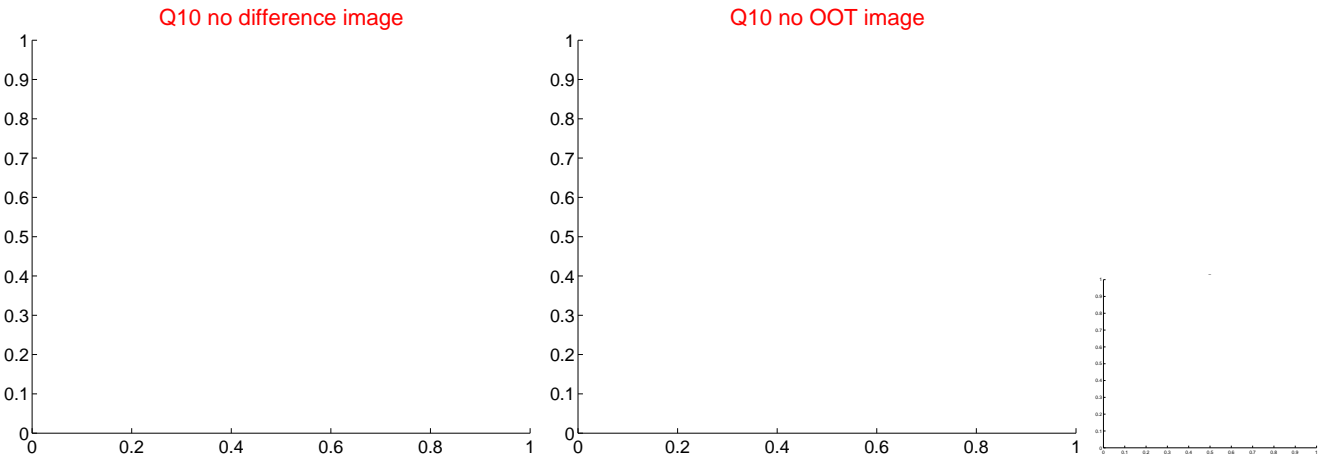
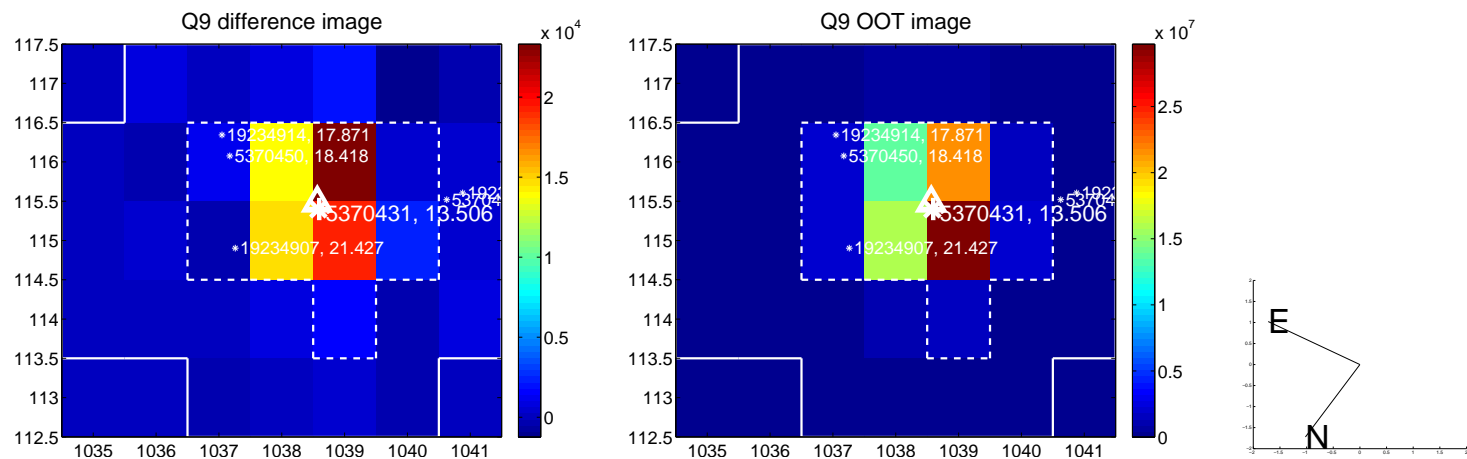
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



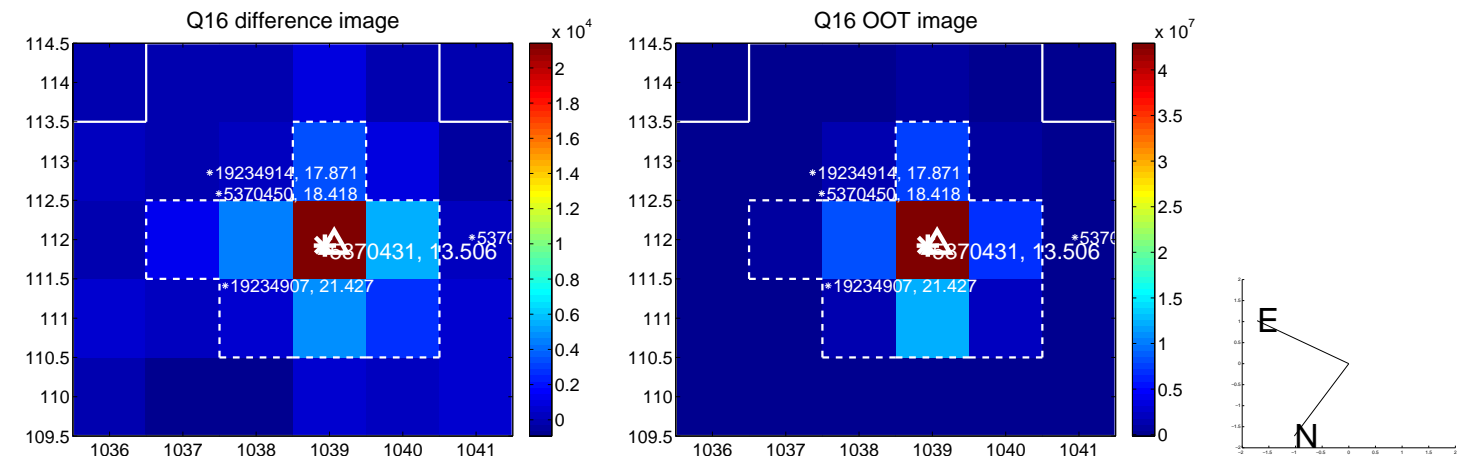
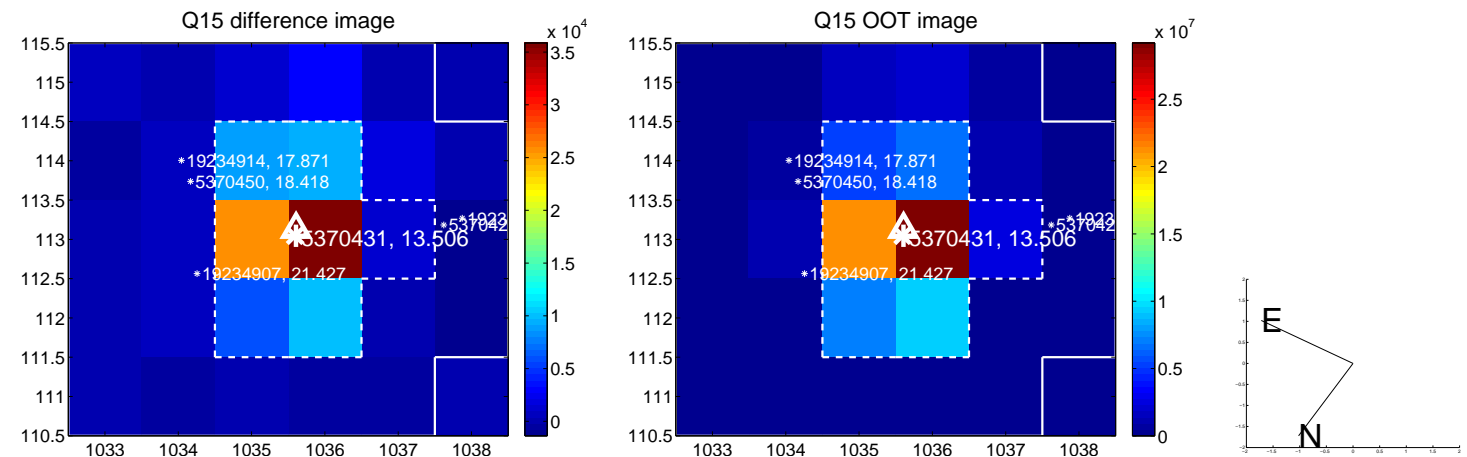
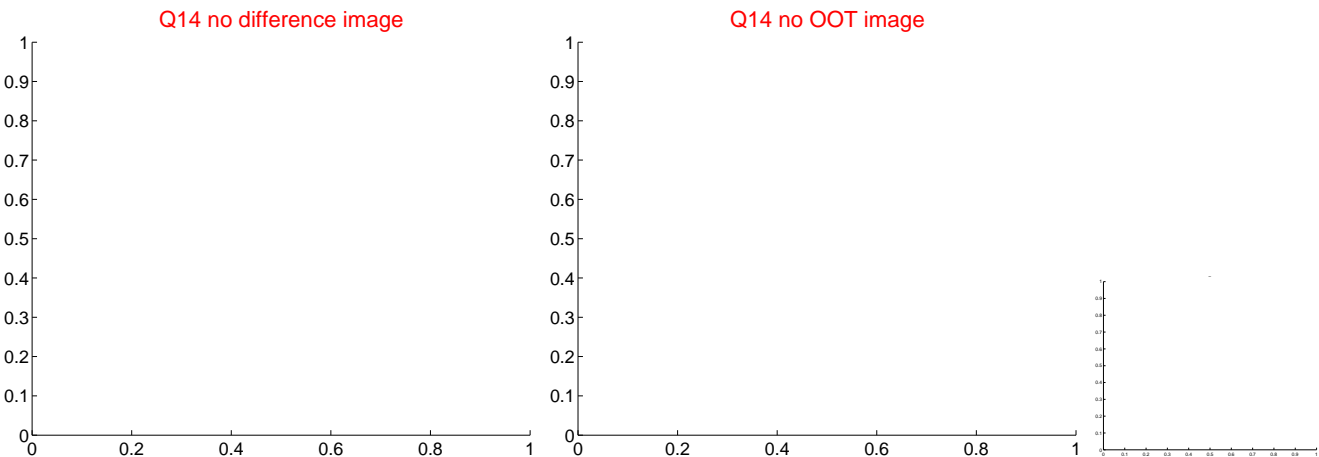
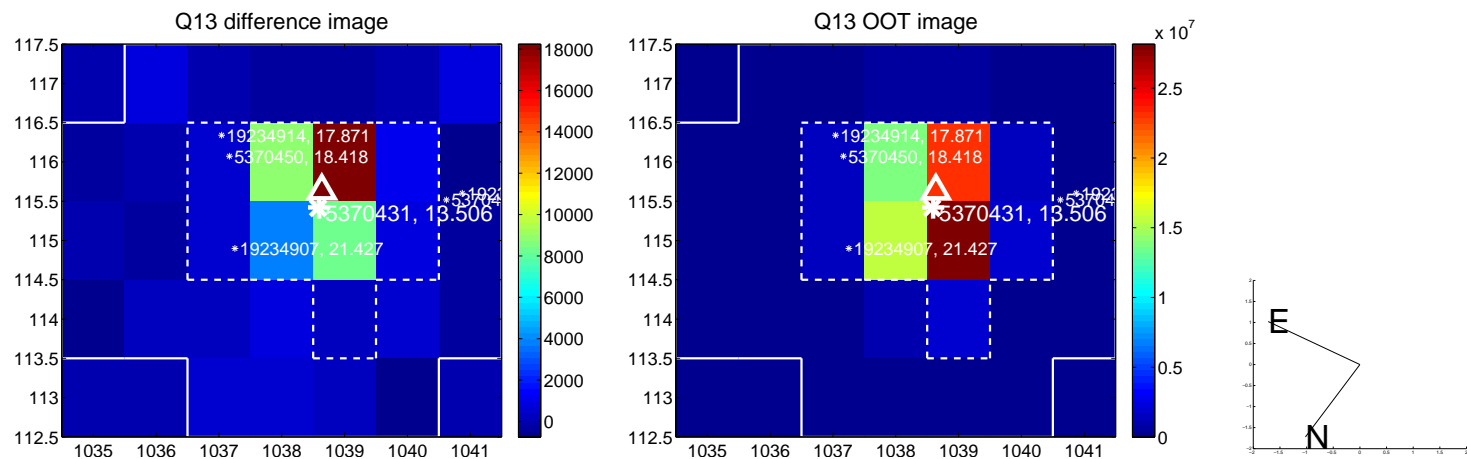
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



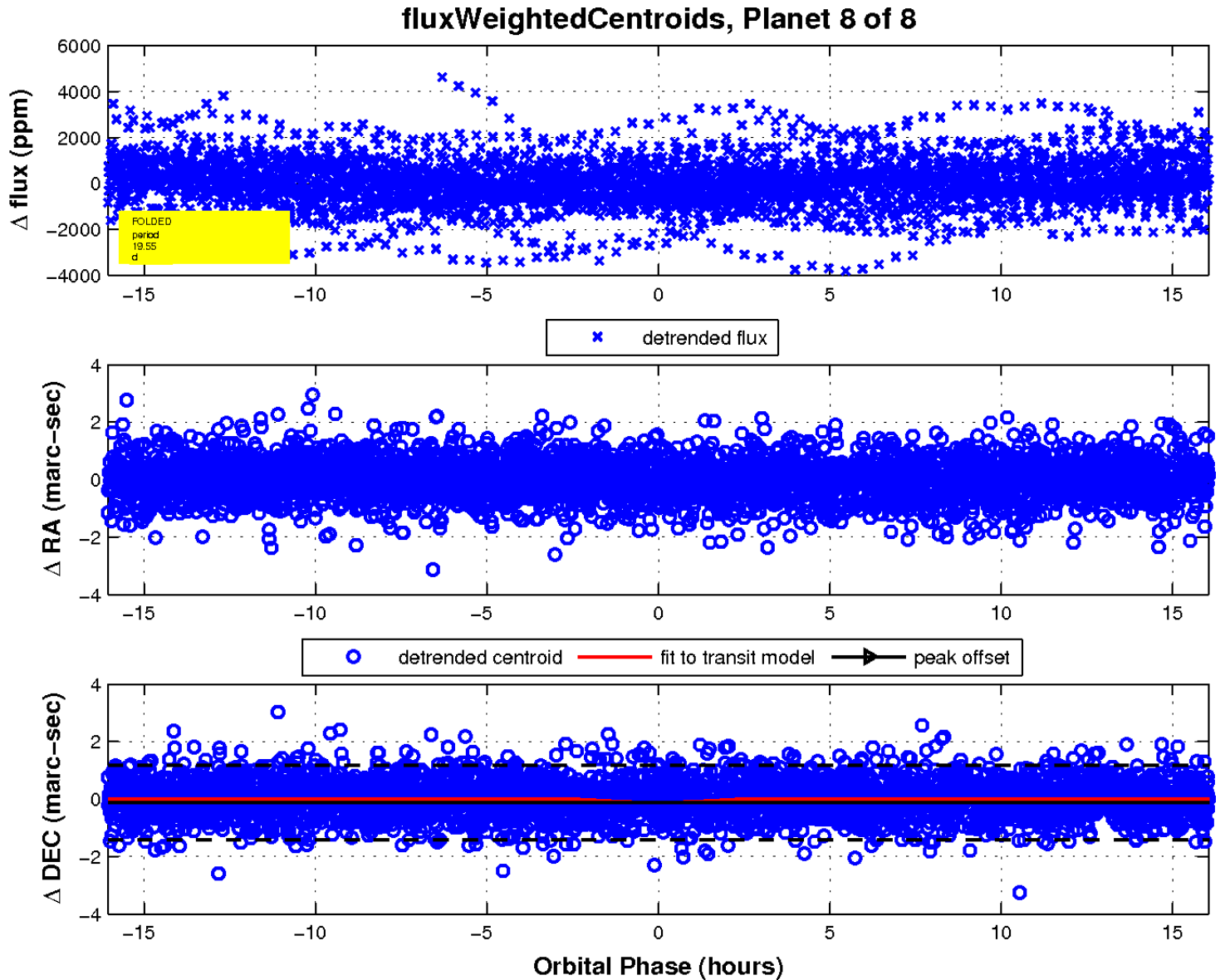
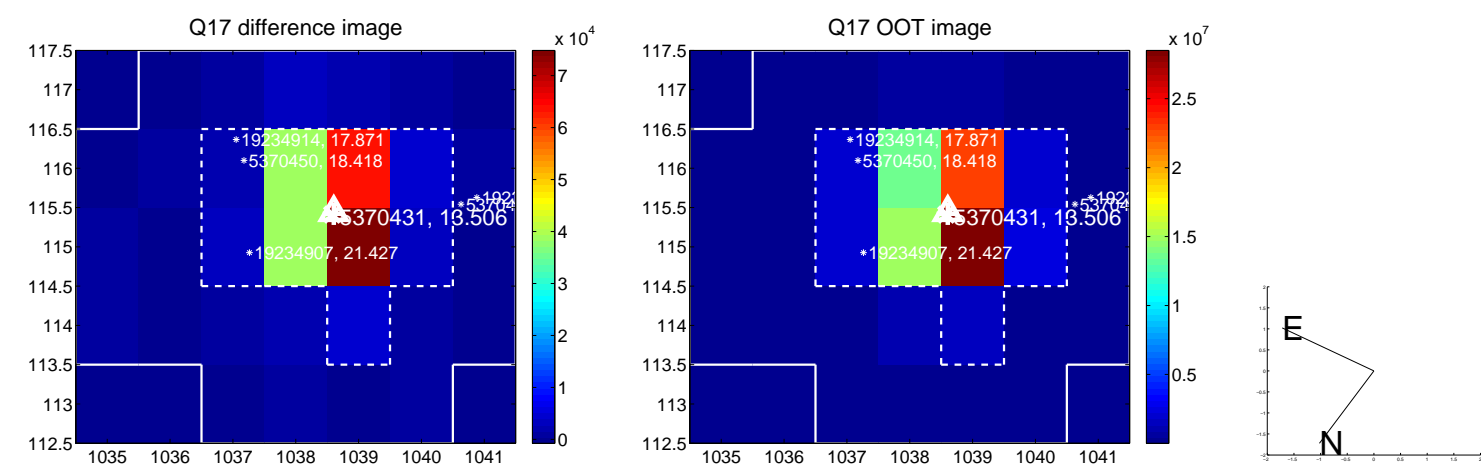
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

