

## KIC 011020521

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
011020521-01	OBS	No	2.929979	134.113706	0.1	0.514	8.2	0.0	3.22	6877	0.10	9371.70
011020521-02	OBS	No	2.930323	133.561397	22.1	5.264	8.1	6.6	3.22	6877	1.78	9370.24
011020521-03	OBS	No	2.930137	132.855754	16.9	12.993	9.2	7.9	3.22	6877	1.42	9371.03
011020521-04	OBS	No	11.171739	137.960832	85.1	3.597	8.7	9.1	3.22	6877	3.48	1573.30
011020521-05	OBS	No	293.095640	157.741380	193.4	6.042	8.2	8.1	3.22	6877	4.96	20.18
011020521-06	OBS	No	118.311612	211.553500	182.8	4.659	8.4	8.4	3.22	6877	5.08	67.65
011020521-07	OBS	No	131.858819	143.359611	66.9	9.614	8.3	5.6	3.22	6877	2.71	58.55
011020521-08	OBS	No	81.557176	178.687435	165.2	4.488	8.1	7.6	3.22	6877	4.58	111.09
011020521-09	OBS	No	36.435749	160.151233	162.1	3.382	8.0	9.4	3.22	6877	4.66	325.29
011020521-10	OBS	No	34.792680	149.579268	94.8	5.285	7.8	7.4	3.22	6877	3.67	345.93

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
011020521-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-04	OBS	FP	0.00	1	0	1	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
011020521-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-07	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-09	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_ALT—CENT_SATURATED
011020521-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

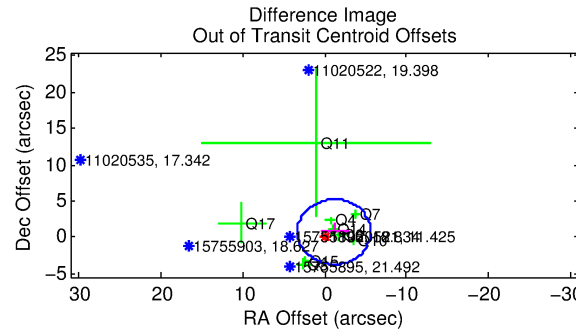
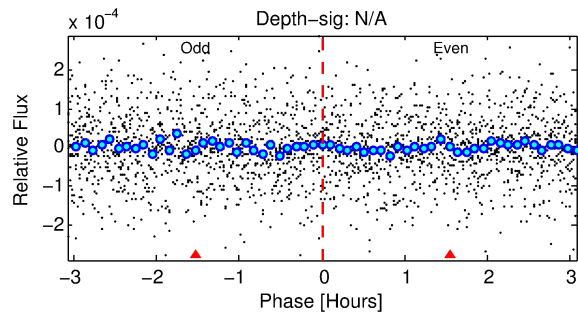
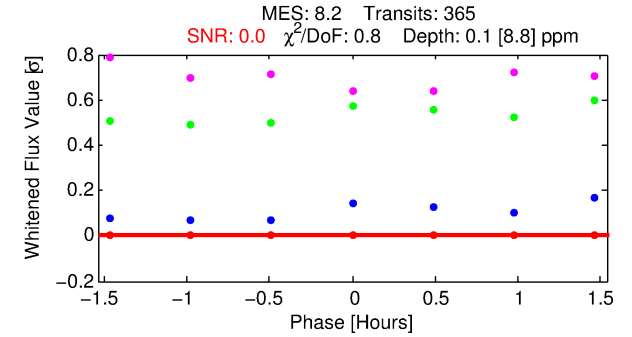
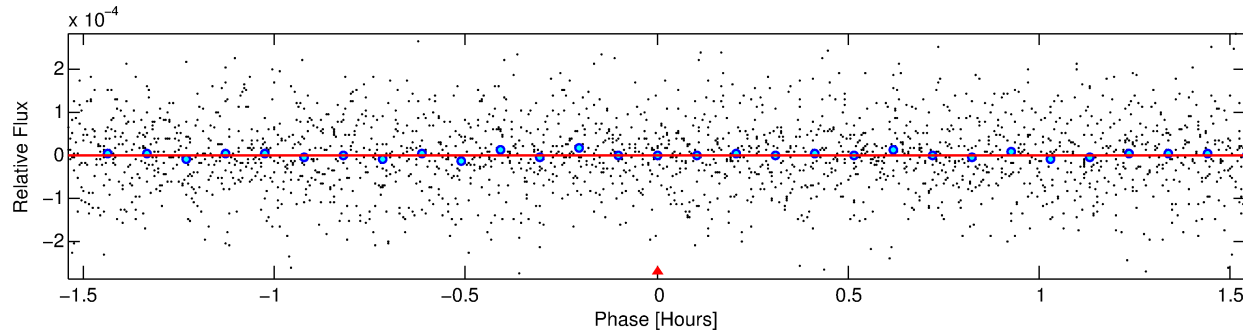
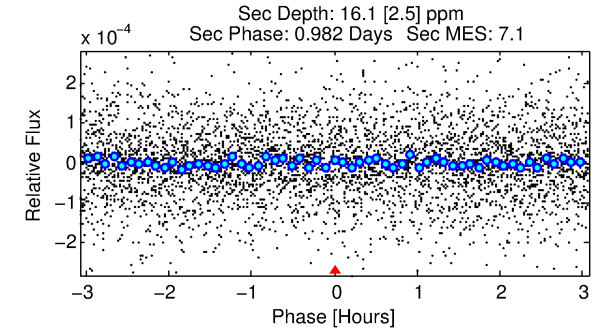
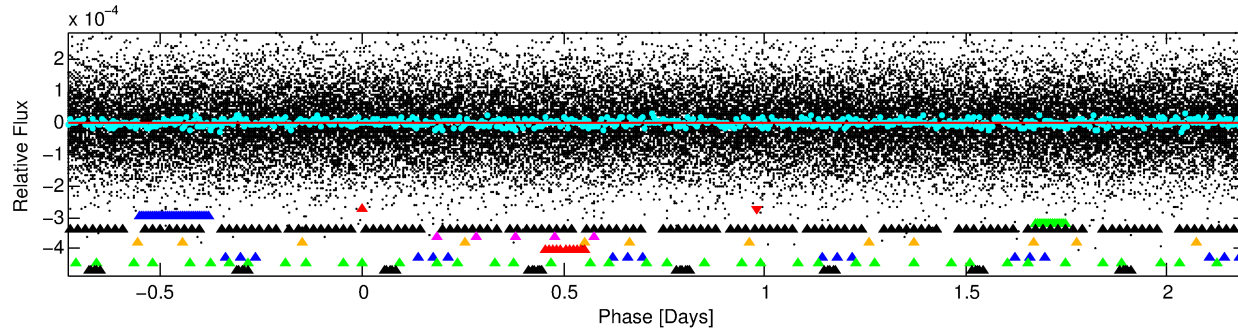
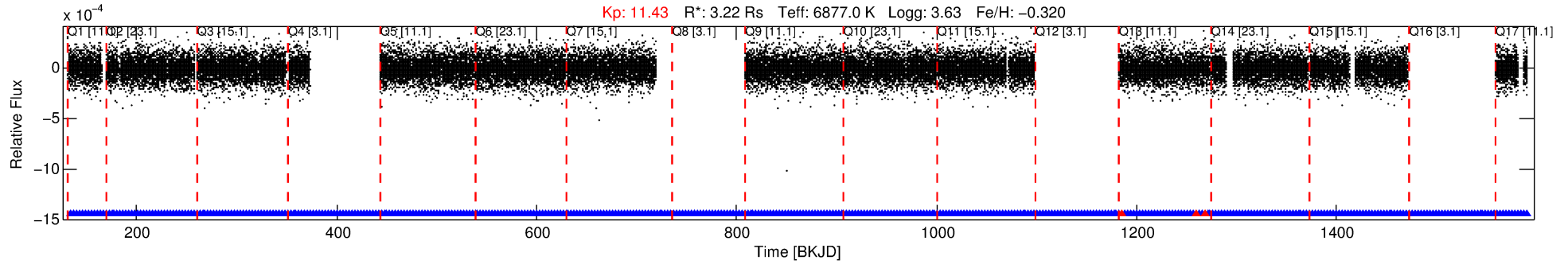
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 011020521-01

No Significant Match Found

# DV One-Page Summary

KIC: 11020521 Candidate: 1 of 10 Period: 2.930 d



## DV Fit Results:

Period = 2.92998 [0.00908] d  
Epoch = 134.1137 [0.9260] BKJD  
Rp/R\* = 0.0003 [0.0167]  
a/R\* = 40.08 [3172.39]  
b = 0.39 [205.57]  
Seff = 9371.70 [5093.52]  
Teq = 2509 [341] K  
Rp = 0.09 [5.86] Re  
a = 0.0471 [0.0162] AU  
Ag = 2188.00 [270946.19] [0.01σ]  
Teffp = 26530 [821322] K [0.03σ]

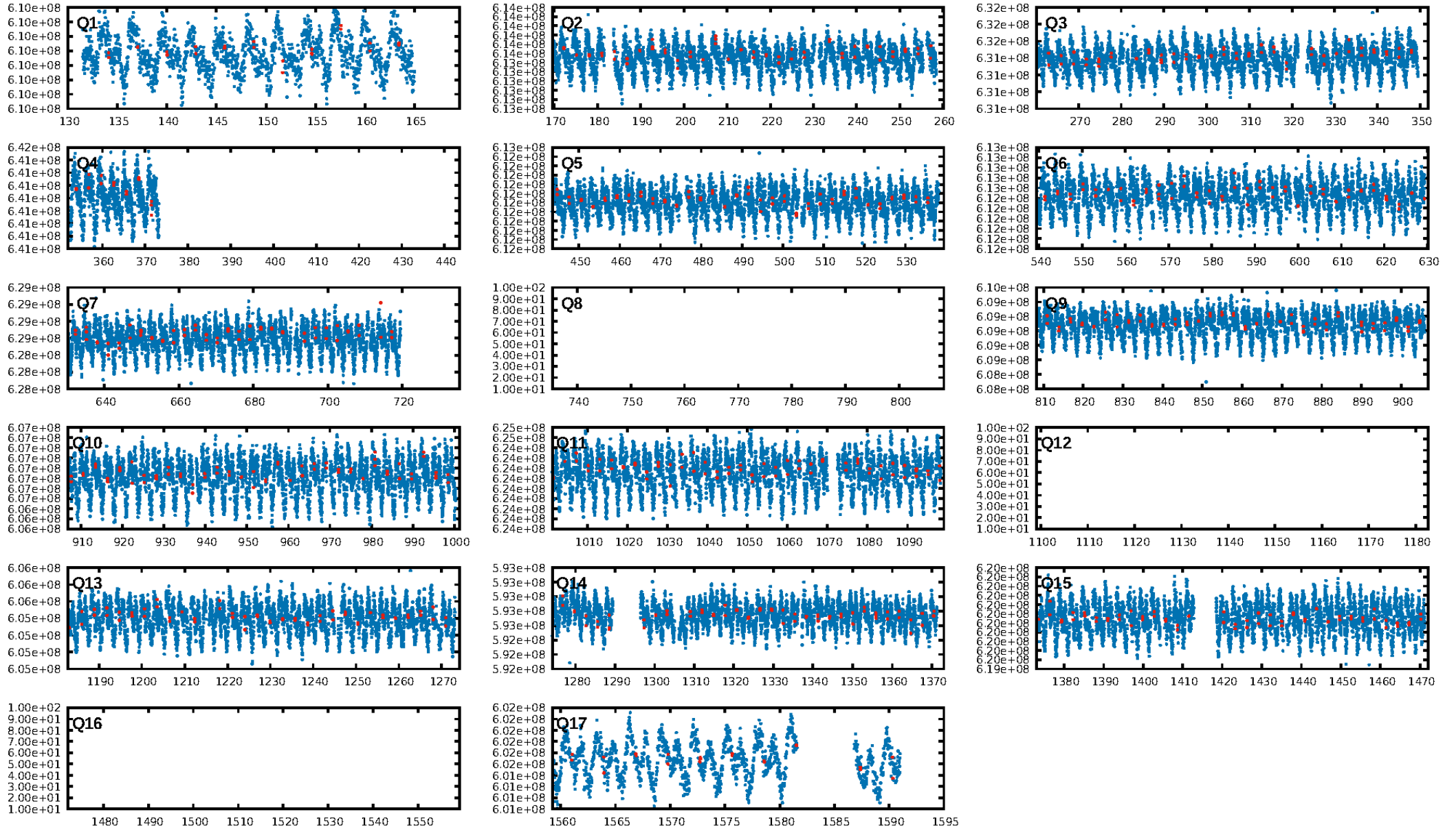
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 0.99 [334/337]  
GhostDiagnostic-chr: N/A  
Centroid-sig: N/A  
Centroid-so: N/A  
OotOffset-rm: 1.351 arcsec [0.91σ]  
KicOffset-rm: 1.305 arcsec [0.89σ]  
OotOffset-st: 3/4/1/1 [9]  
KicOffset-st: 3/4/1/1 [9]  
DiffImageQuality-fgm: 0.56 [5/9]  
DiffImageOverlap-fno: 1.00 [14/14]

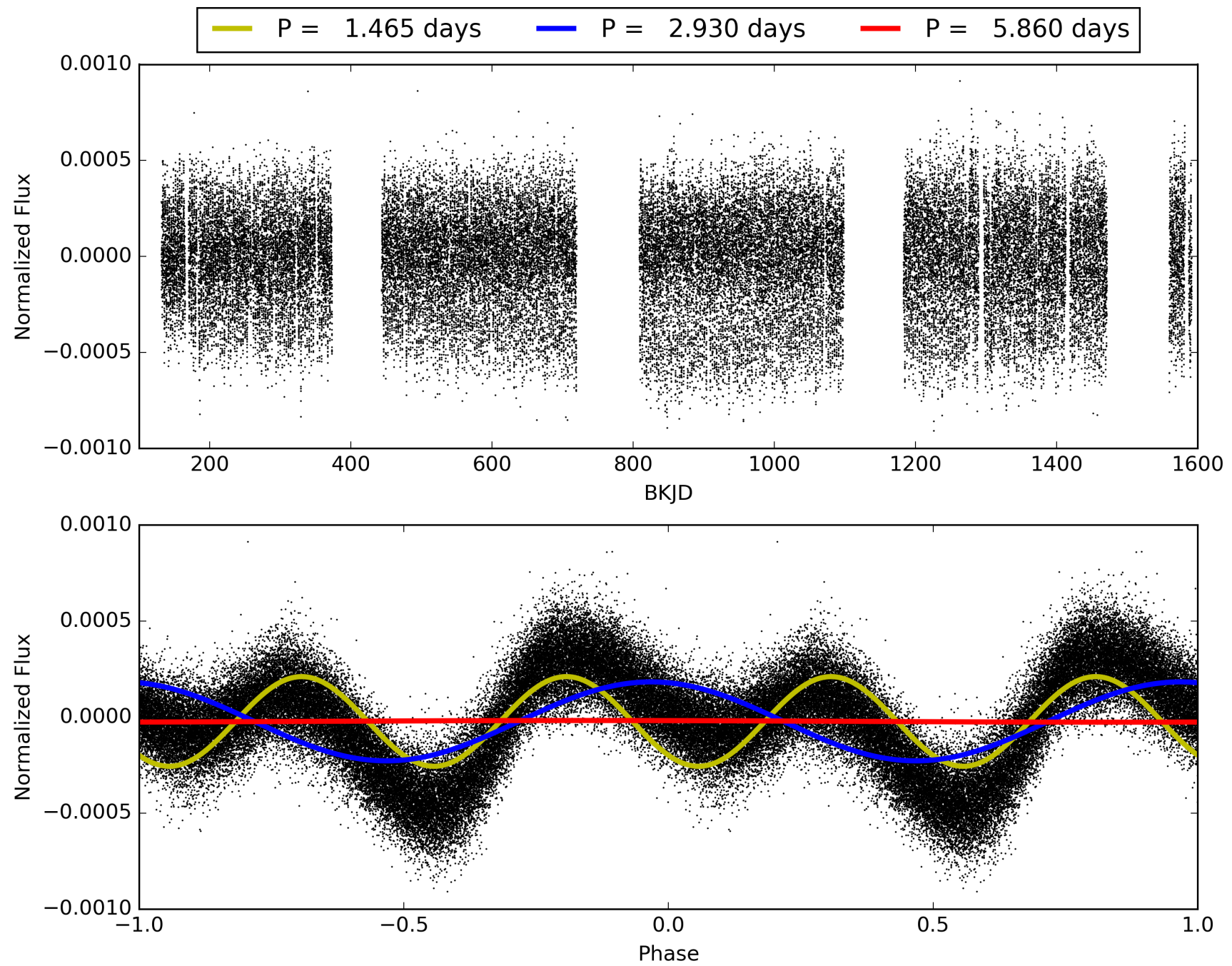
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 05:44:35 Z

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

# TCE 011020521-01, PDC Light Curves



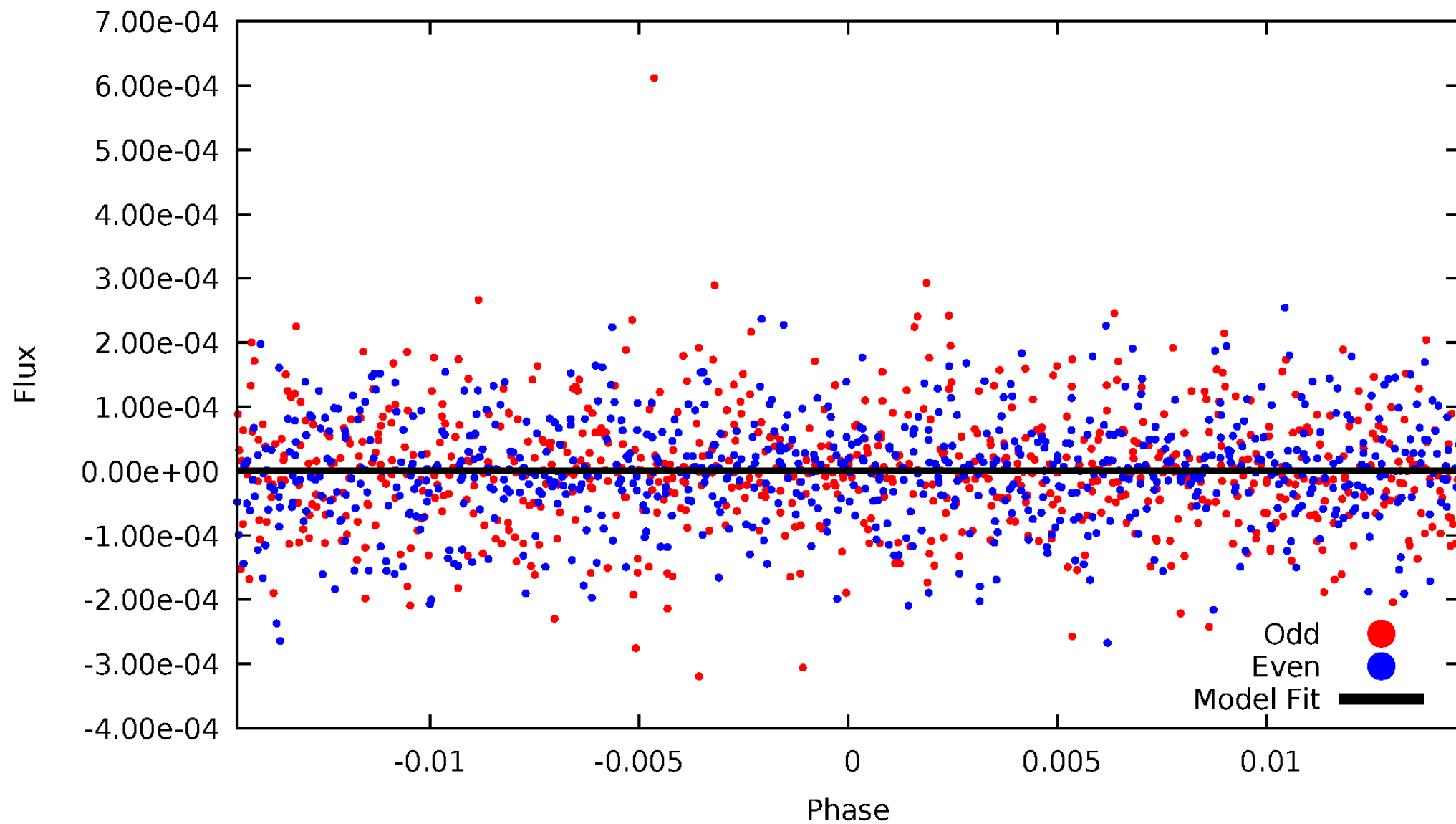
TCE 011020521-01





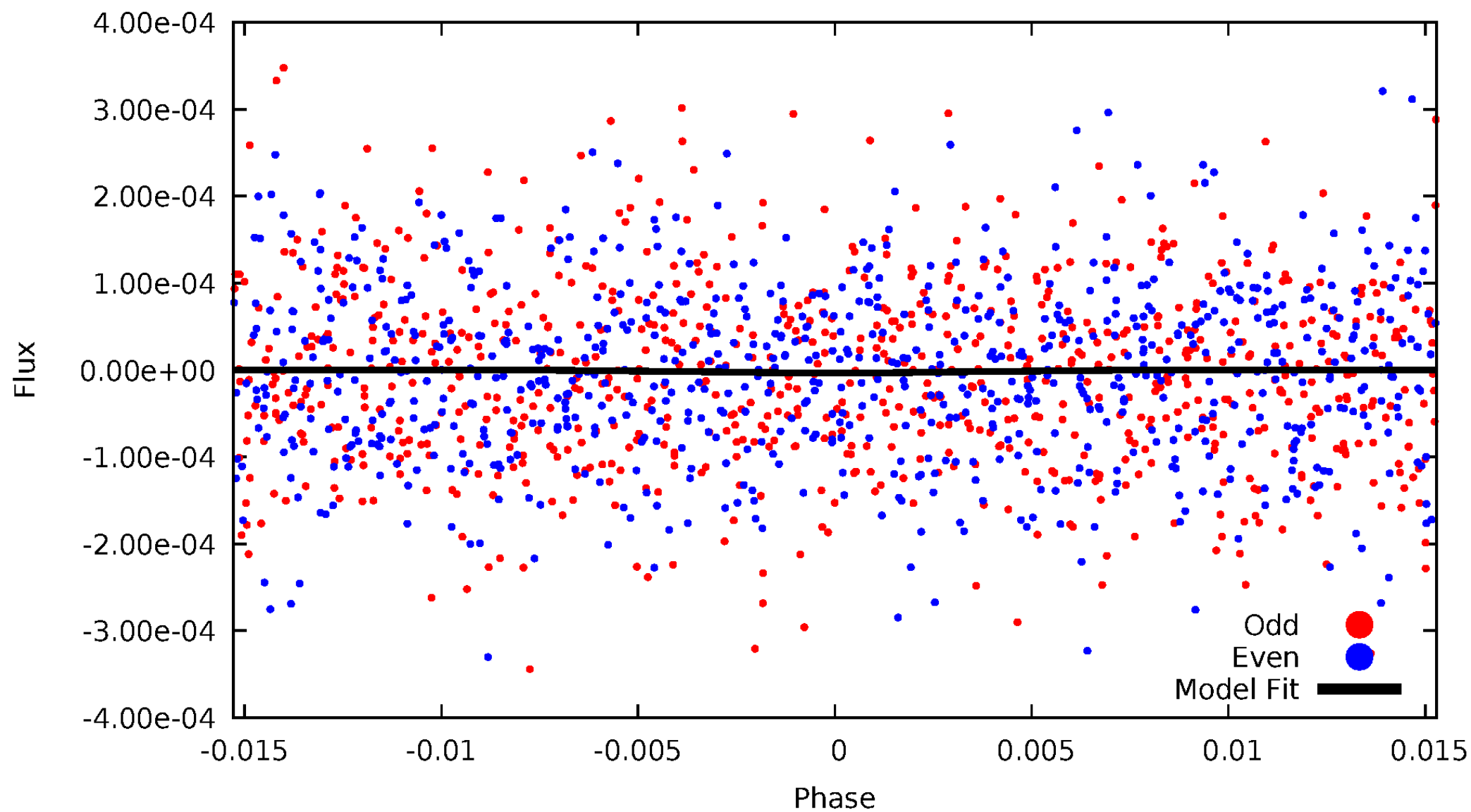
# DV Odd/Even

TCE 011020521-01

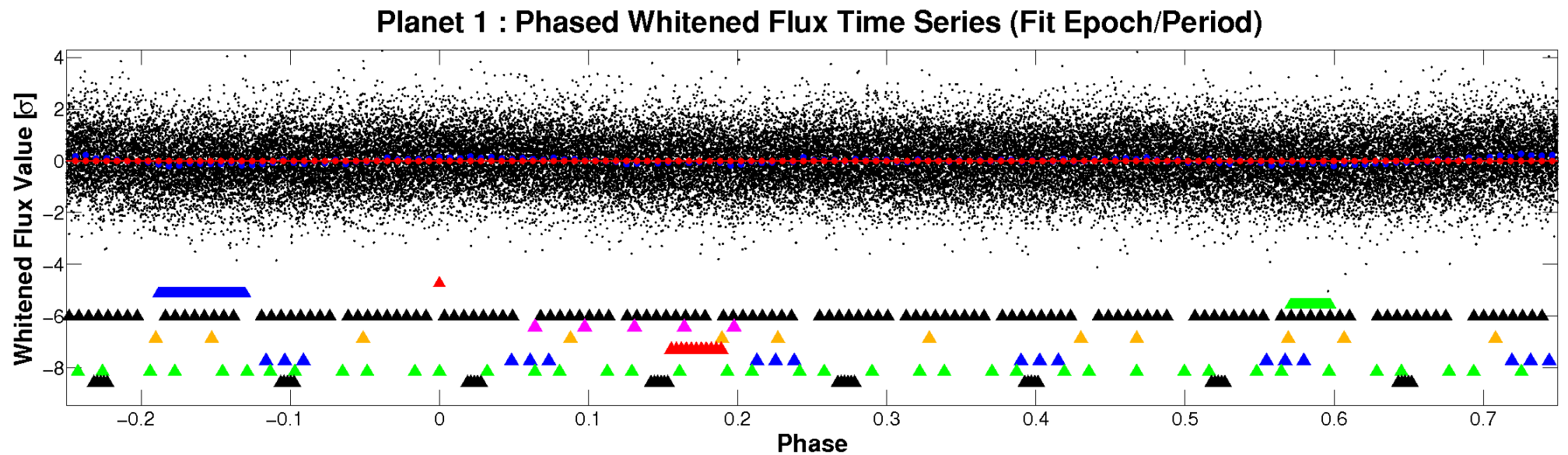
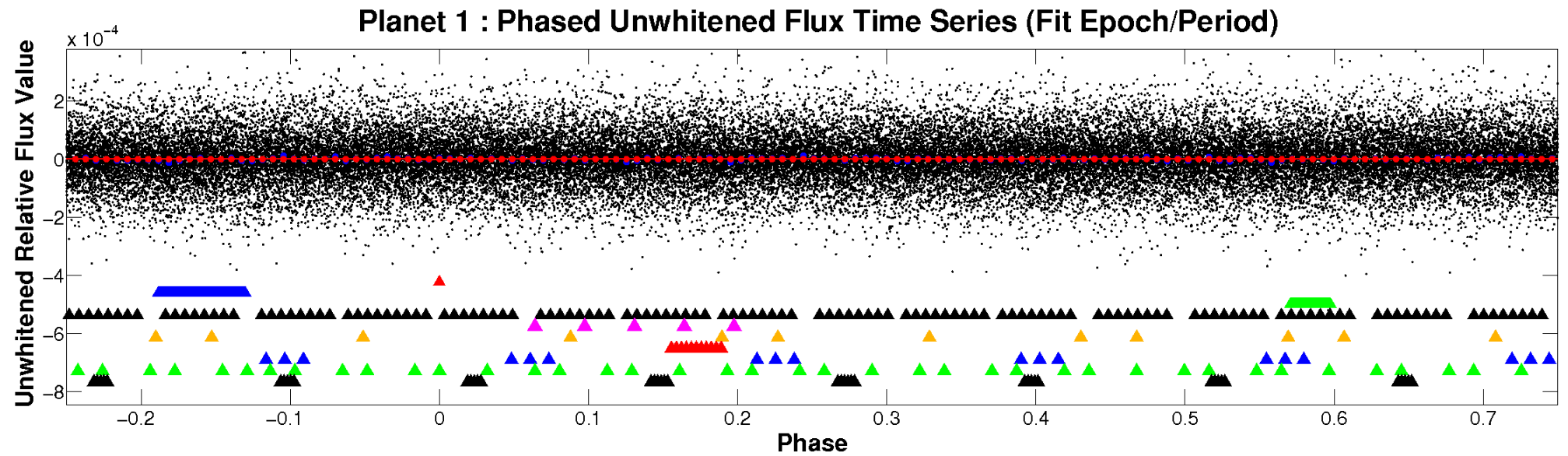


# ALT Odd/Even

TCE 011020521-01

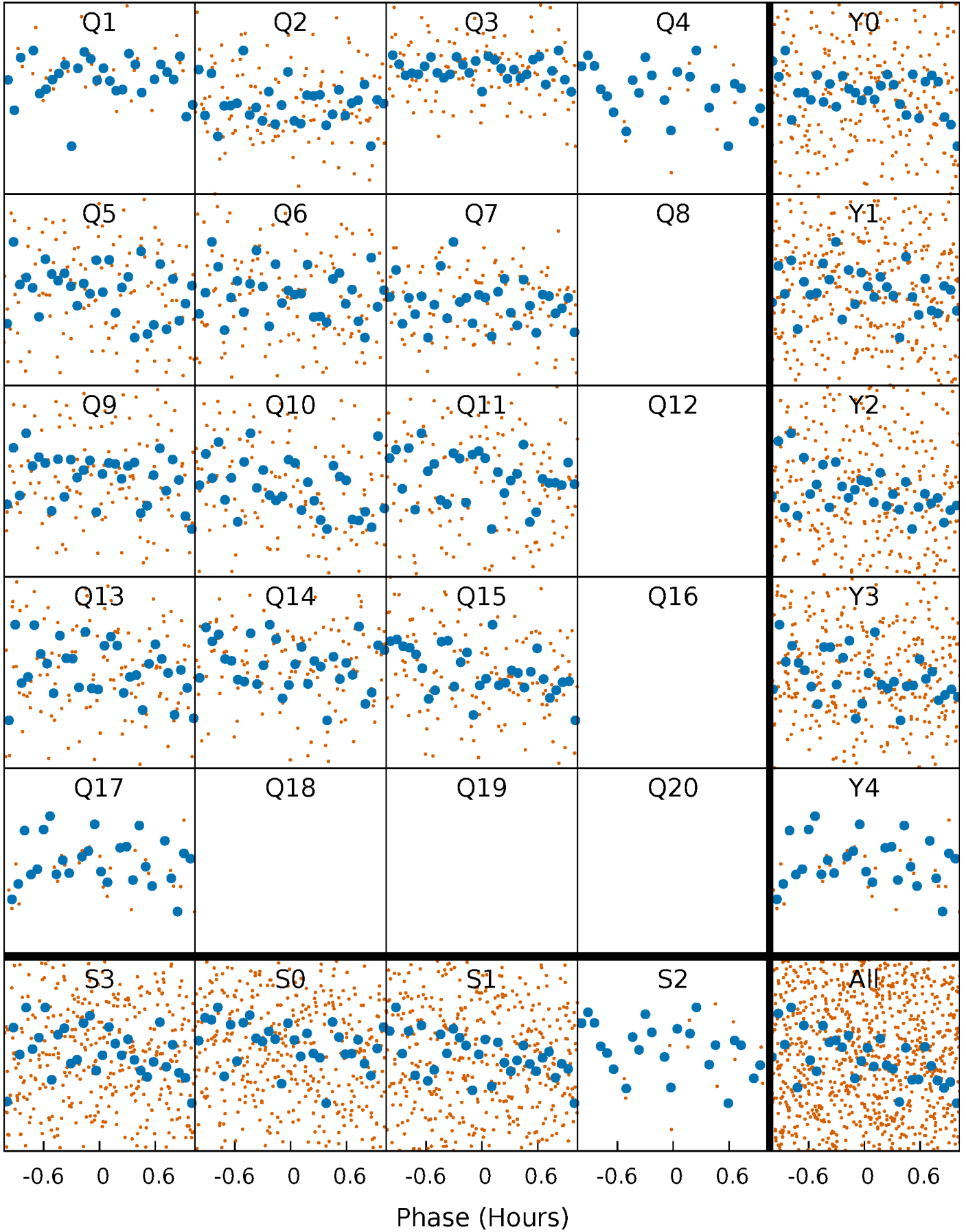


# Non-Whitened Vs. Whitened Light Curve



# PDC Quarter-Phased Transit Curves

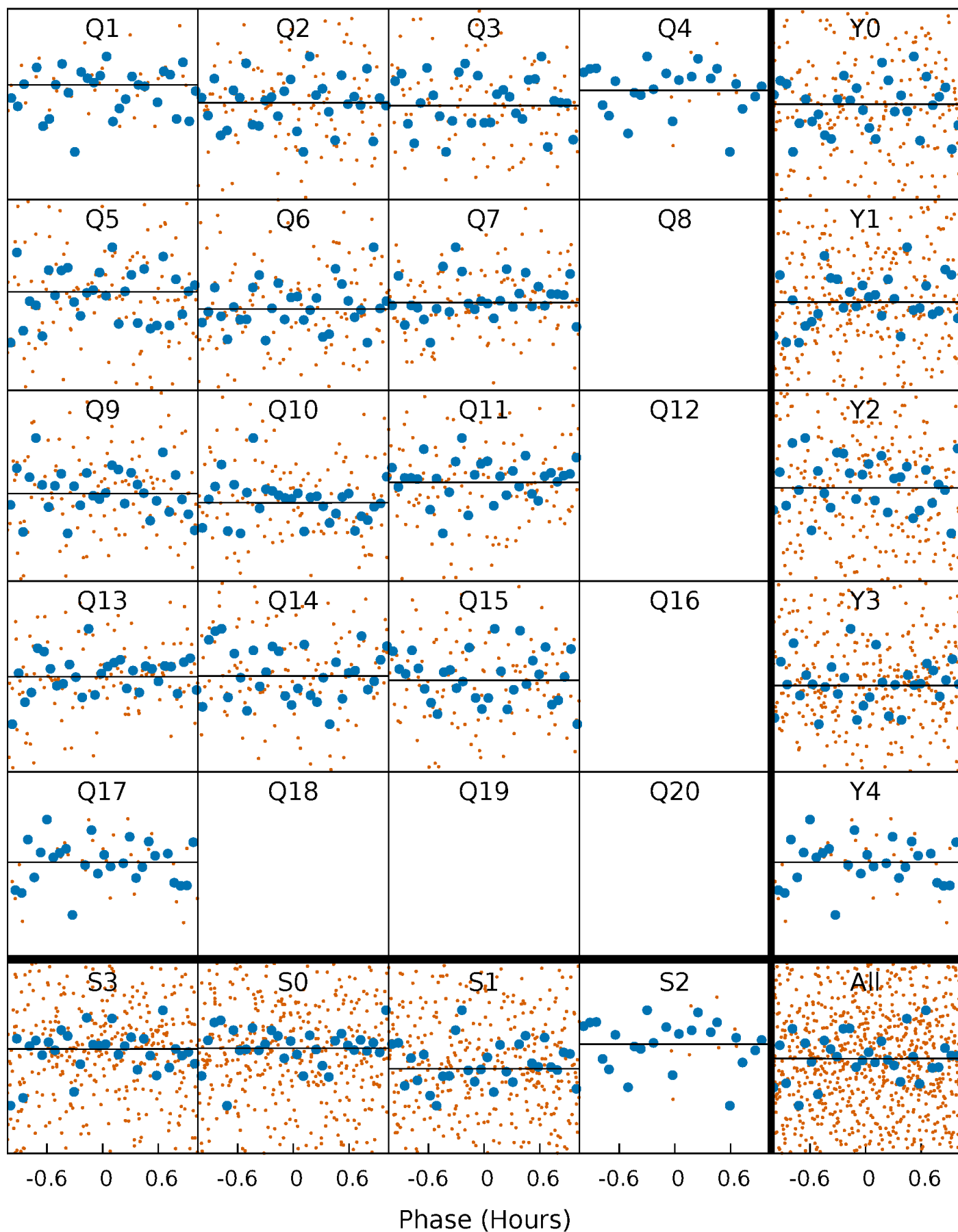
TCE 011020521-01 P= 2.929979 Days  $T_0=134.113706$  (BKJD)





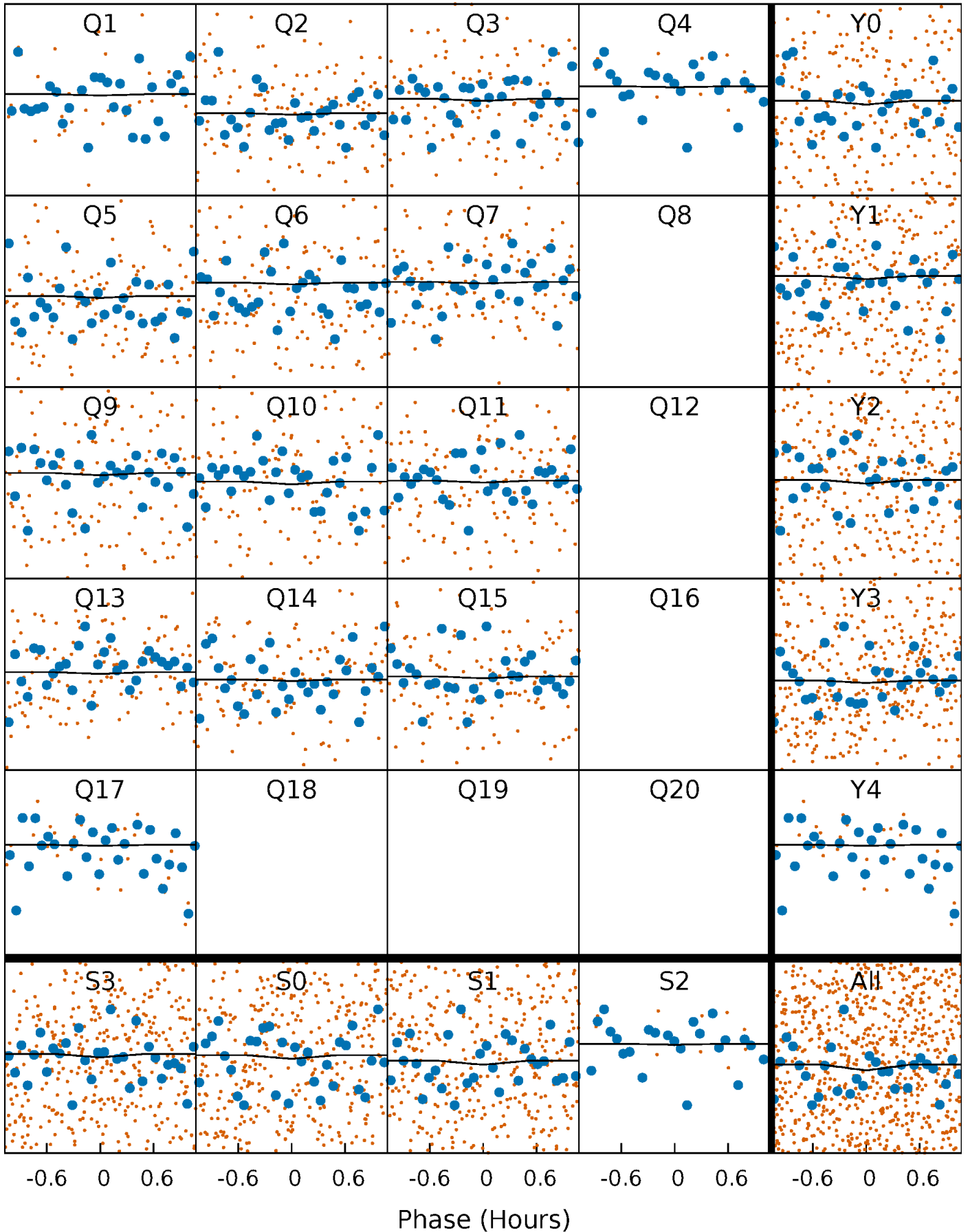
# DV Quarter-Phased Transit Curves

TCE 011020521-01 P= 2.929979 Days  $T_0=134.113706$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

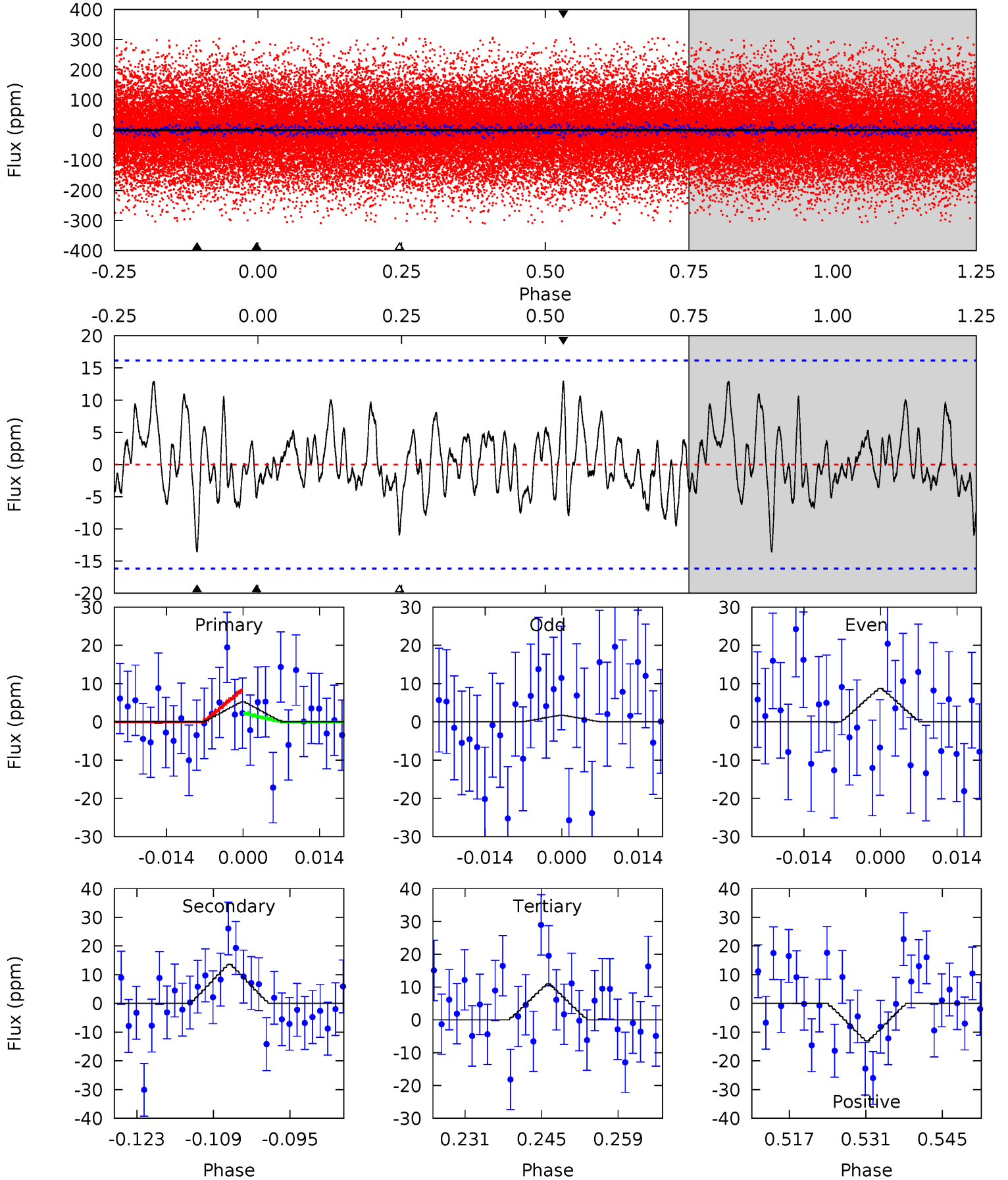
TCE 011020521-01 P= 2.930003 Days  $T_0=134.106258$  (BKJD)



# DV Model-Shift Uniqueness Test

011020521-01, P = 2.929979 Days, E = 131.183727 Days

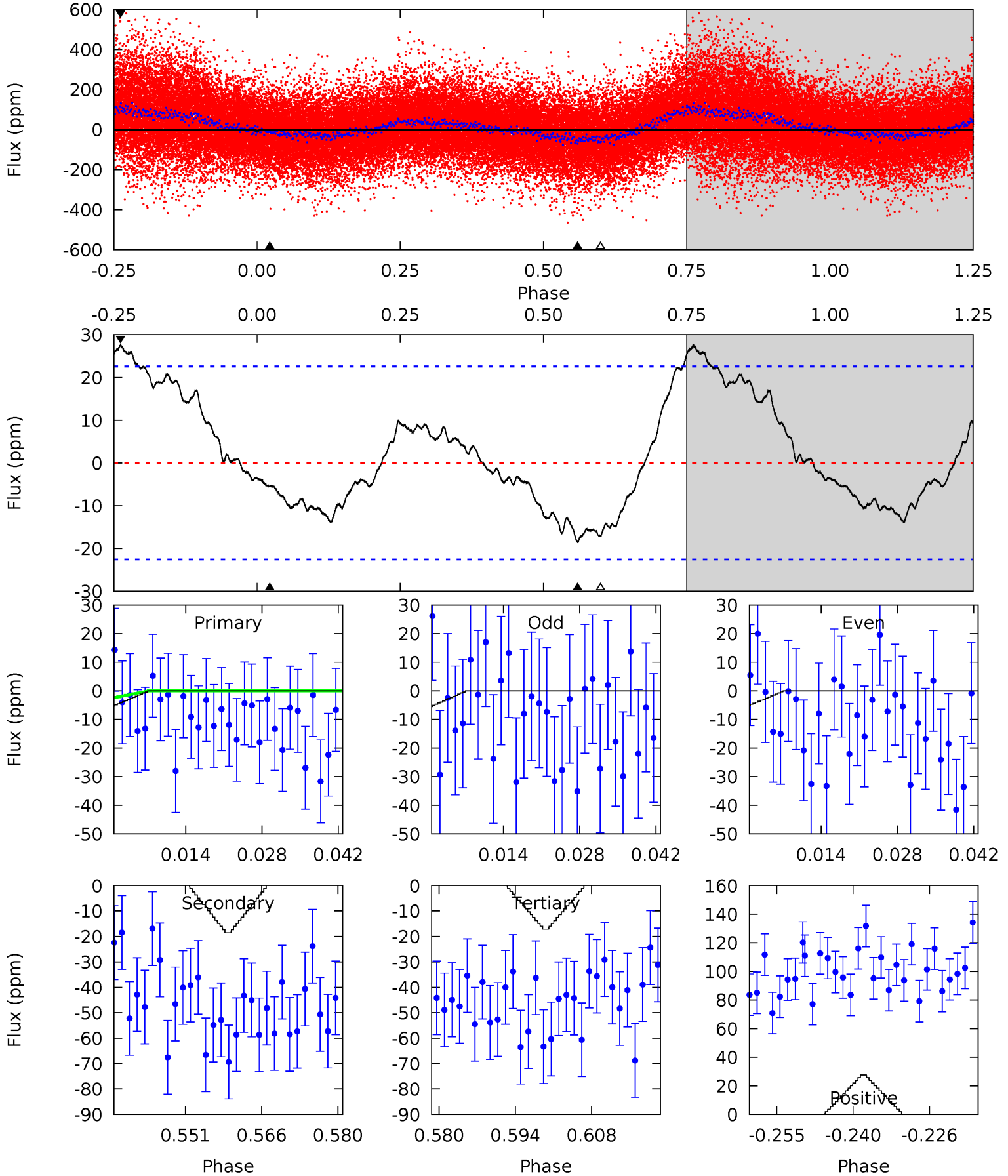
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
1.61	4.18	3.37	4.01	4.97	2.47	1.32	-1.75	-2.39	0.82	0.18	1.08	6.38	0.49	0.93



# Alt Model-Shift Uniqueness Test

011020521-01, P = 2.930003 Days, E = 131.176255 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
1.24	4.07	3.77	6.06	4.96	2.45	2.59	-2.52	-4.82	0.31	-1.98	0.04	1.41	0.60	0.67





### Stellar Parameters For KIC 011020521

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6877^{+170}_{-204}$	$3.632^{+0.304}_{-0.076}$	$-0.320^{+0.300}_{-0.250}$	$3.219^{+0.406}_{-1.217}$	$1.619^{+0.227}_{-0.312}$	$0.068^{+0.149}_{-0.017}$
	+2%/-3%	+8%/-2%	+94%/-78%	+13%/-38%	+14%/-19%	+218%/-25%
Source	PHO1	FLK73	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 011020521-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-14 \pm 3$	$3.66^{+4.14}_{-2.66}$	$3440^{+179}_{-304}$	$3966^{+3350}_{-6502}$	$1.238^{+14.021}_{-0.981}$
Alt.	$-19 \pm 5$	$3.91^{+4.13}_{-2.78}$	$3410^{+212}_{-325}$	$4057^{+3611}_{-1568}$	$1.402^{+17.035}_{-1.068}$

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

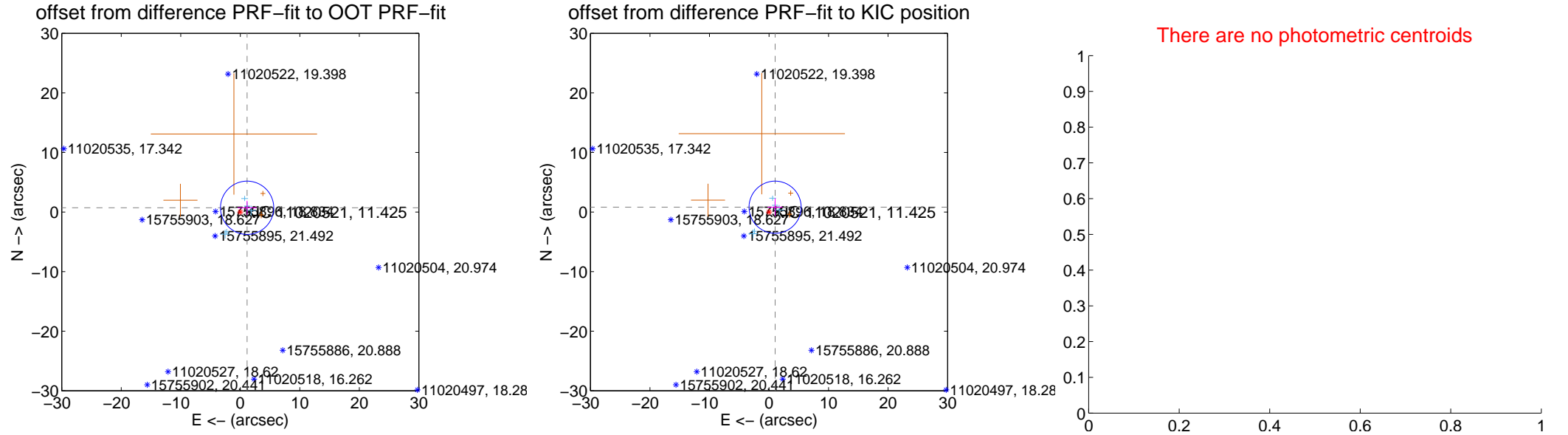
## DV Centroid Data

Supplemental centroid analysis for 011020521-01. **Kepler magnitude: 11.43.** Transit SNR 0.01

There are 5 quarters with good PRF difference image offsets

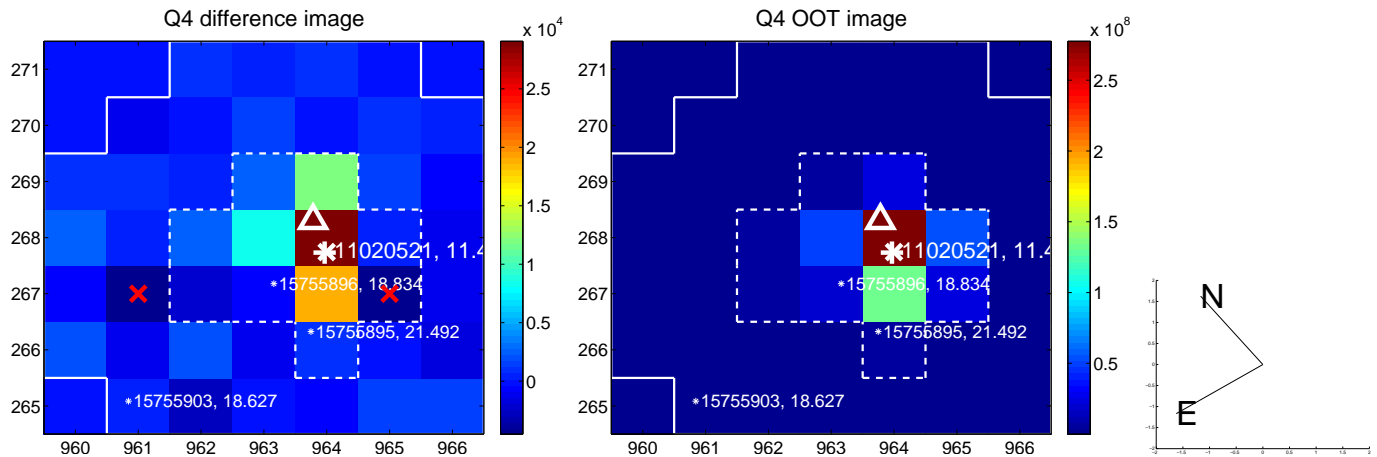
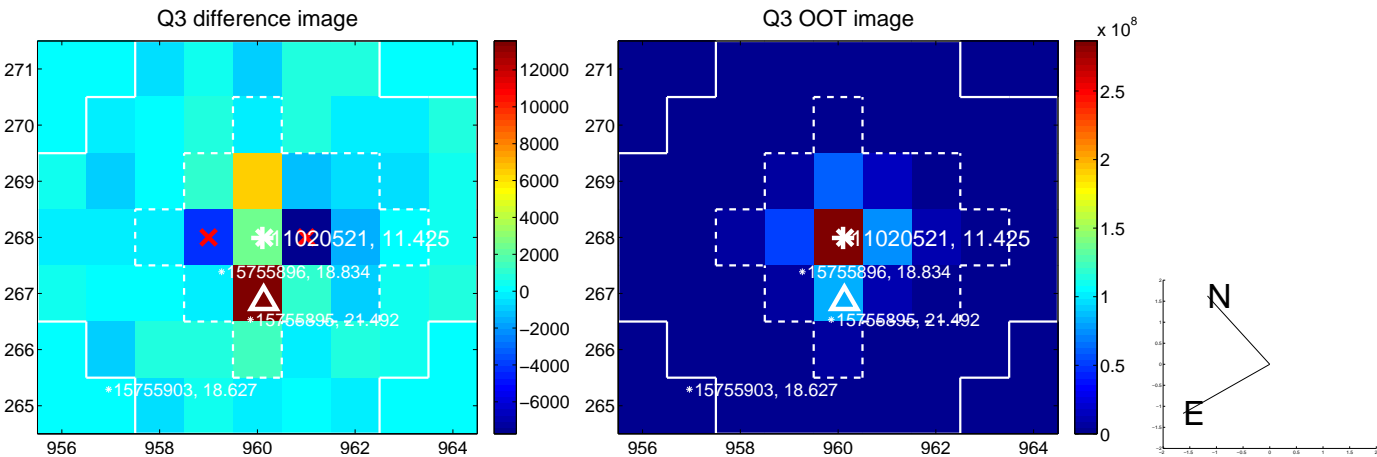
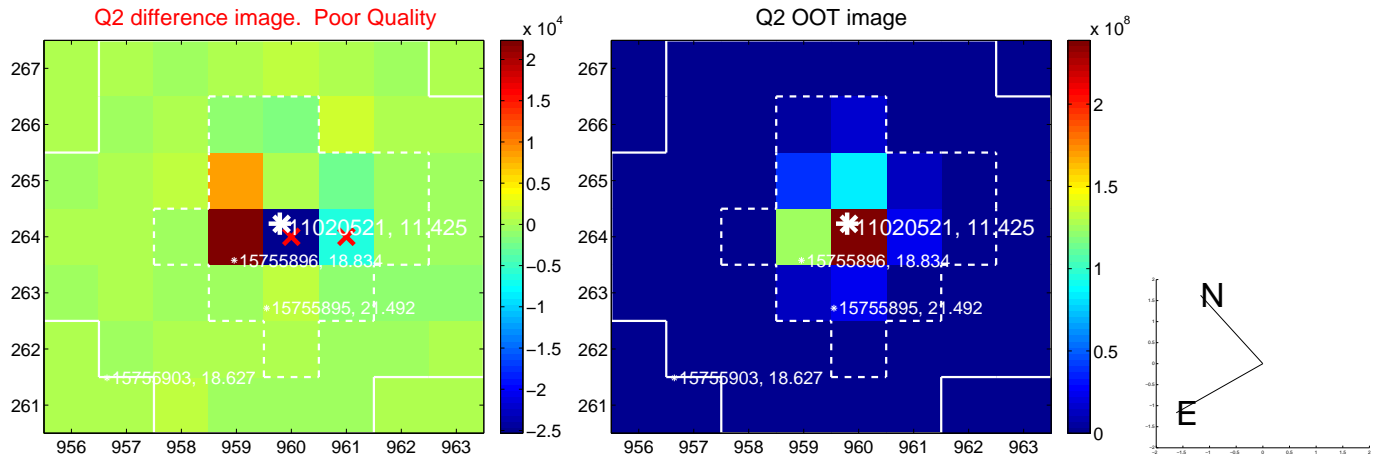
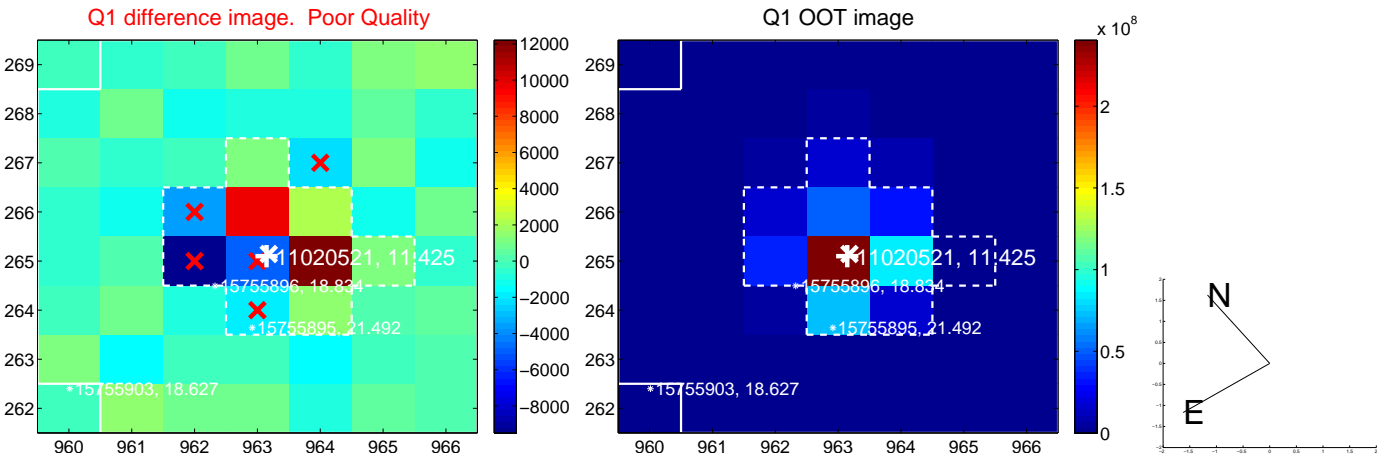
The direct PRF centroid is offset from the target star catalog position by about 0.19 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.351 \pm 1.491$	0.91	$-1.147 \pm 1.594$	$0.715 \pm 1.187$
PRF-fit source offset from KIC position	$1.305 \pm 1.459$	0.89	$-1.022 \pm 1.253$	$0.811 \pm 1.494$
photometric centroid source offset	—	—	—	—

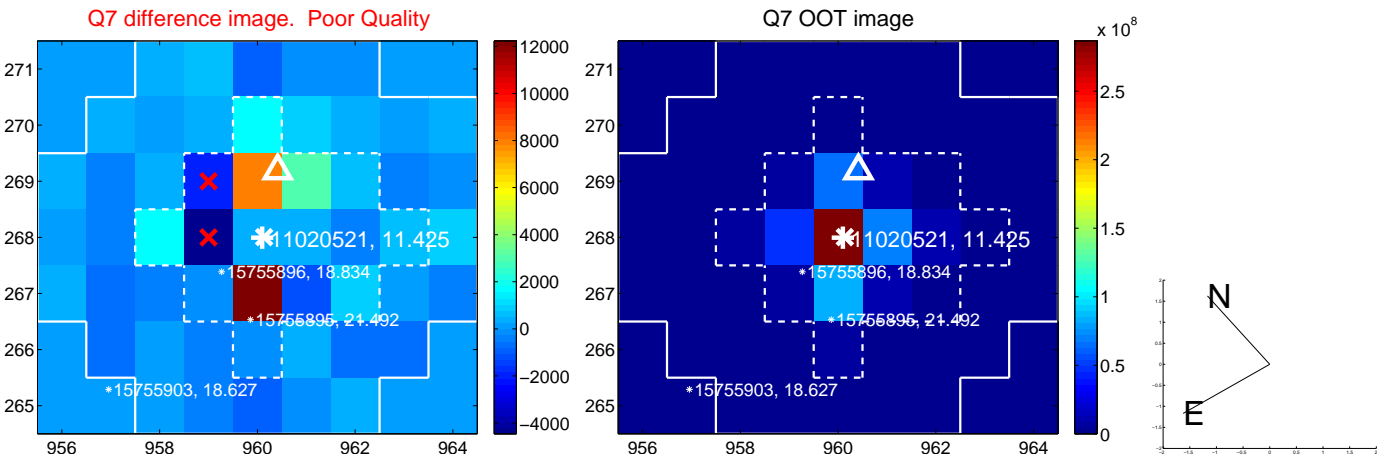
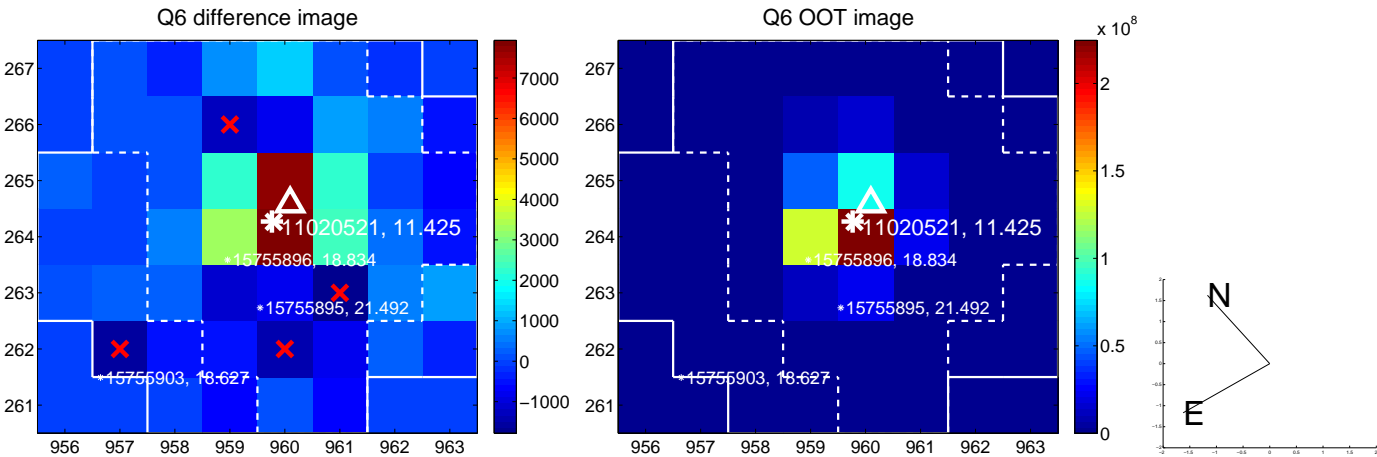
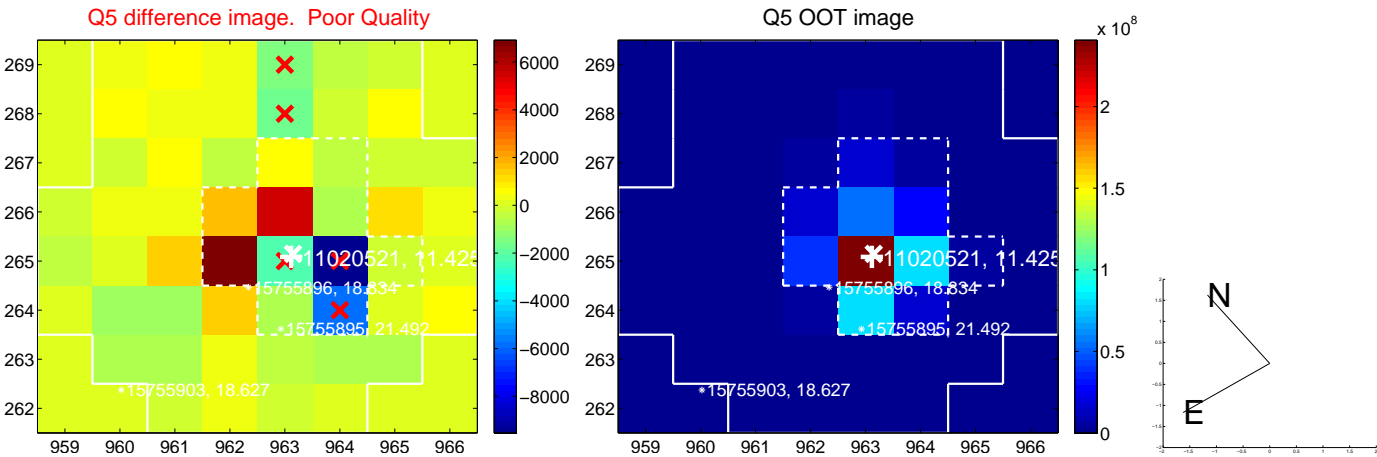


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

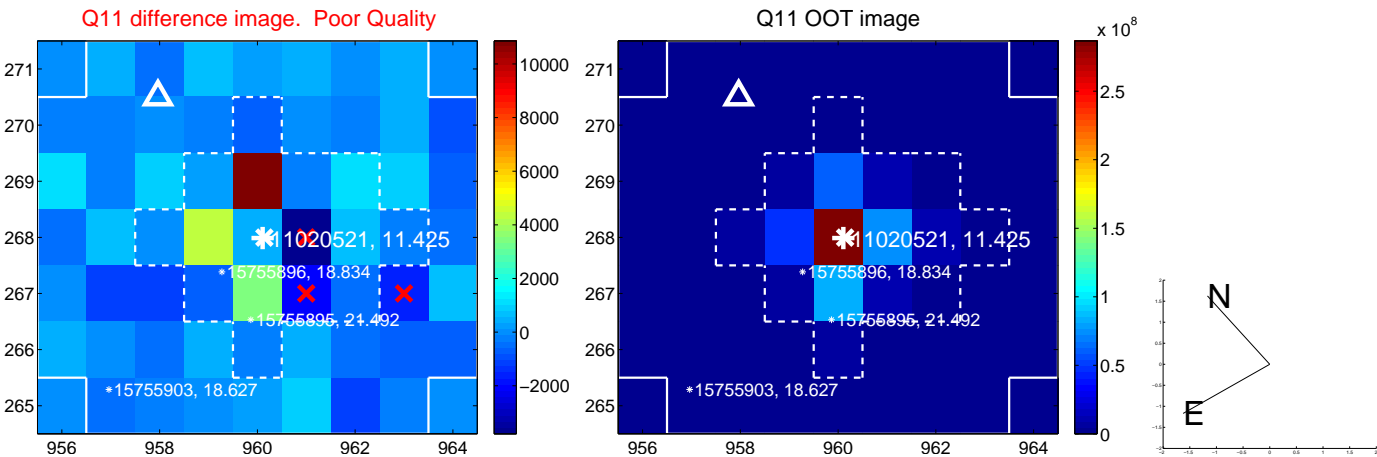
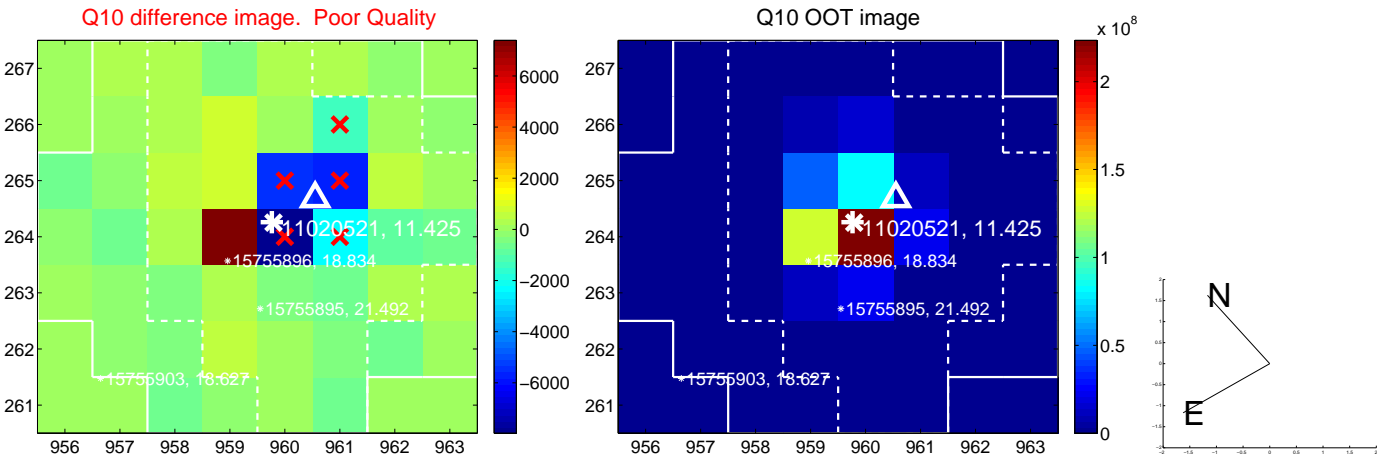
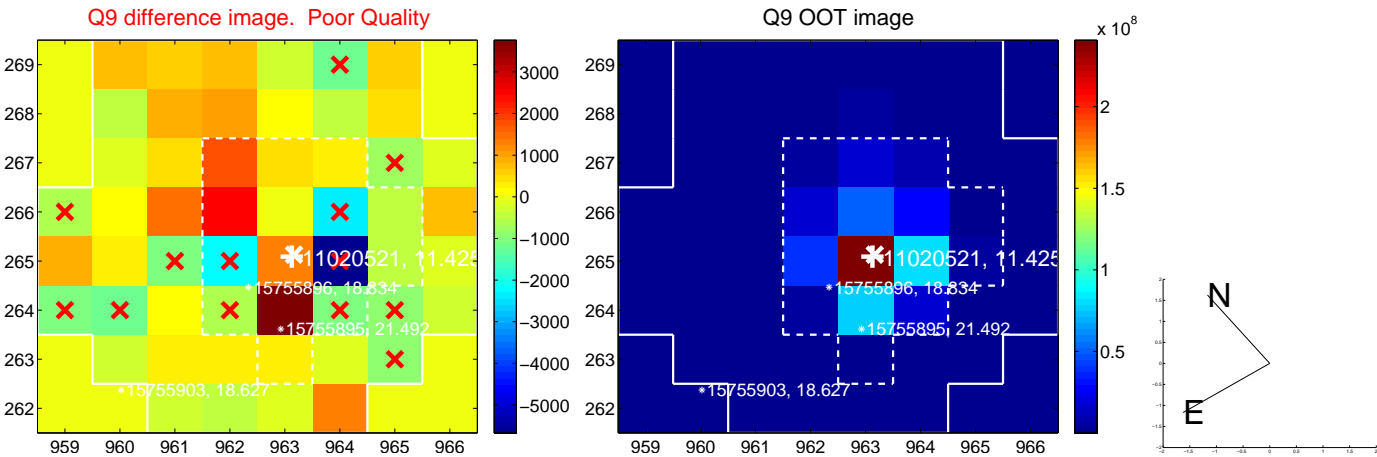


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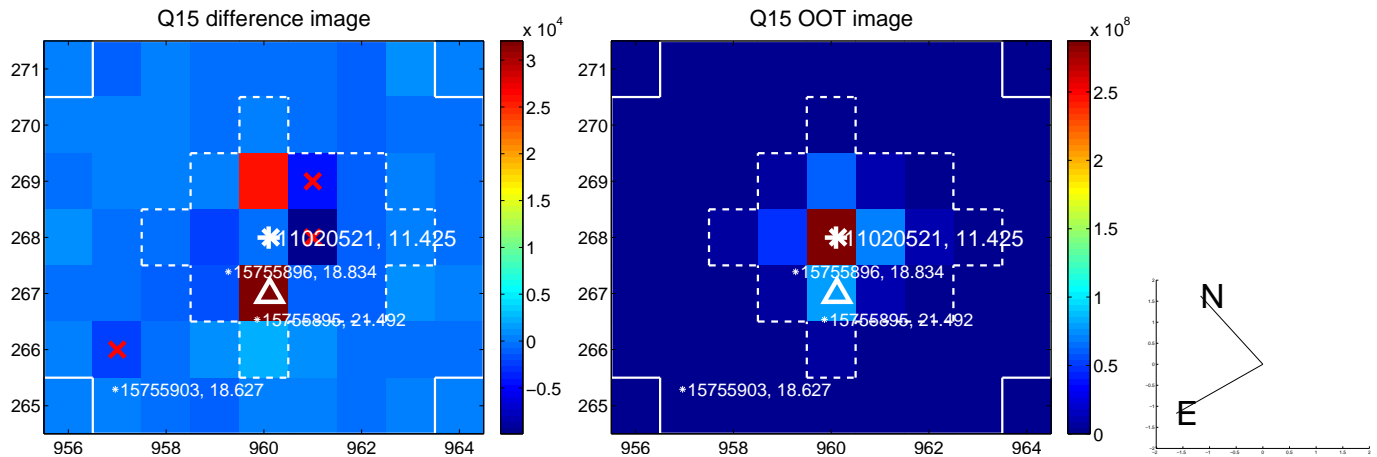
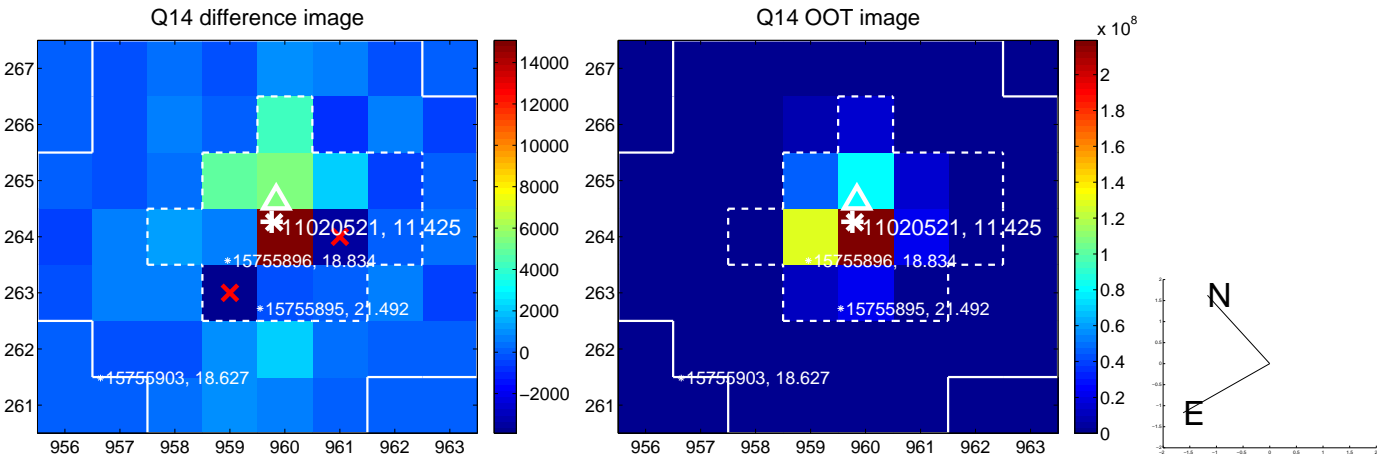
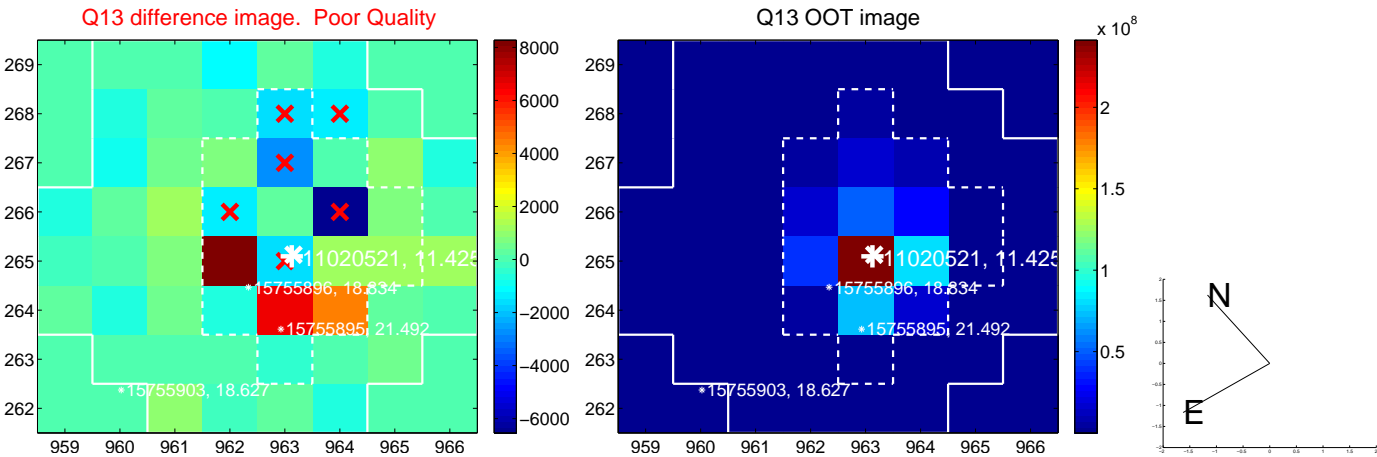




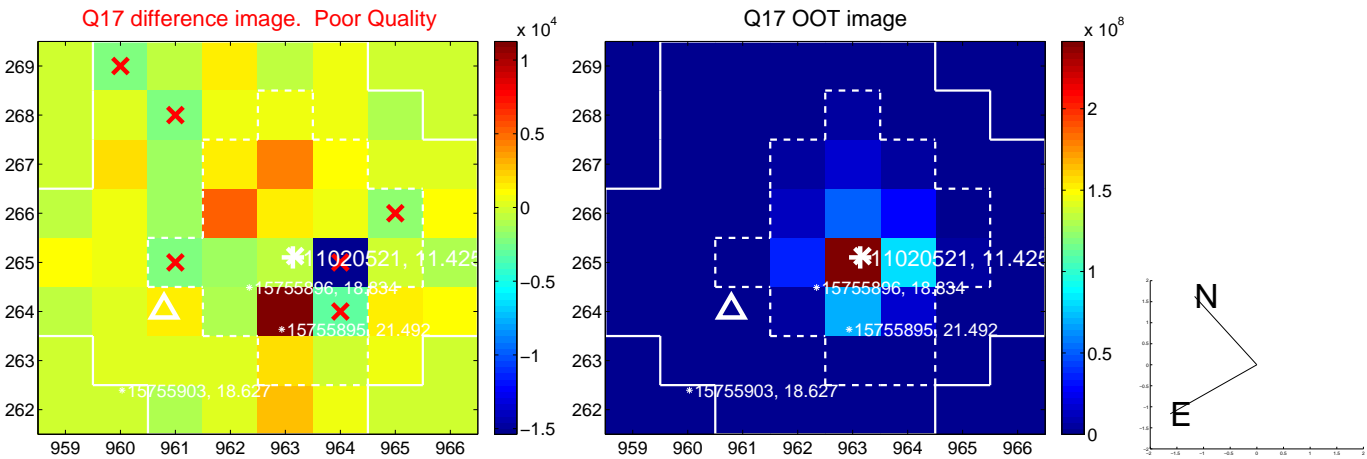
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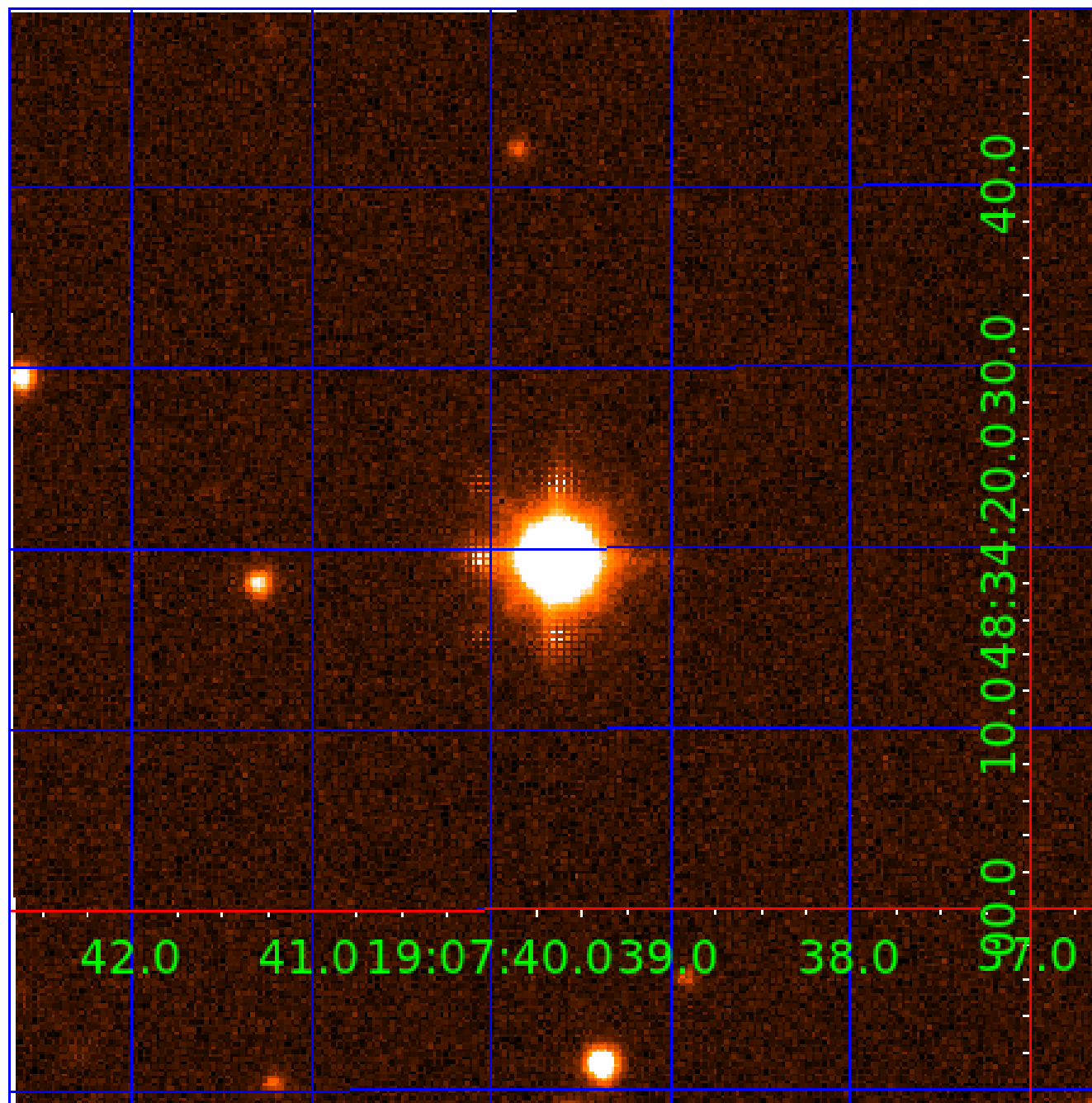
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folded centroid time series figure for this object.

UKIRT Image

Declination





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011020521-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-04	OBS	FP	0.00	1	0	1	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
011020521-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-07	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-09	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_ALT—CENT_SATURATED
011020521-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED

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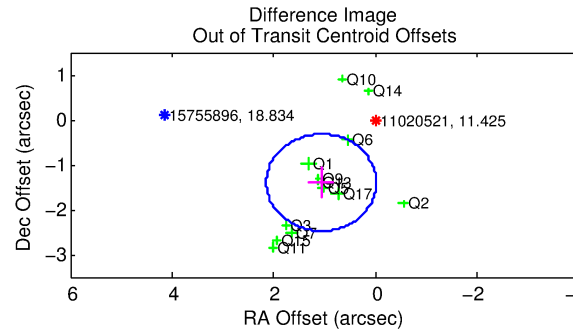
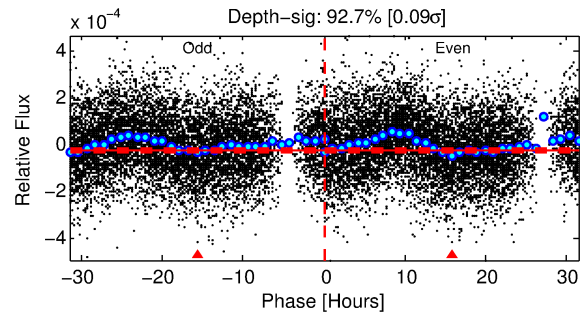
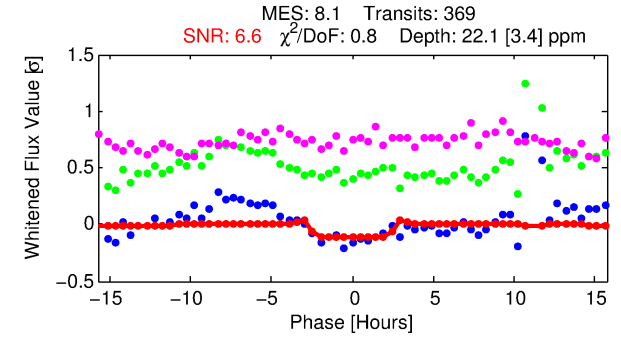
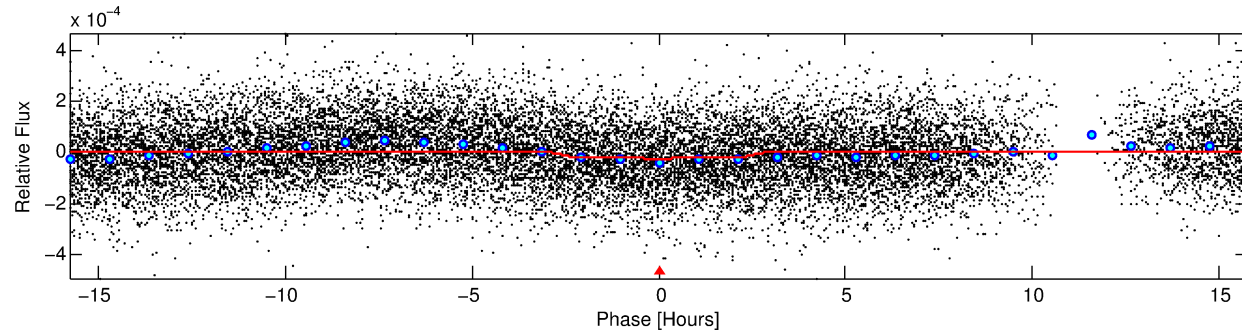
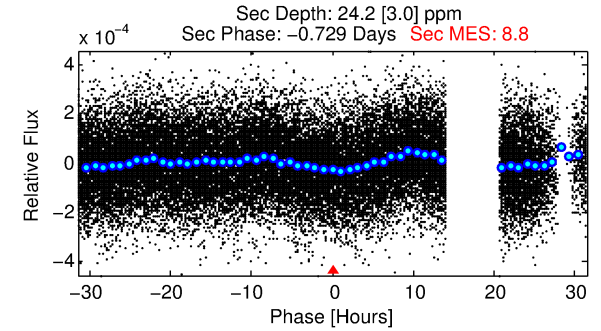
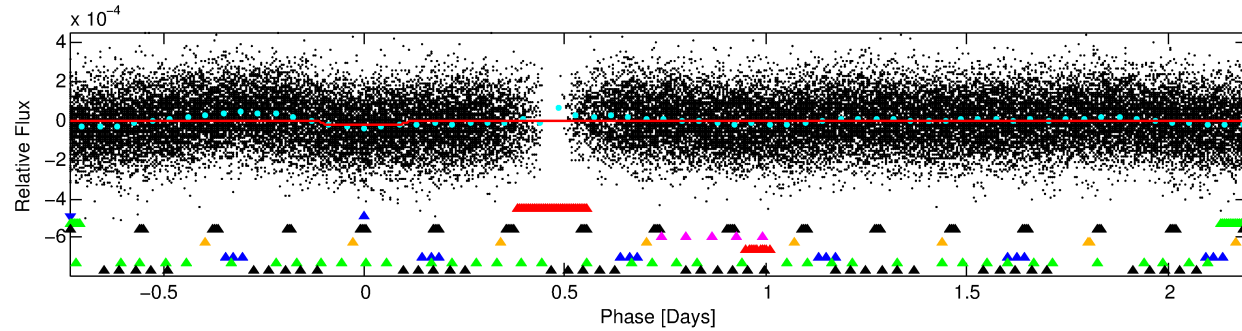
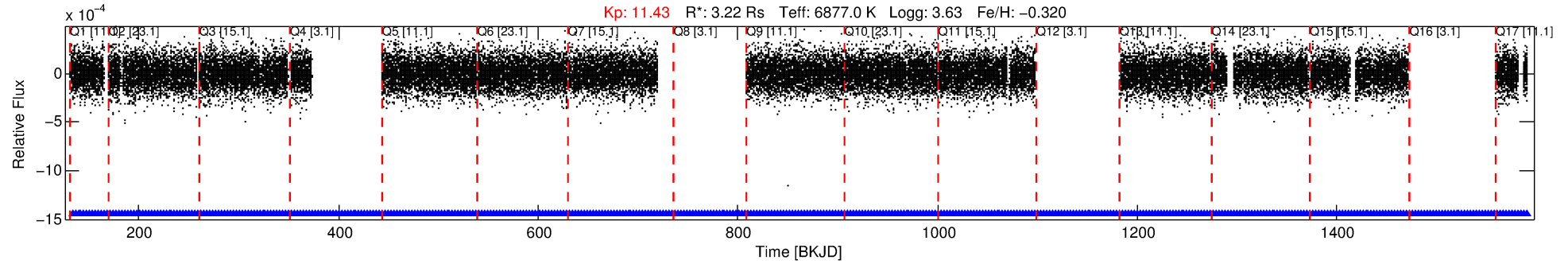
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 011020521-02

No Significant Match Found

# DV One-Page Summary

KIC: 11020521 Candidate: 2 of 10 Period: 2.930 d



## DV Fit Results:

Period = 2.93032 [0.00003] d  
Epoch = 133.5614 [0.0057] BKJD  
Rp/R\* = 0.0051 [0.0014]  
a/R\* = 1.99 [2.40]  
b = 0.92 [0.28]  
Seff = 9370.23 [5092.57]  
Teq = 2509 [341] K  
Rp = 1.78 [0.83] Re  
a = 0.0471 [0.0162] AU  
Ag = 9.25 [7.09] [1.16σ]  
Teffp = 6764 [958] K [4.18σ]

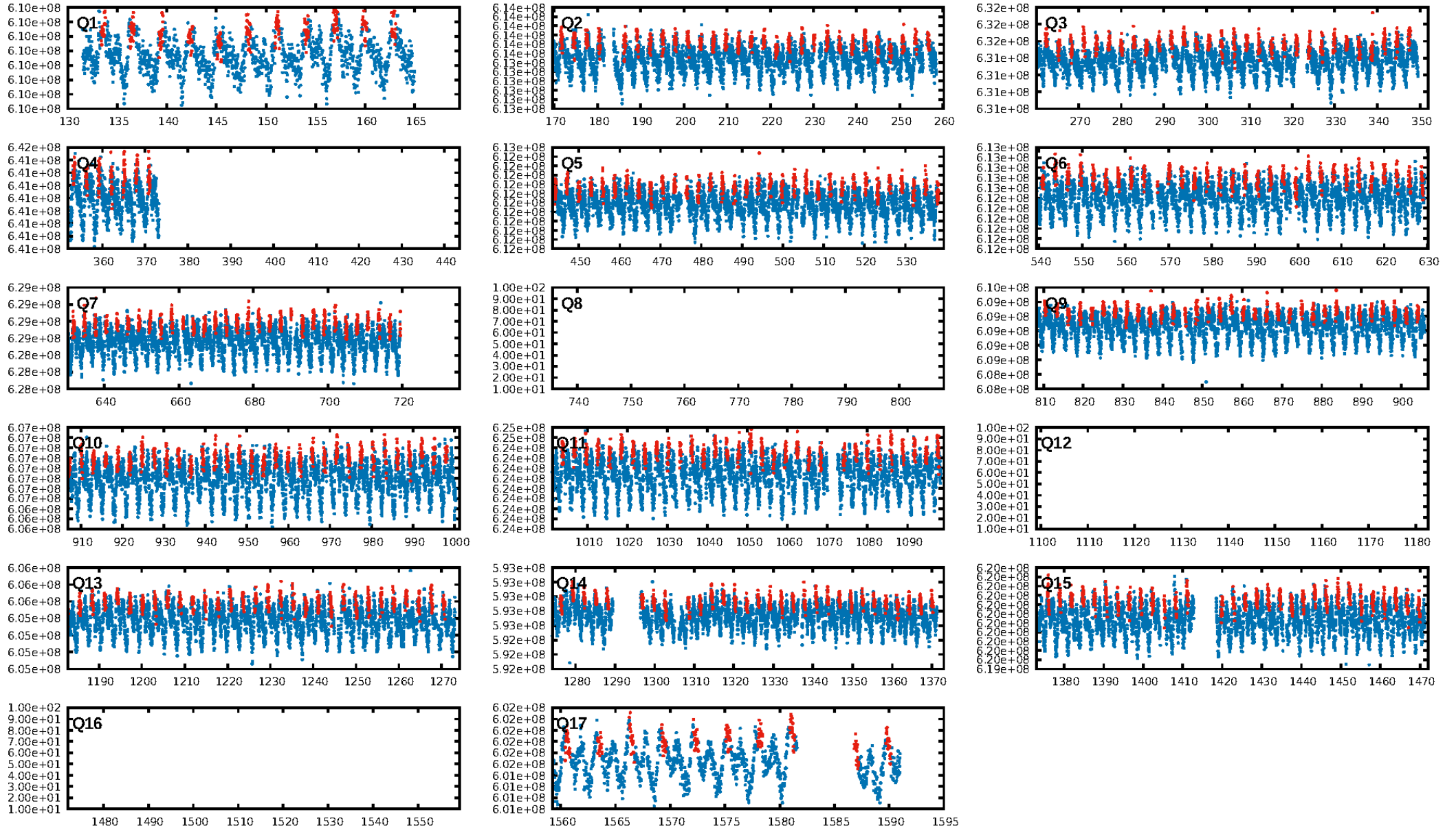
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: 100.0% [31.02σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [341/341]  
GhostDiagnostic-chr: -3.488  
Centroid-sig: N/A  
Centroid-so: N/A  
OotOffset-rm: 1.759 arcsec [4.89σ]  
KicOffset-rm: 1.836 arcsec [5.49σ]  
OotOffset-st: 4/4/0/5 [13]  
KicOffset-st: 4/4/0/5 [13]  
DiffImageQuality-fgm: 0.00 [0/13]  
DiffImageOverlap-fno: 0.23 [3/13]

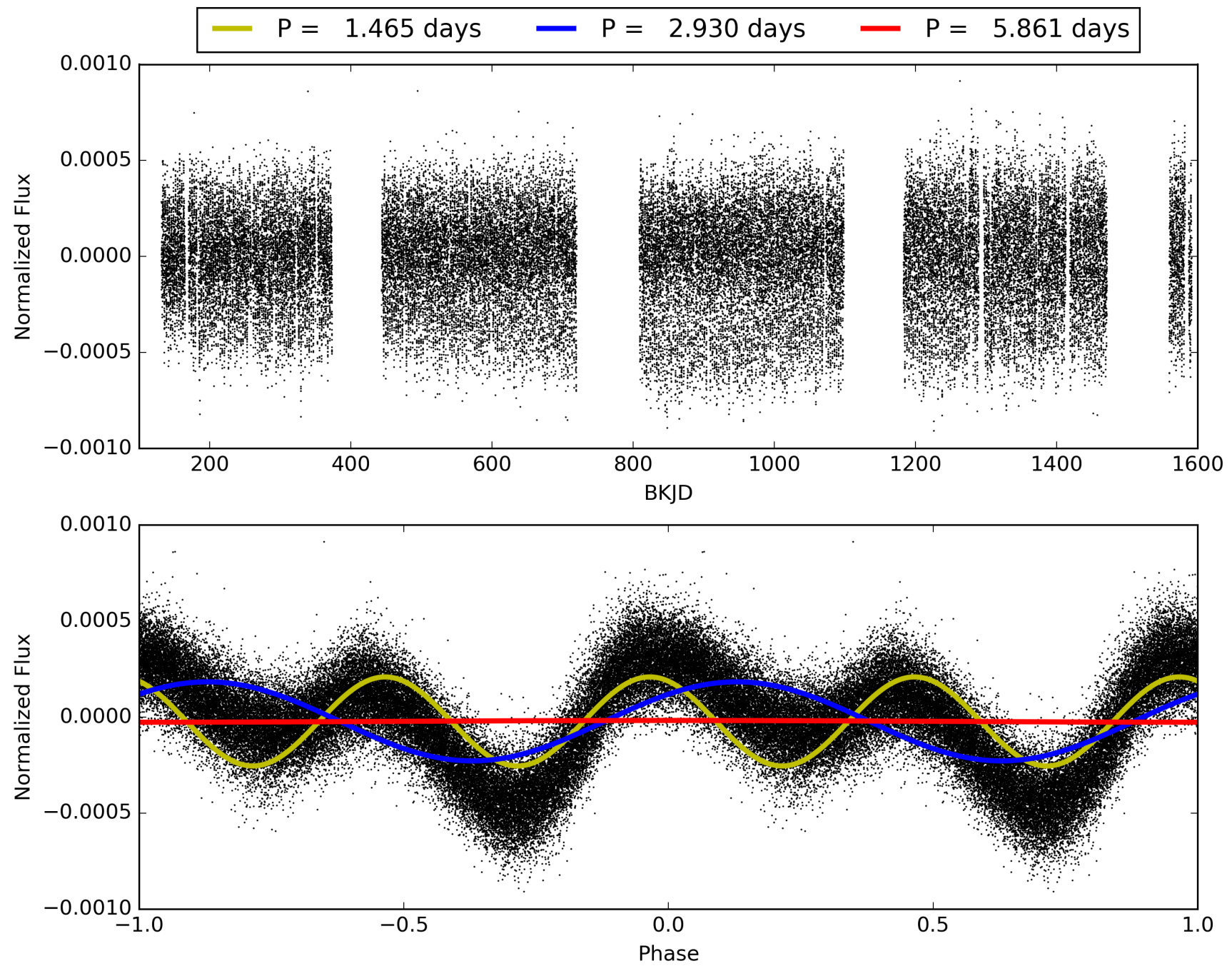
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 05:44:42 Z

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

# TCE 011020521-02, PDC Light Curves



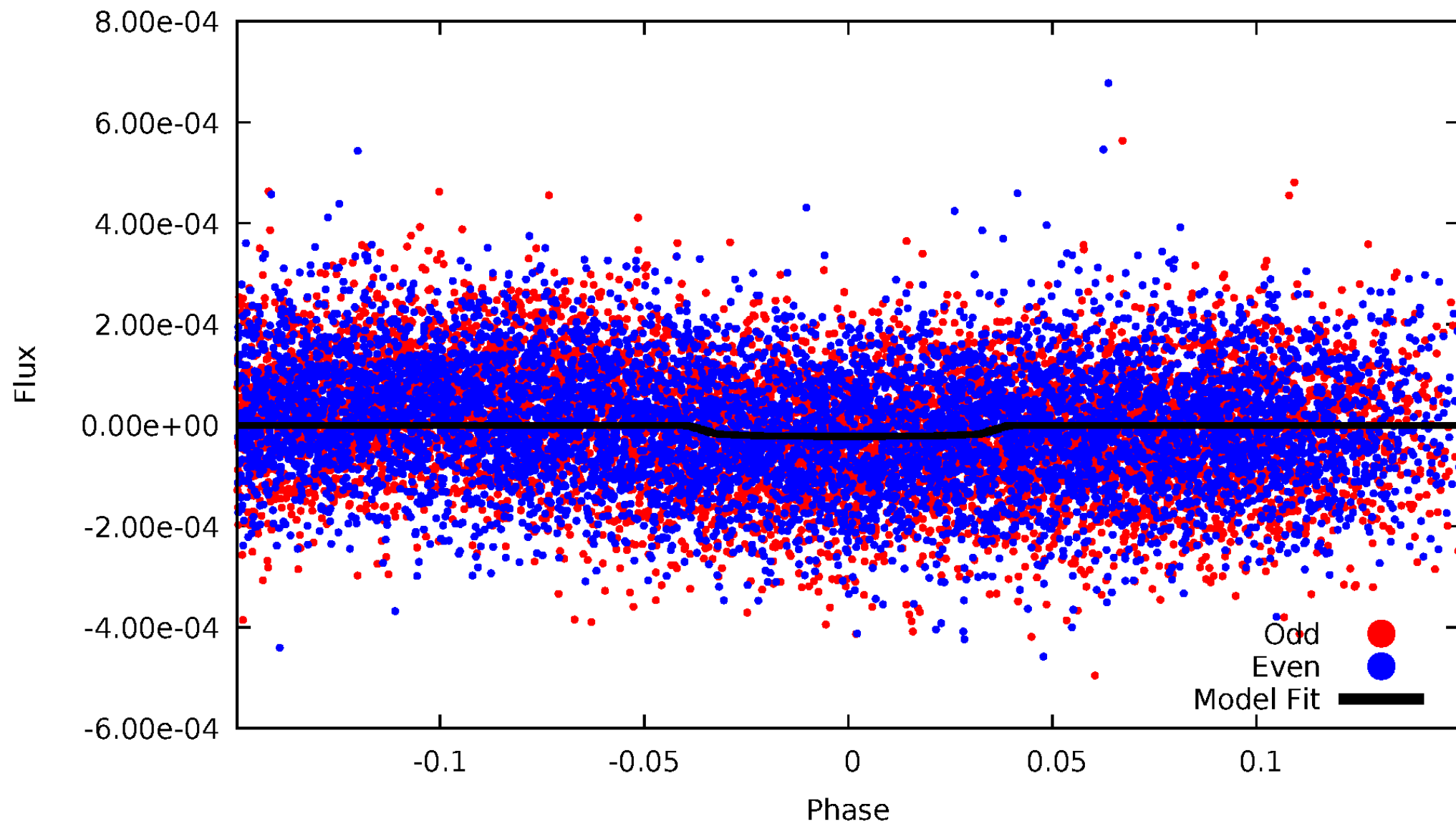
TCE 011020521-02





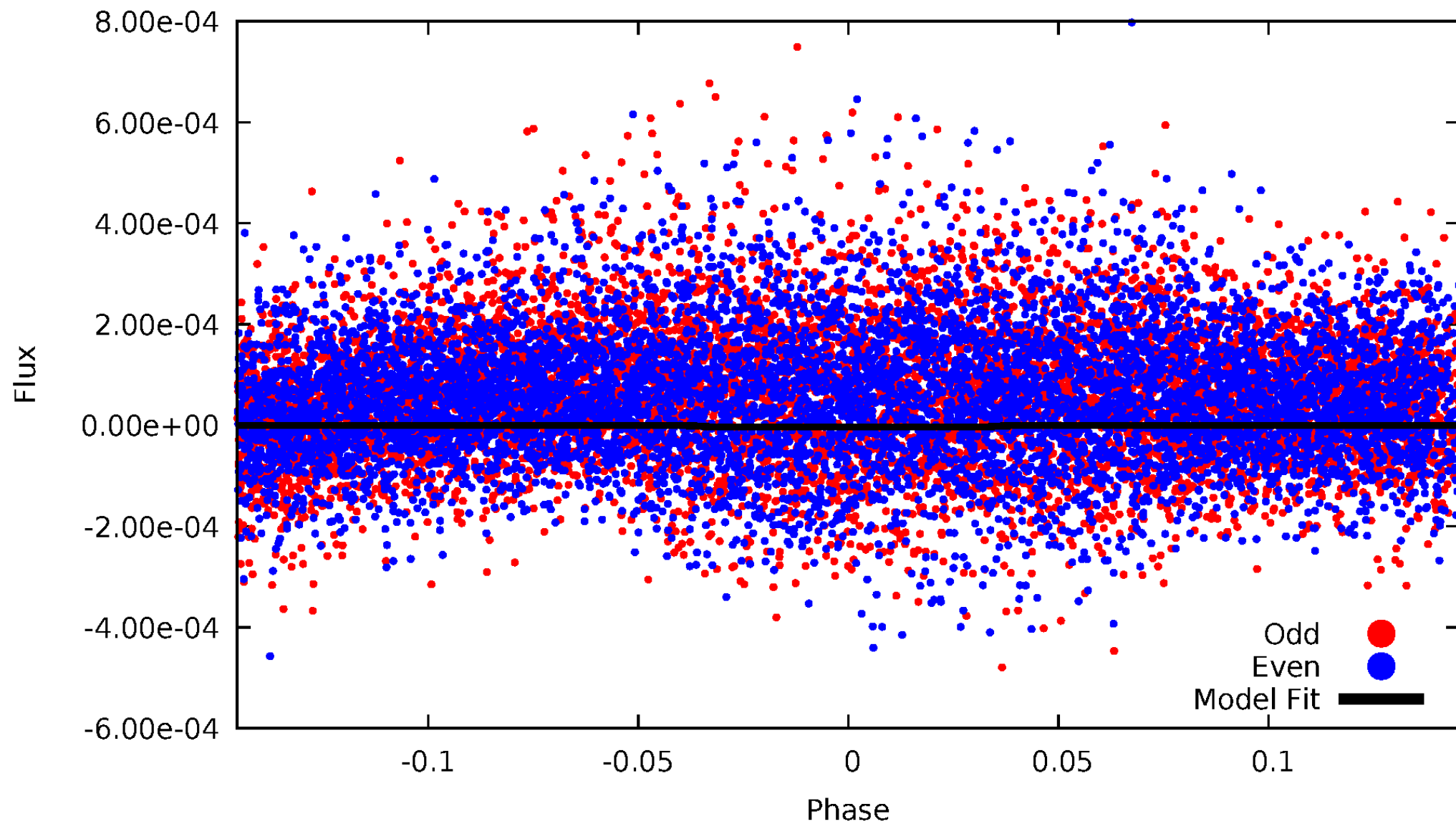
DV Odd/Even

TCE 011020521-02



# ALT Odd/Even

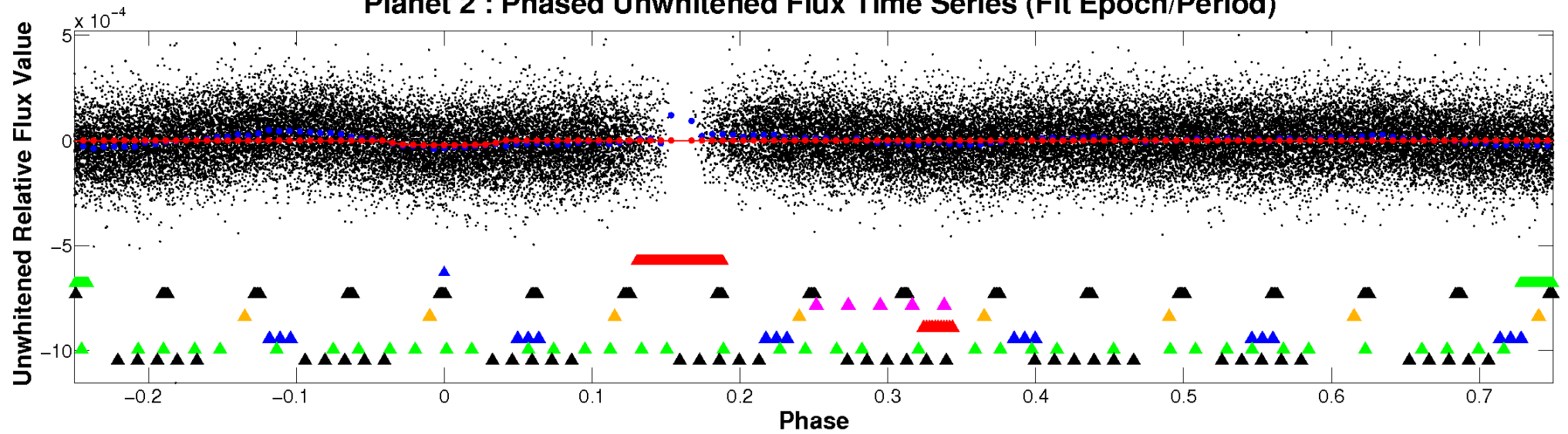
TCE 011020521-02



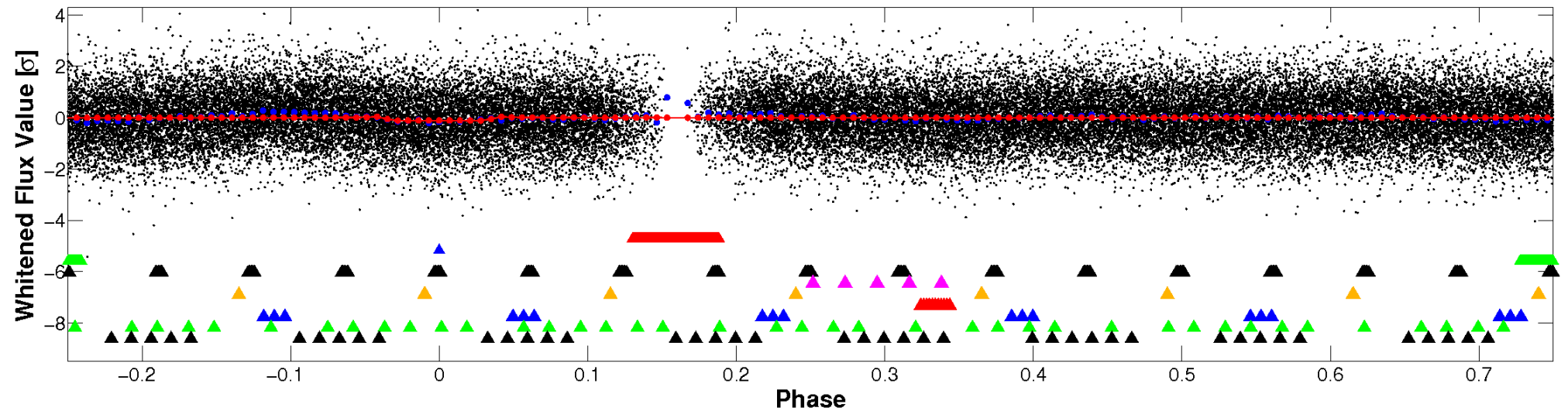


# Non-Whitened Vs. Whitened Light Curve

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

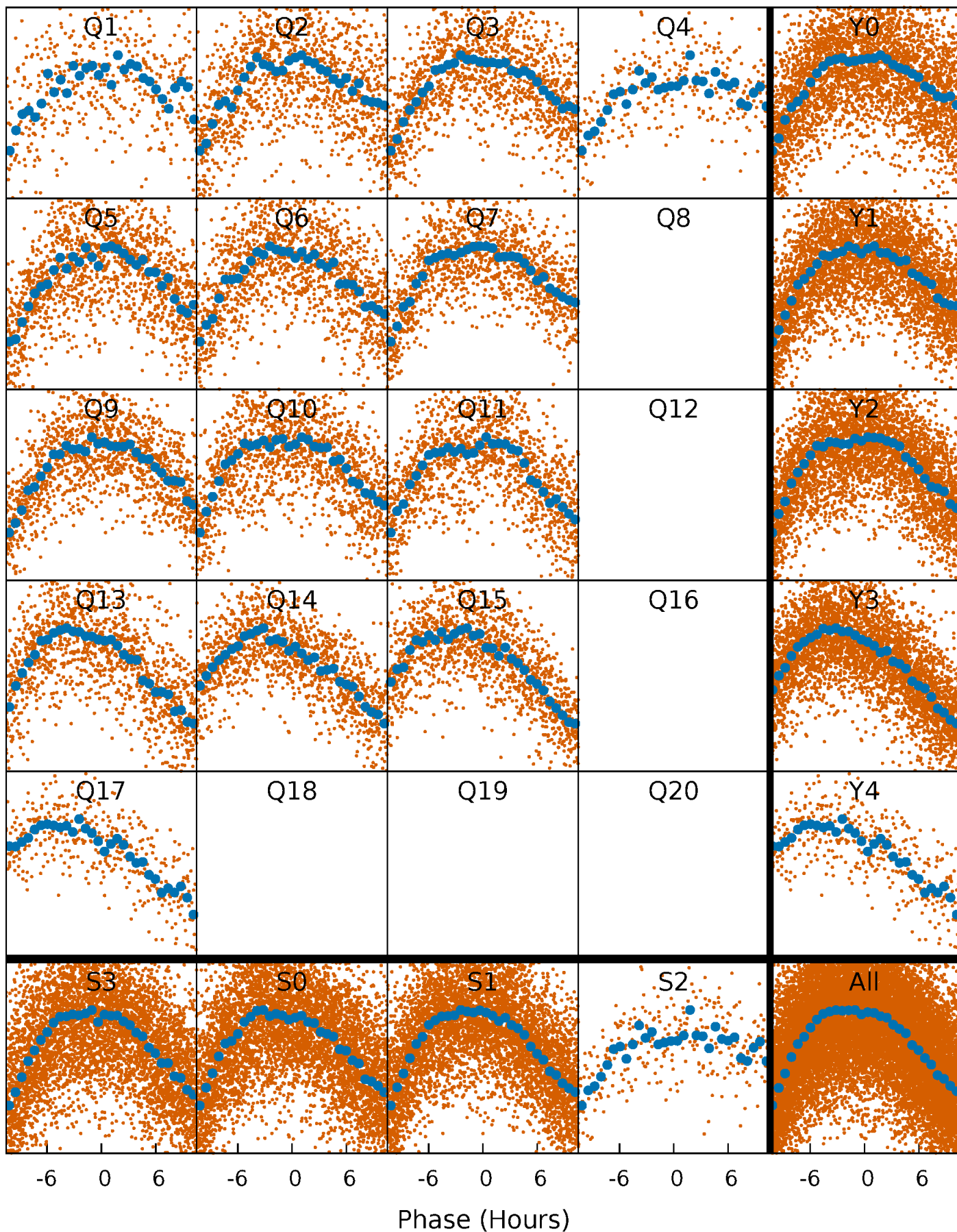


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



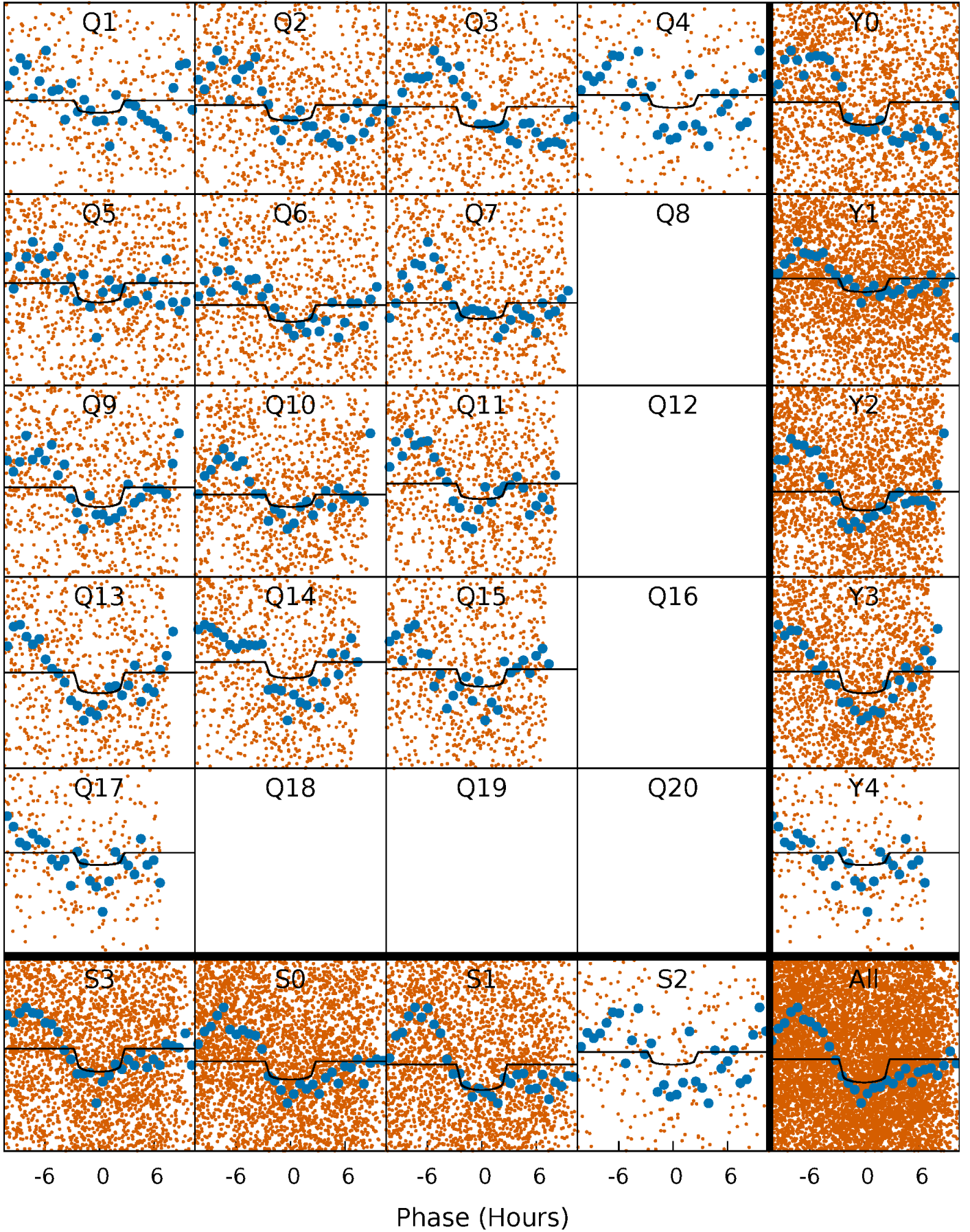
# PDC Quarter-Phased Transit Curves

TCE 011020521-02   P= 2.930323 Days    $T_0=133.561397$  (BKJD)



# DV Quarter-Phased Transit Curves

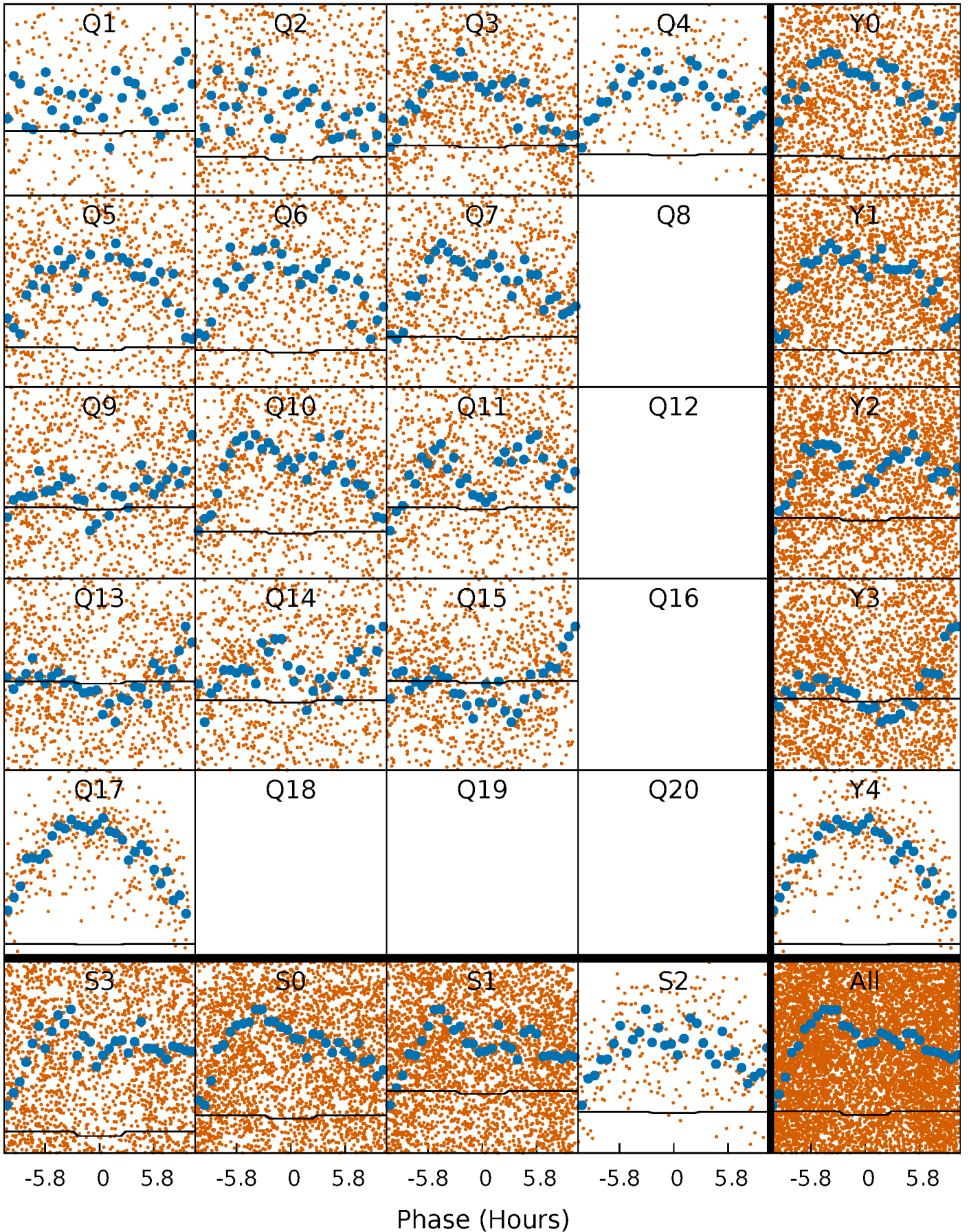
TCE 011020521-02 P= 2.930323 Days  $T_0=133.561397$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

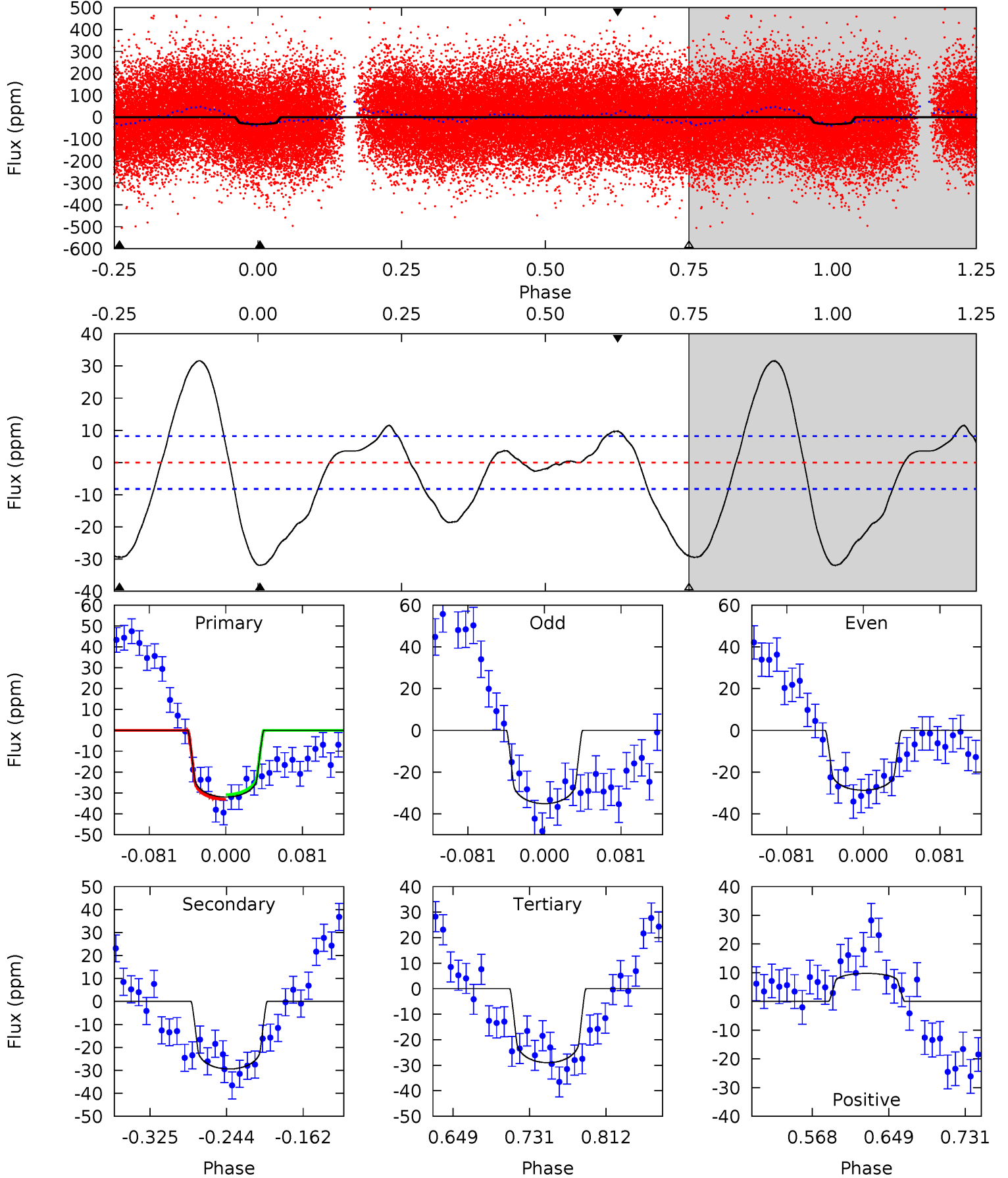
TCE 011020521-02     $P = 2.930072$  Days     $T_0 = 133.567961$  (BKJD)



# DV Model-Shift Uniqueness Test

011020521-02, P = 2.930323 Days, E = 130.631074 Days

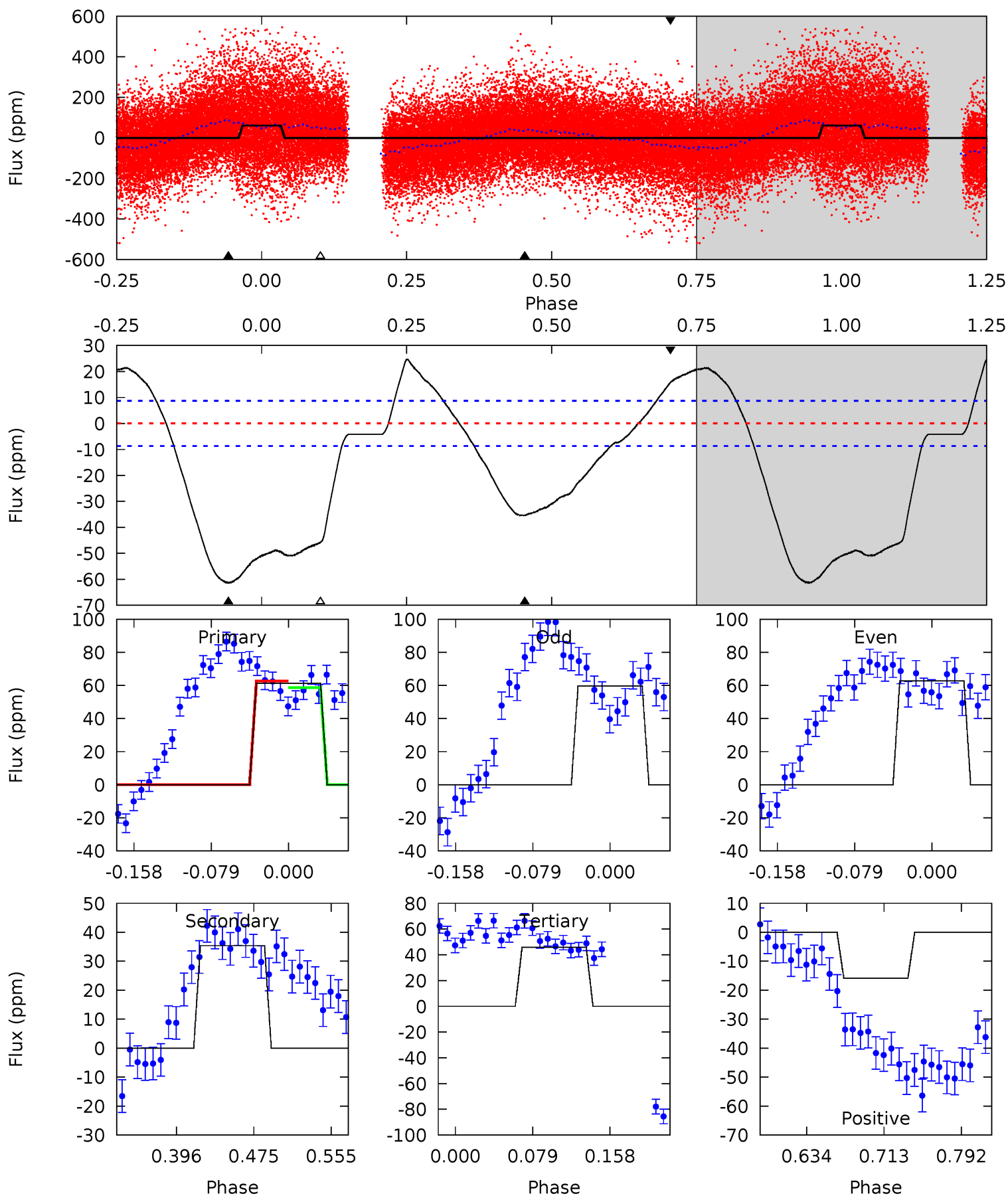
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
17.9	16.5	16.2	5.47	4.61	1.74	7.40	1.65	12.4	0.24	11.0	1.80	1.11	0.50	0.62



# Alt Model-Shift Uniqueness Test

011020521-02, P = 2.930072 Days, E = 130.637889 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
32.5	18.8	24.2	8.38	4.61	1.76	12.0	8.21	24.1	-5.49	10.4	0.81	1.06	0.29	1.13



### Stellar Parameters For KIC 011020521

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6877^{+170}_{-204}$	$3.632^{+0.304}_{-0.076}$	$-0.320^{+0.300}_{-0.250}$	$3.219^{+0.406}_{-1.217}$	$1.619^{+0.227}_{-0.312}$	$0.068^{+0.149}_{-0.017}$
	+2%/-3%	+8%/-2%	+94%/-78%	+13%/-38%	+14%/-19%	+218%/-25%
Source	PHO1	FLK73	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 011020521-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-29 \pm 2$	$1.70^{+0.55}_{-0.53}$	$3432^{+190}_{-297}$	$7073^{+1433}_{-924}$	$13^{+13}_{-5}$
Alt.	$-35 \pm 2$	$0.64^{+0.44}_{-0.37}$	$3429^{+178}_{-273}$	$15604^{+28528}_{-5494}$	$108^{+488}_{-70}$

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



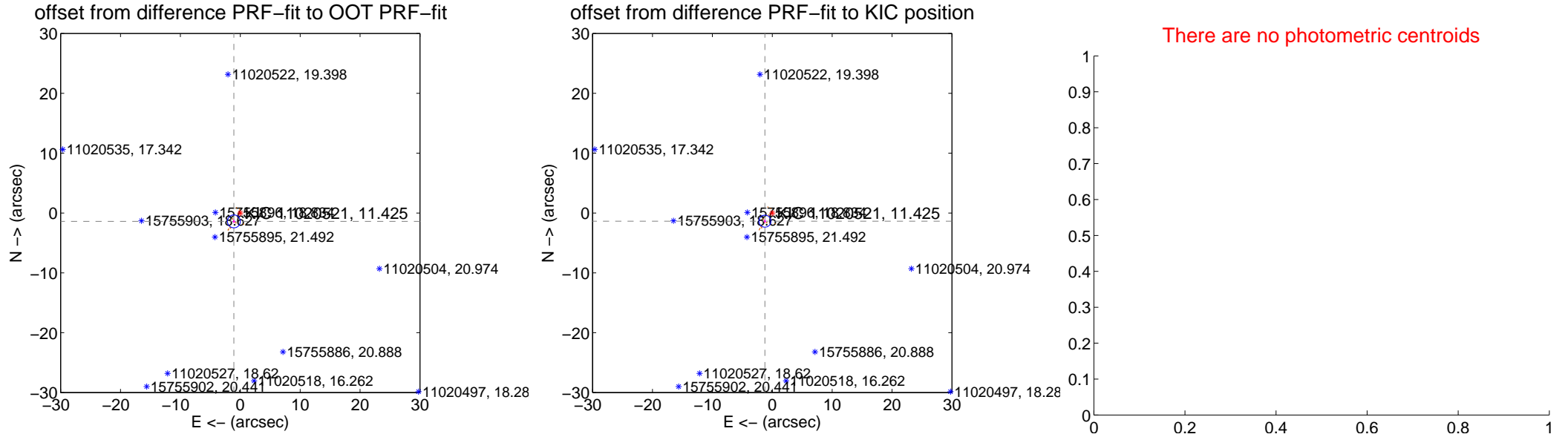
## DV Centroid Data

Supplemental centroid analysis for 011020521-02. **Kepler magnitude: 11.43.** Transit SNR 6.64

**There are 0 quarters with good PRF difference image offsets**

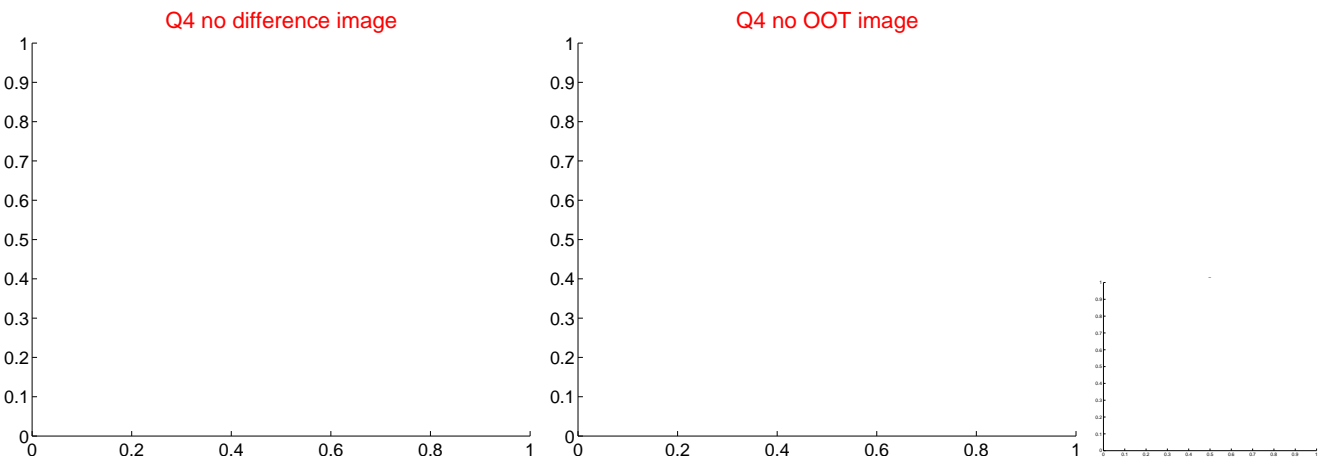
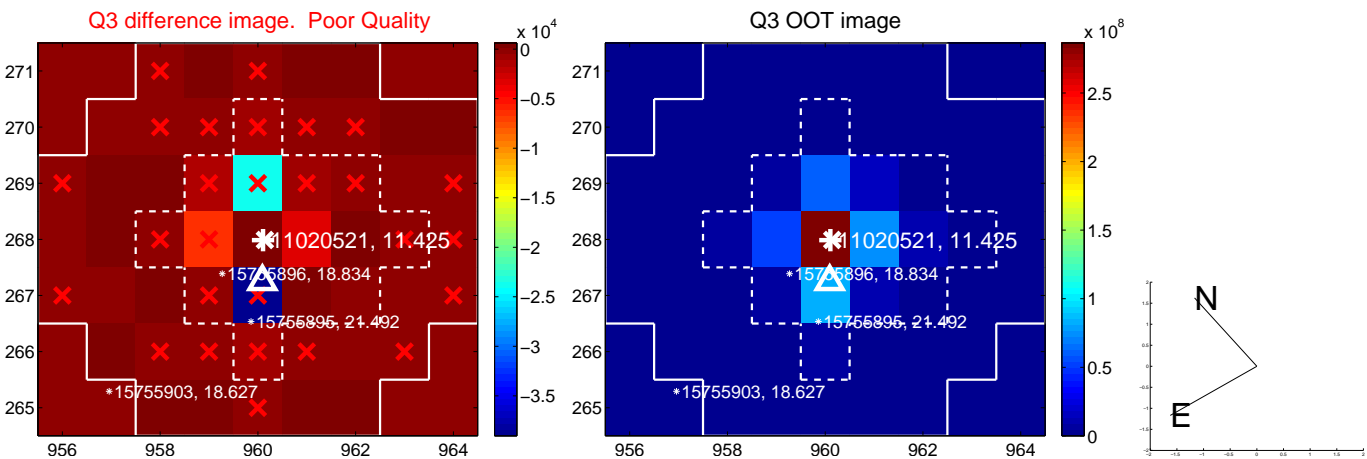
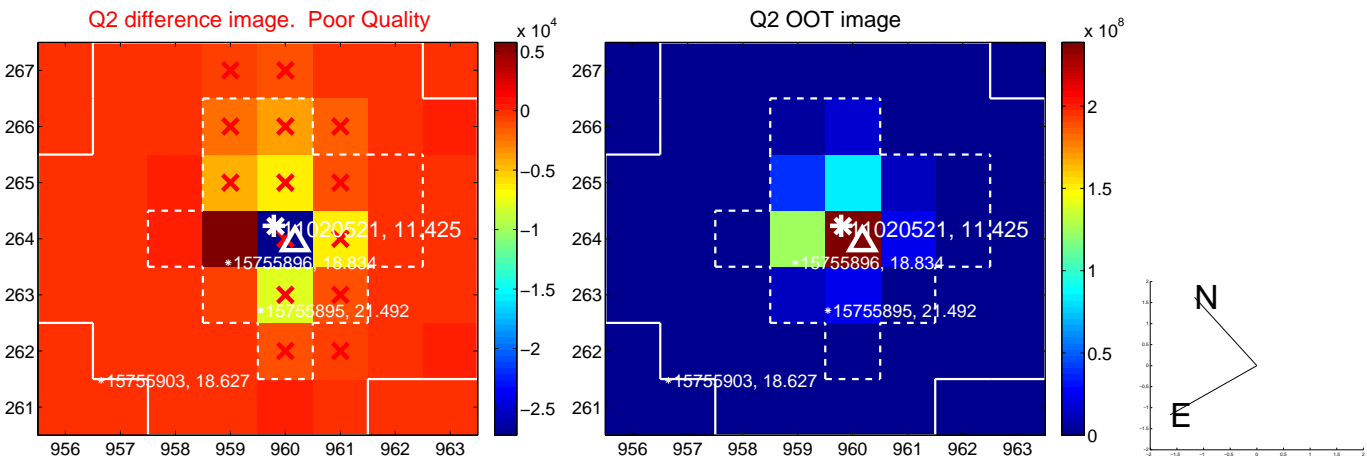
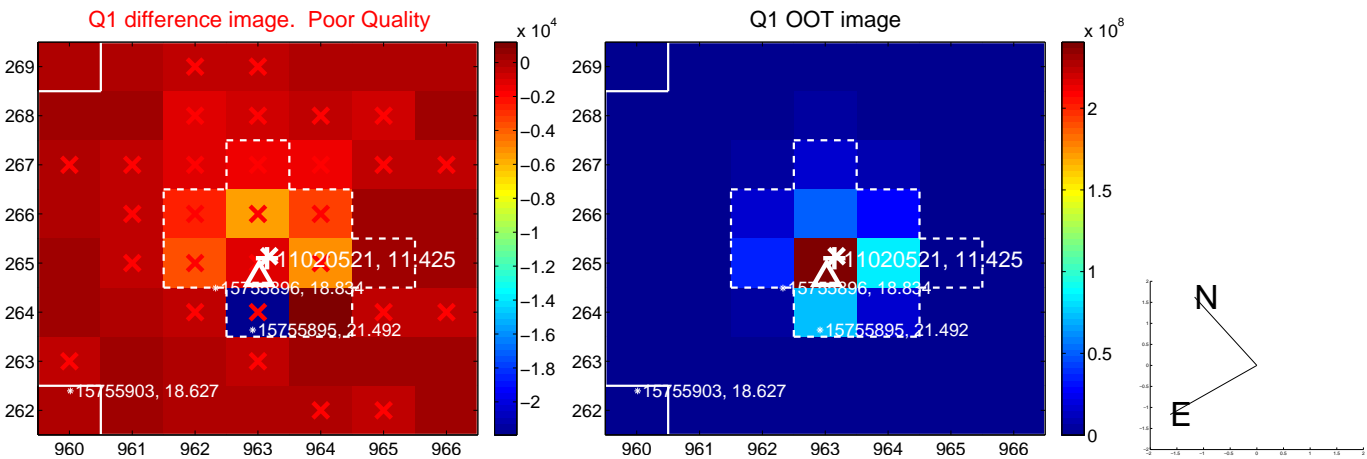
The direct PRF centroid is offset from the target star catalog position by about 0.19 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	<b>1.759 <math>\pm</math> 0.360</b>	<b>4.89</b>	1.066 $\pm$ 0.231	-1.399 $\pm$ 0.326
PRF-fit source offset from KIC position	<b>1.836 <math>\pm</math> 0.334</b>	<b>5.49</b>	1.226 $\pm$ 0.210	-1.367 $\pm$ 0.317
photometric centroid source offset	—	—	—	—

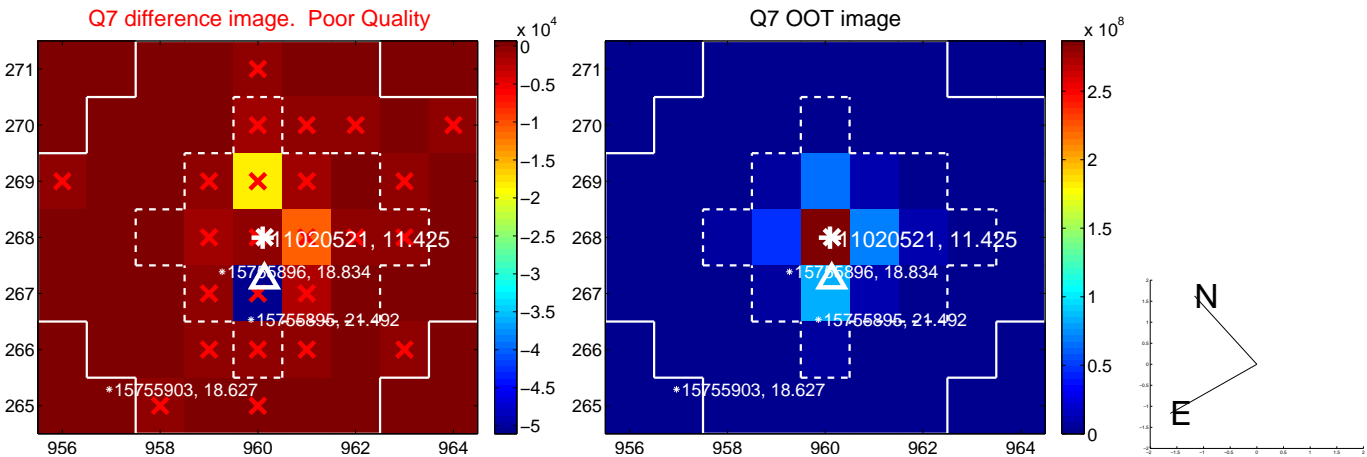
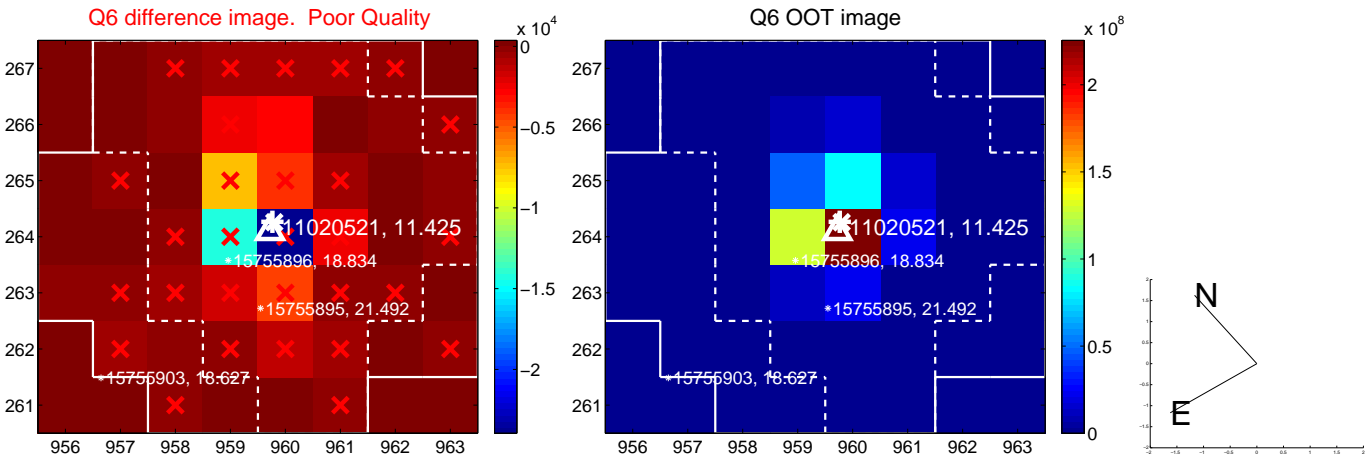
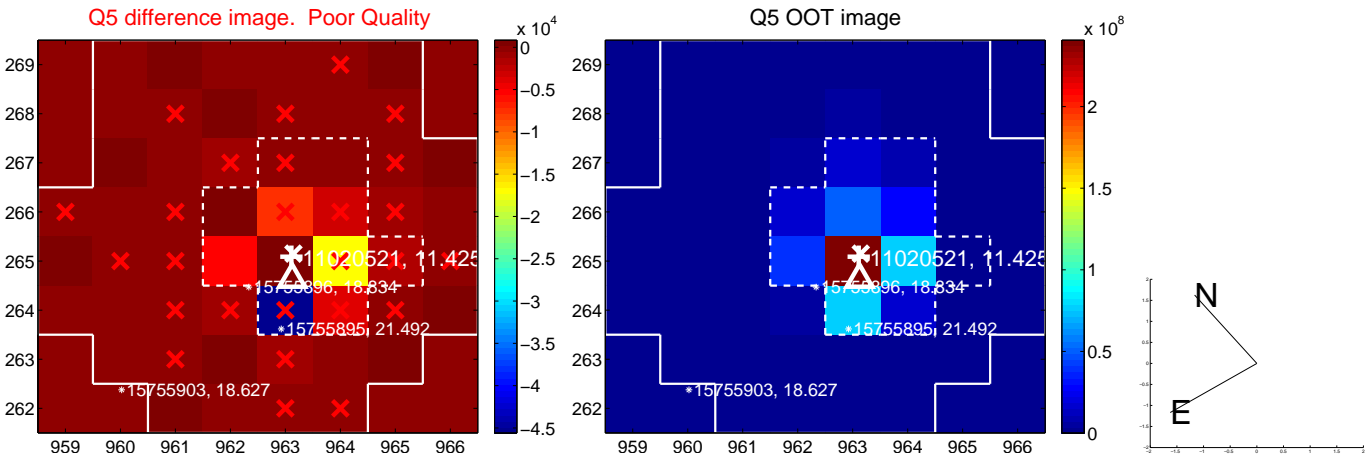


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

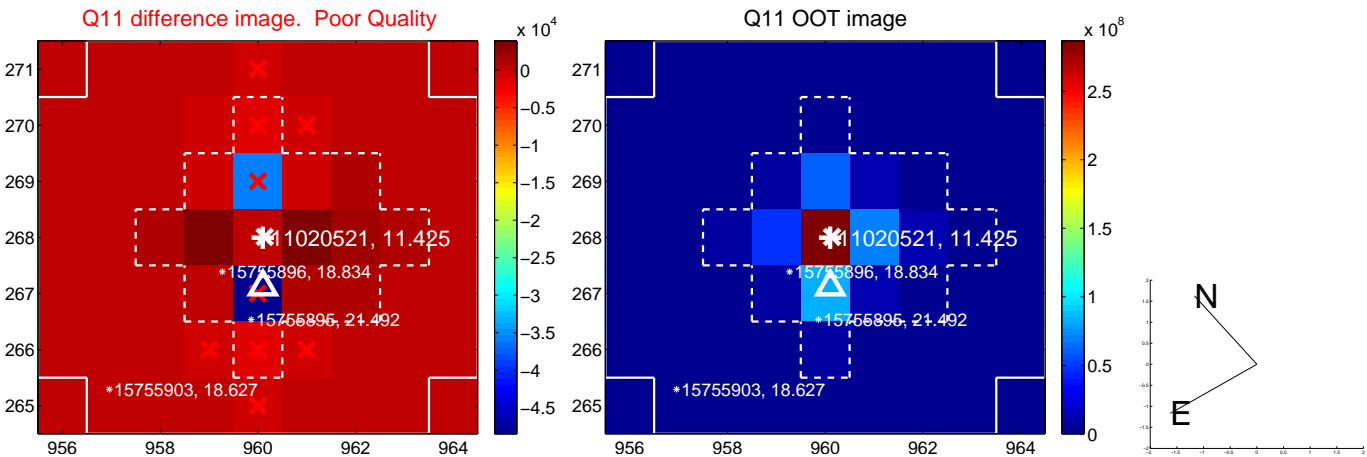
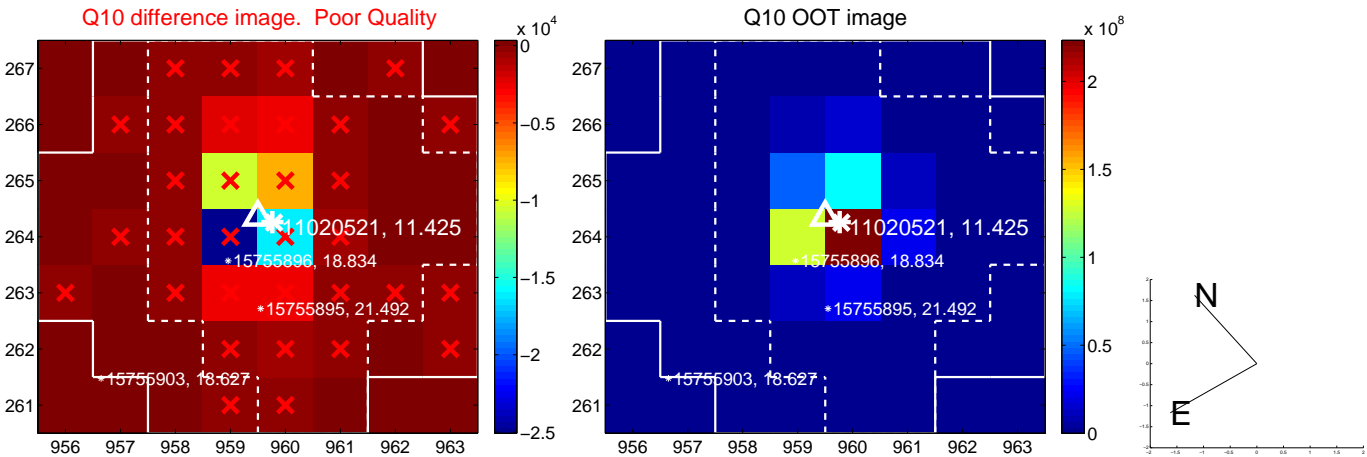
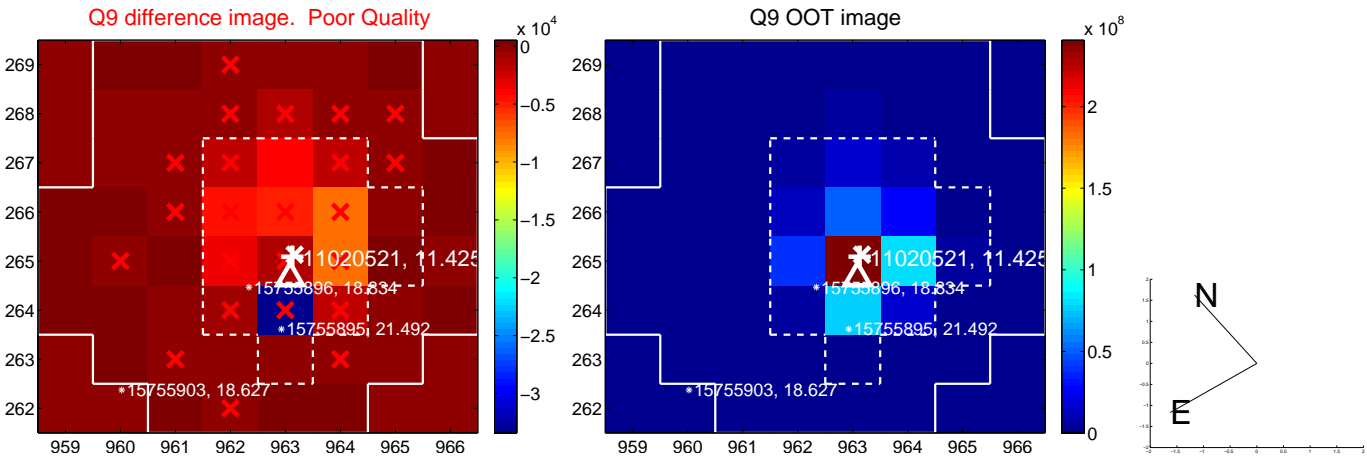
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



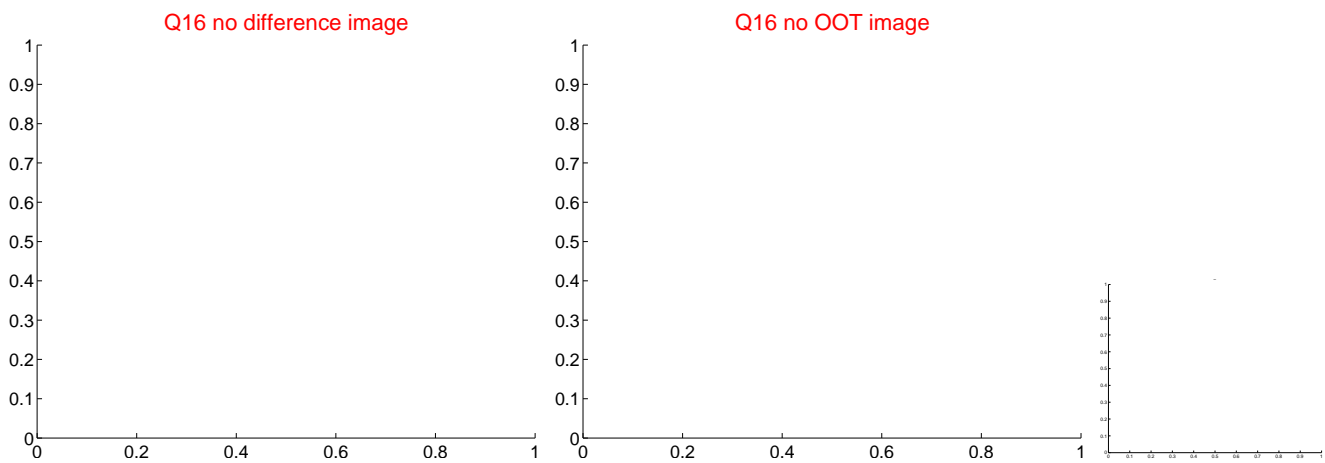
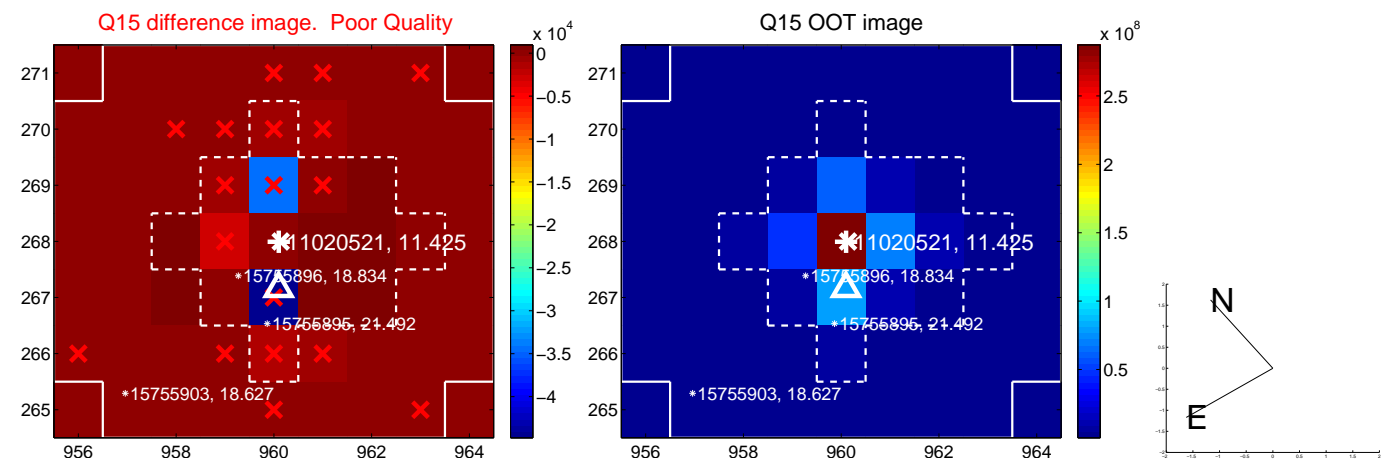
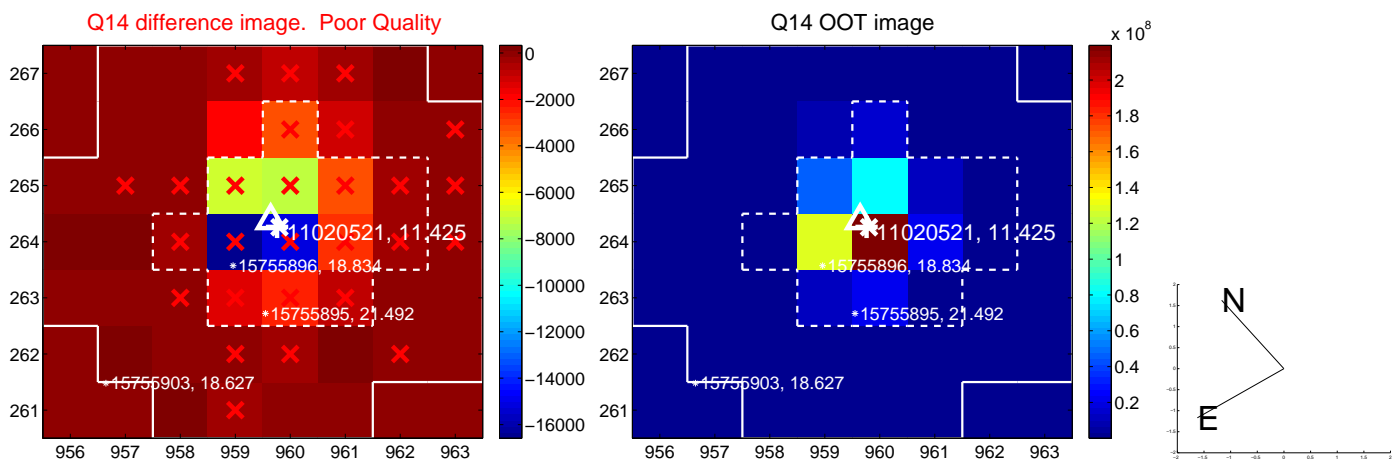
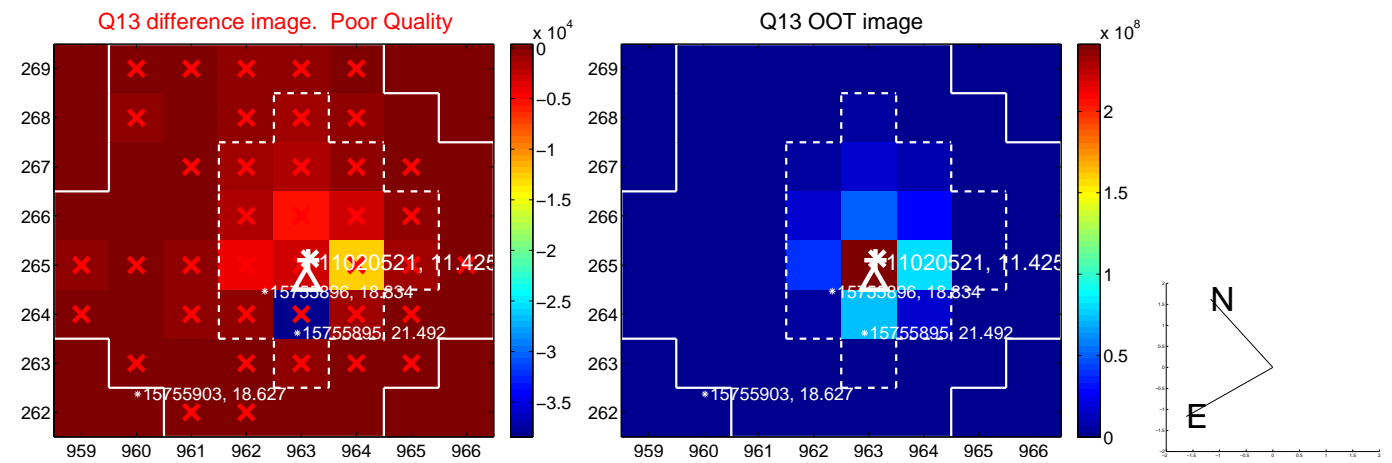
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



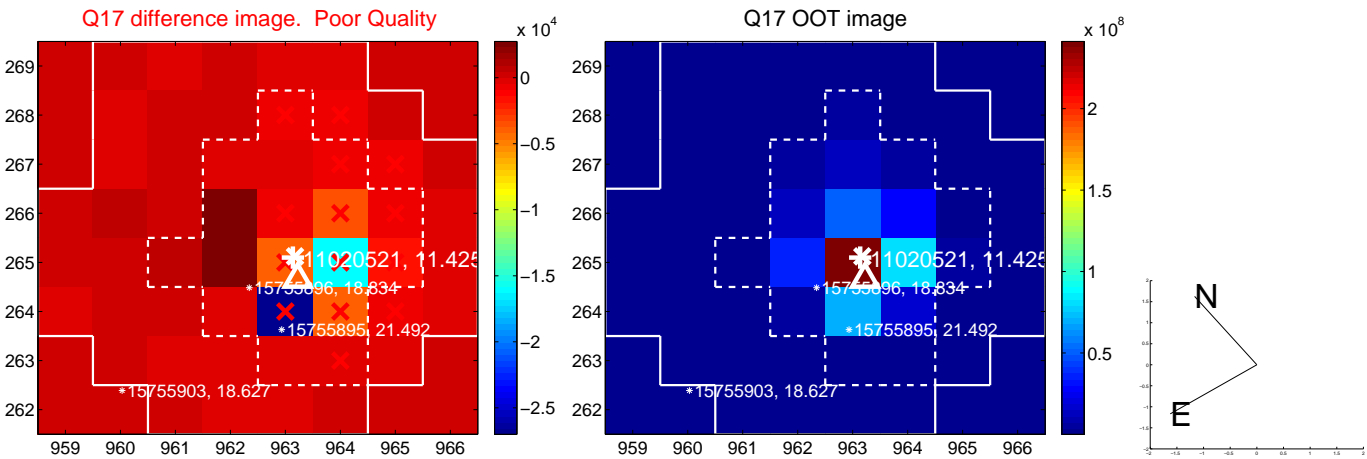
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



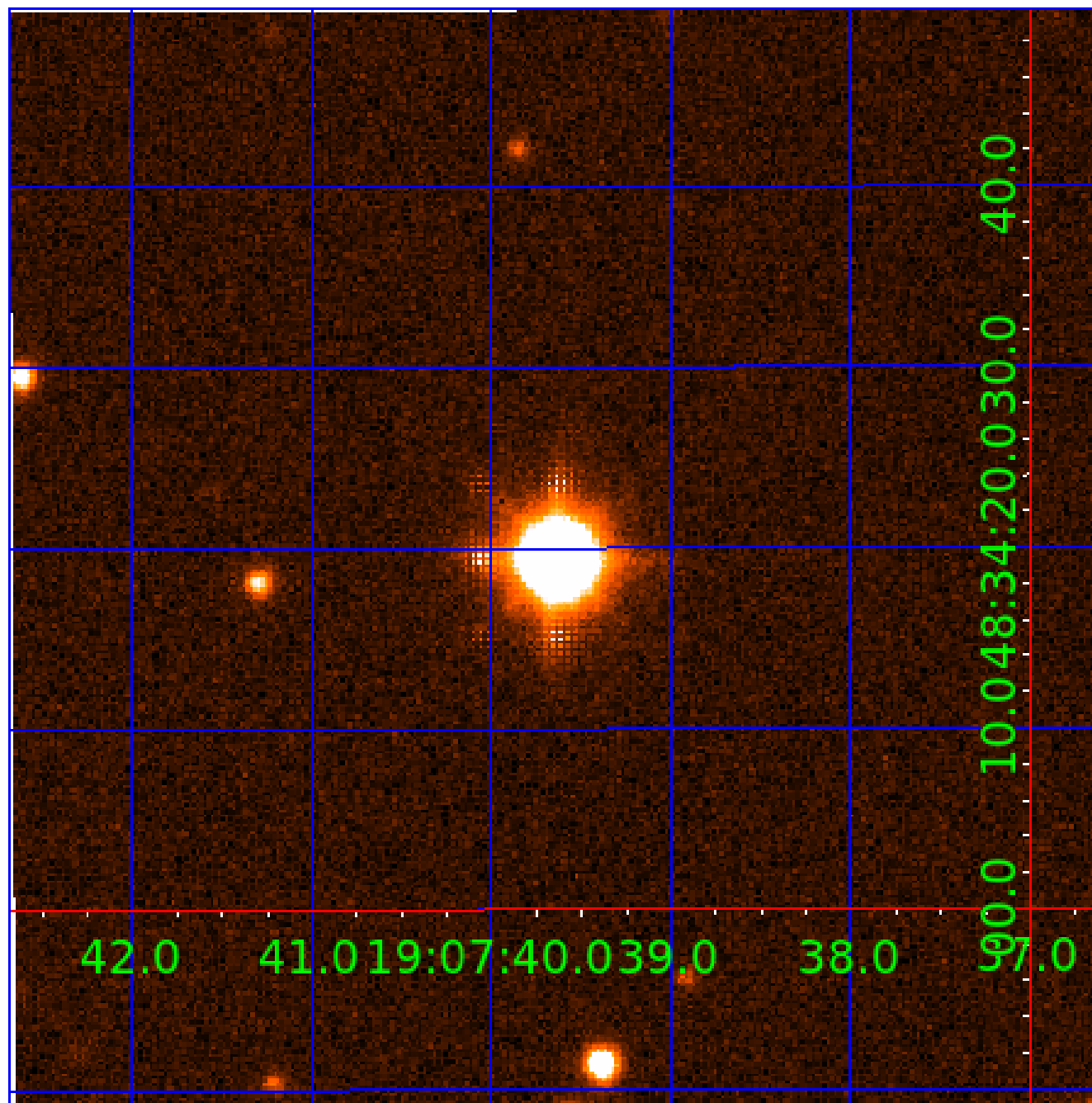
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



folded centroid time series figure for this object.

UKIRT Image

Declination





## KIC 011020521

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
011020521-01	OBS	No	2.929979	134.113706	0.1	0.514	8.2	0.0	3.22	6877	0.10	9371.70
011020521-02	OBS	No	2.930323	133.561397	22.1	5.264	8.1	6.6	3.22	6877	1.78	9370.24
011020521-03	OBS	No	2.930137	132.855754	16.9	12.993	9.2	7.9	3.22	6877	1.42	9371.03
011020521-04	OBS	No	11.171739	137.960832	85.1	3.597	8.7	9.1	3.22	6877	3.48	1573.30
011020521-05	OBS	No	293.095640	157.741380	193.4	6.042	8.2	8.1	3.22	6877	4.96	20.18
011020521-06	OBS	No	118.311612	211.553500	182.8	4.659	8.4	8.4	3.22	6877	5.08	67.65
011020521-07	OBS	No	131.858819	143.359611	66.9	9.614	8.3	5.6	3.22	6877	2.71	58.55
011020521-08	OBS	No	81.557176	178.687435	165.2	4.488	8.1	7.6	3.22	6877	4.58	111.09
011020521-09	OBS	No	36.435749	160.151233	162.1	3.382	8.0	9.4	3.22	6877	4.66	325.29
011020521-10	OBS	No	34.792680	149.579268	94.8	5.285	7.8	7.4	3.22	6877	3.67	345.93

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
011020521-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-04	OBS	FP	0.00	1	0	1	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
011020521-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-07	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-09	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_ALT—CENT_SATURATED
011020521-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

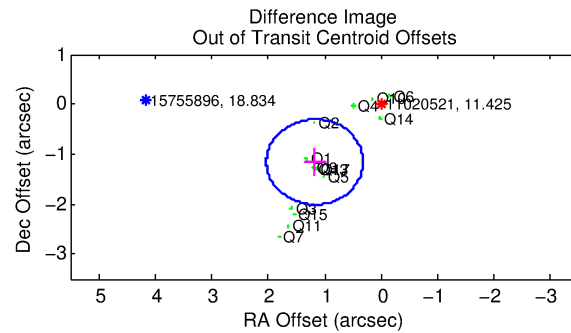
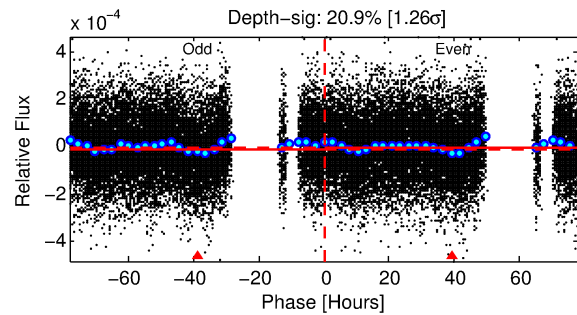
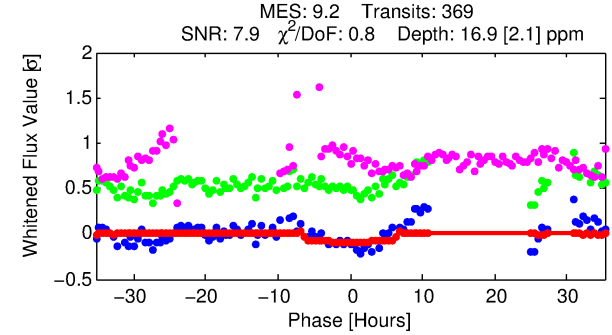
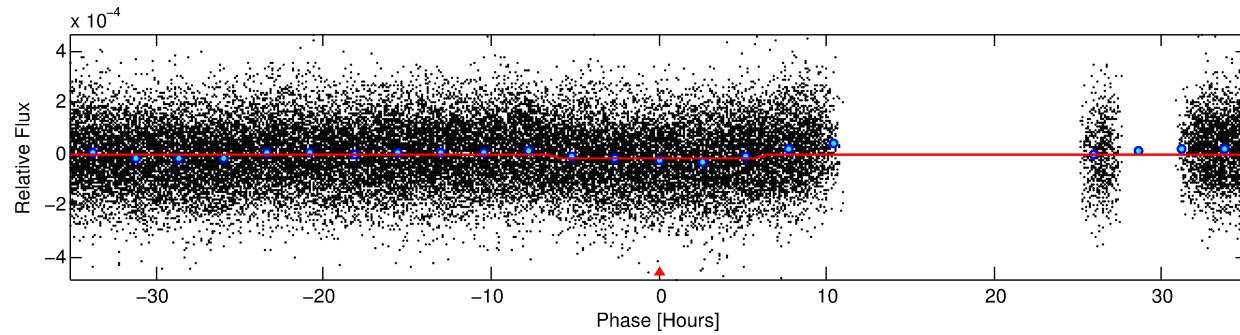
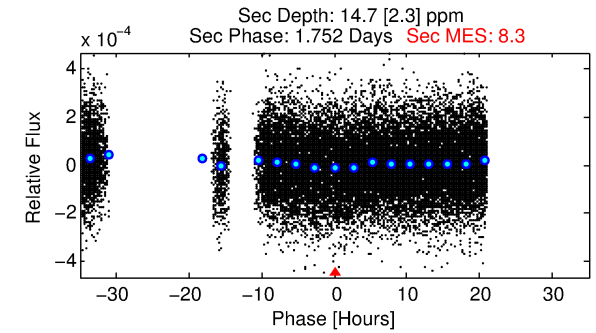
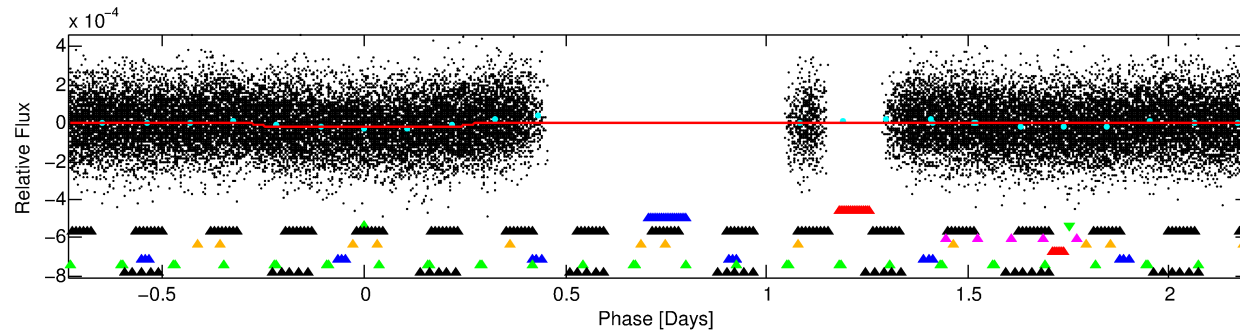
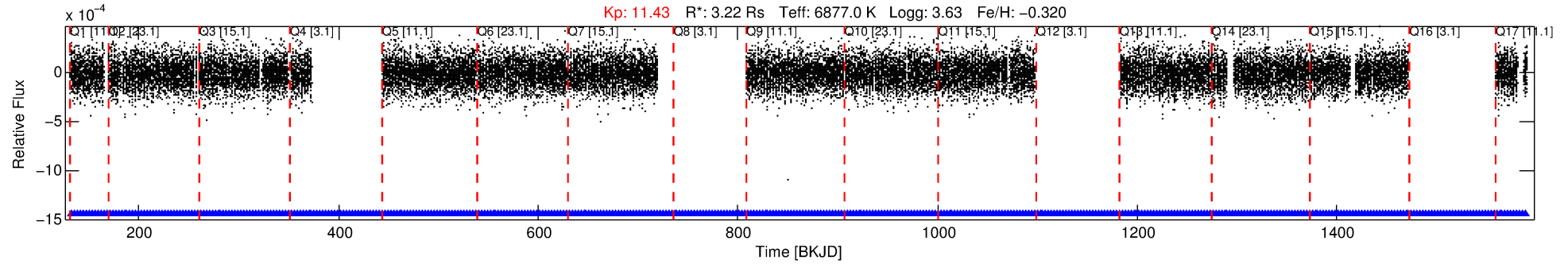
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 011020521-03

No Significant Match Found

# DV One-Page Summary

KIC: 11020521 Candidate: 3 of 10 Period: 2.930 d



## DV Fit Results:

Period = 2.93014 [0.00005] d  
Epoch = 132.8558 [0.0091] BKJD  
Rp/R\* = 0.0040 [0.0011]  
a/R\* = 1.47 [1.24]  
b = 0.72 [1.07]  
Seff = 9371.03 [5093.01]  
Teq = 2509 [341] K  
Rp = 1.42 [0.66] Re  
a = 0.0471 [0.0162] AU  
Ag = 8.85 [6.86] [1.15σ]  
Teffp = 6691 [965] K [4.09σ]

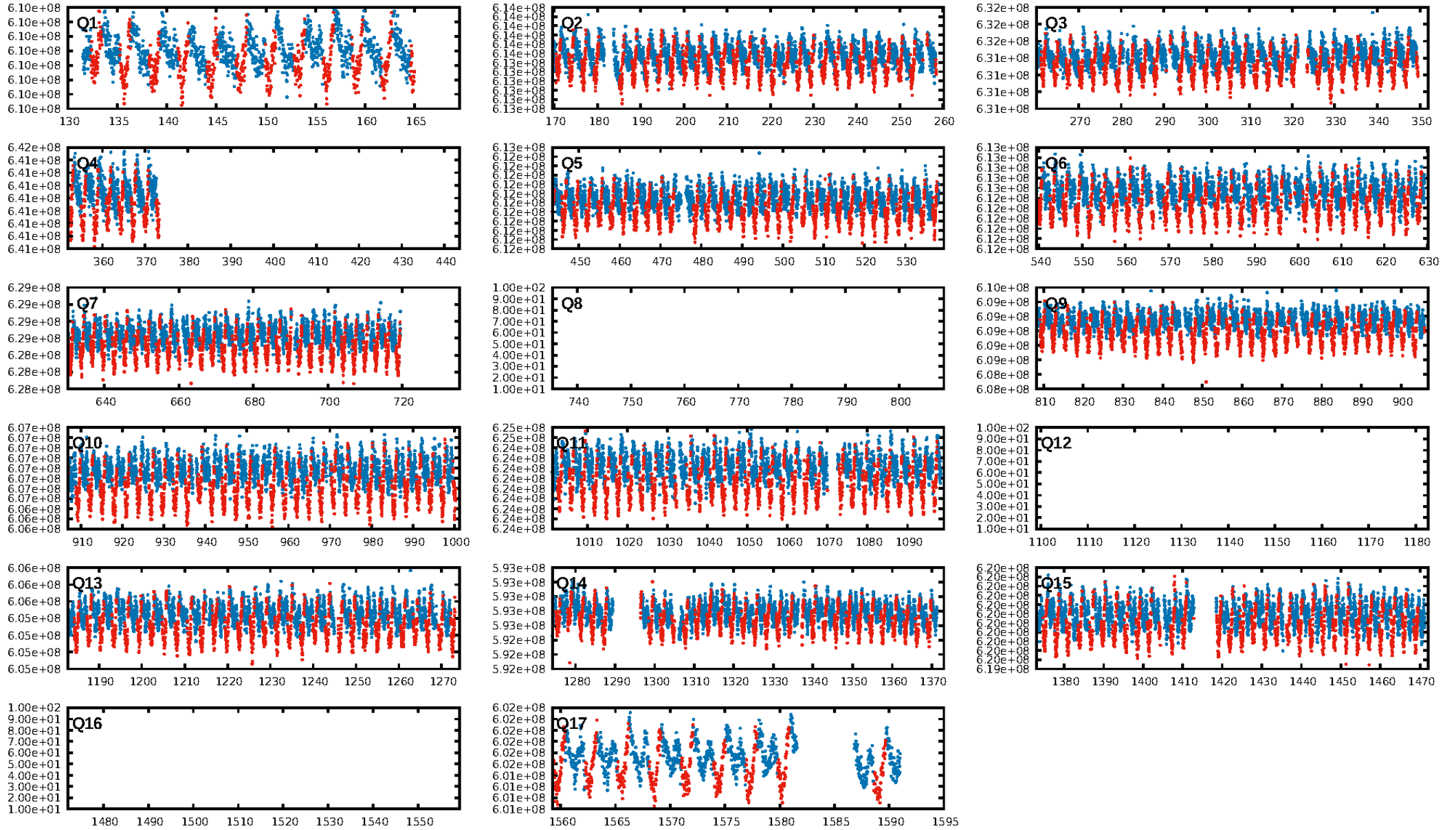
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [340/340]  
GhostDiagnostic-chr: 0.5294  
Centroid-sig: N/A  
Centroid-so: N/A  
OotOffset-rm: 1.648 arcsec [5.79σ]  
KicOffset-rm: 1.870 arcsec [6.22σ]  
OotOffset-st: 4/4/1/5 [14]  
KicOffset-st: 4/4/1/5 [14]  
DiffImageQuality-fgm: 1.00 [14/14]  
DiffImageOverlap-fno: 0.00 [0/14]

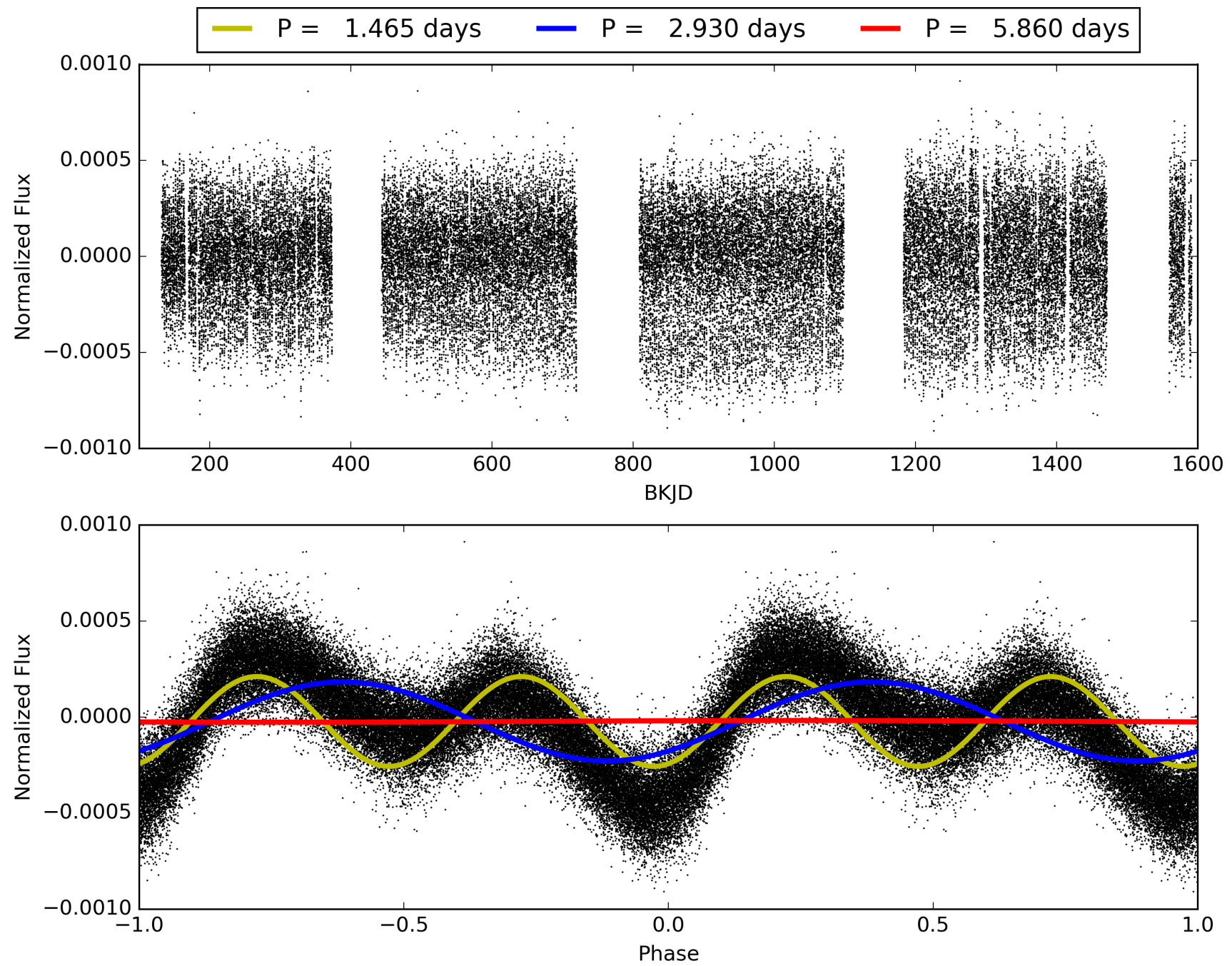
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 05:44:52 Z

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

# TCE 011020521-03, PDC Light Curves

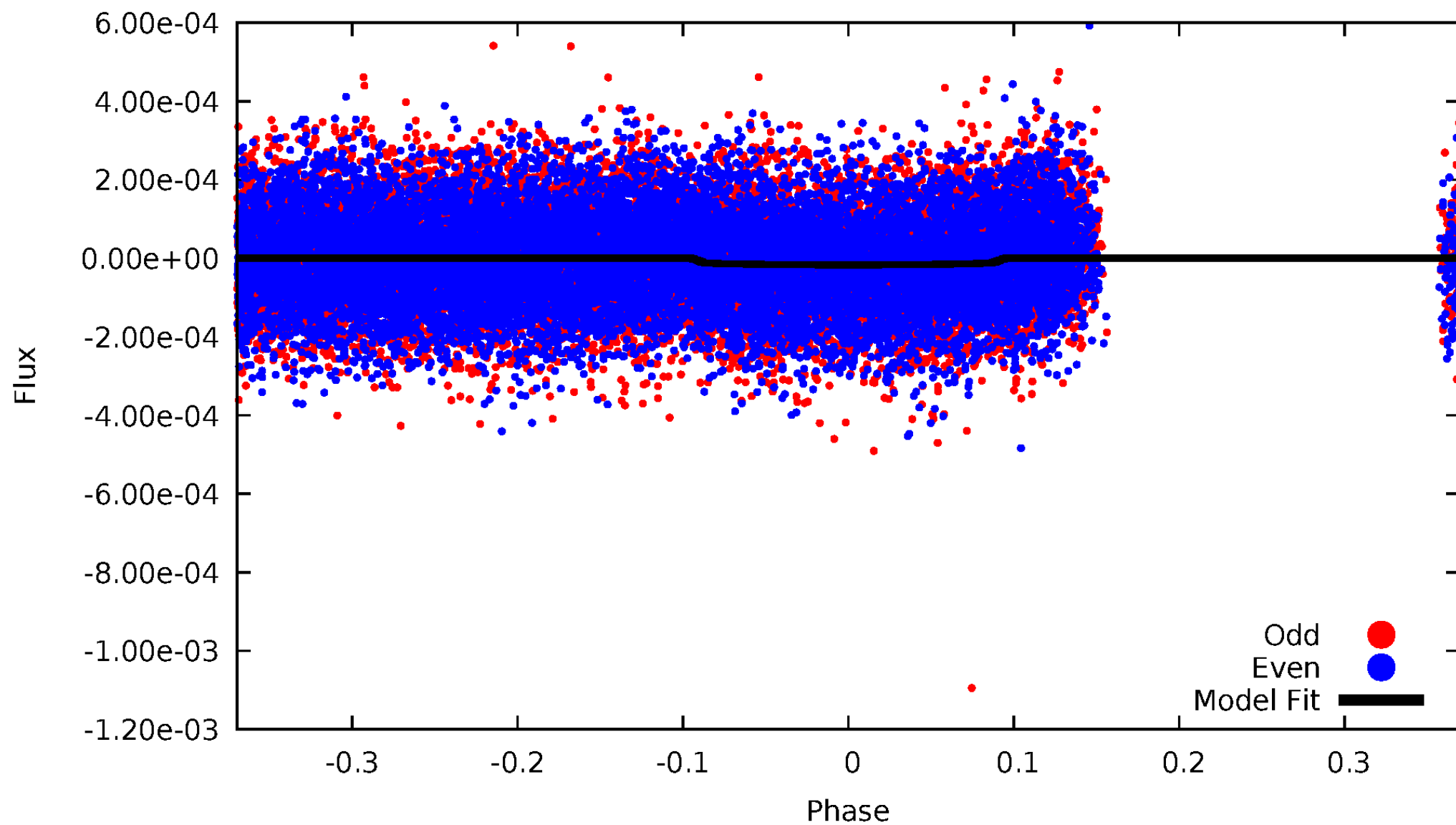


TCE 011020521-03



# DV Odd/Even

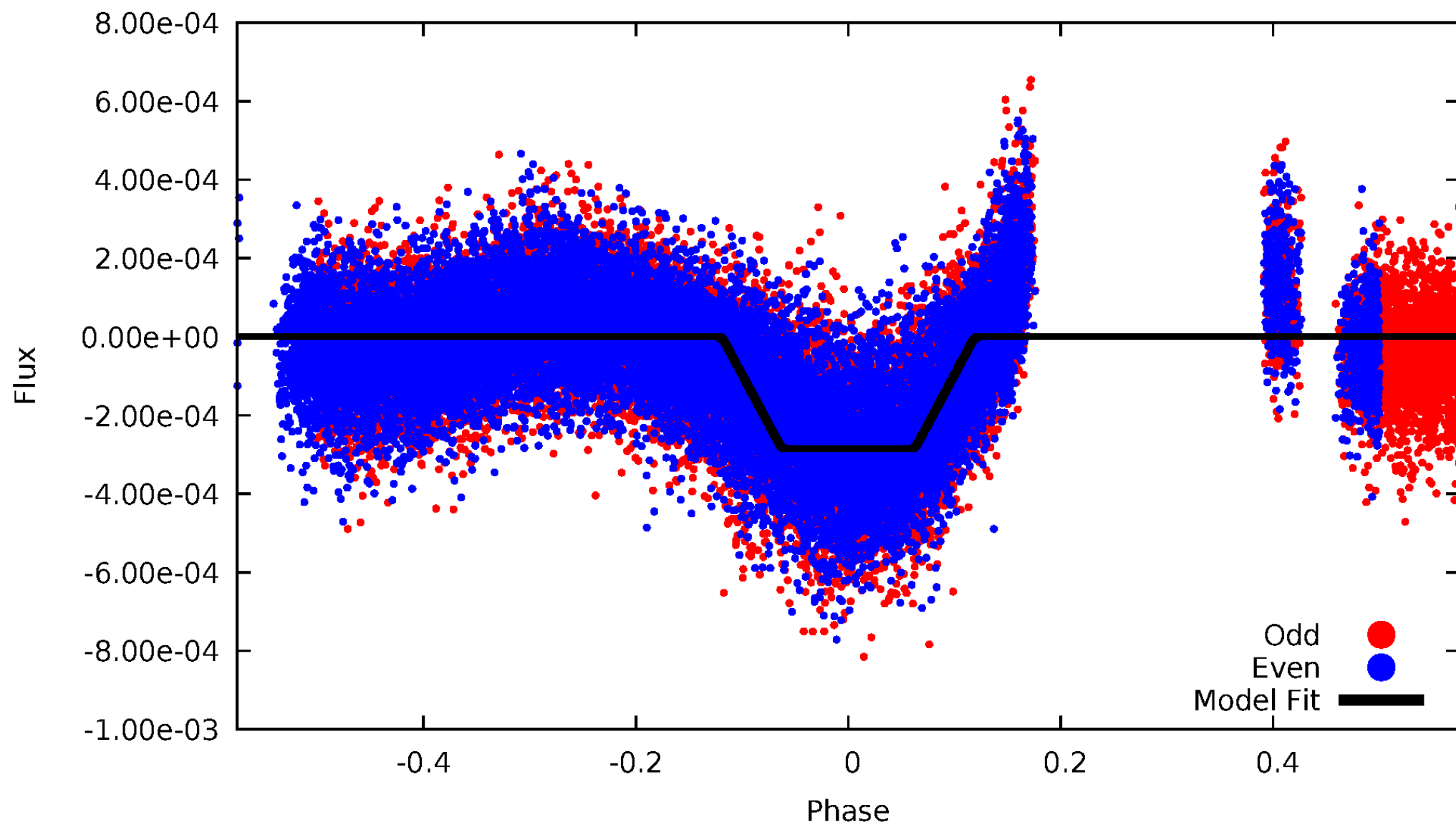
TCE 011020521-03





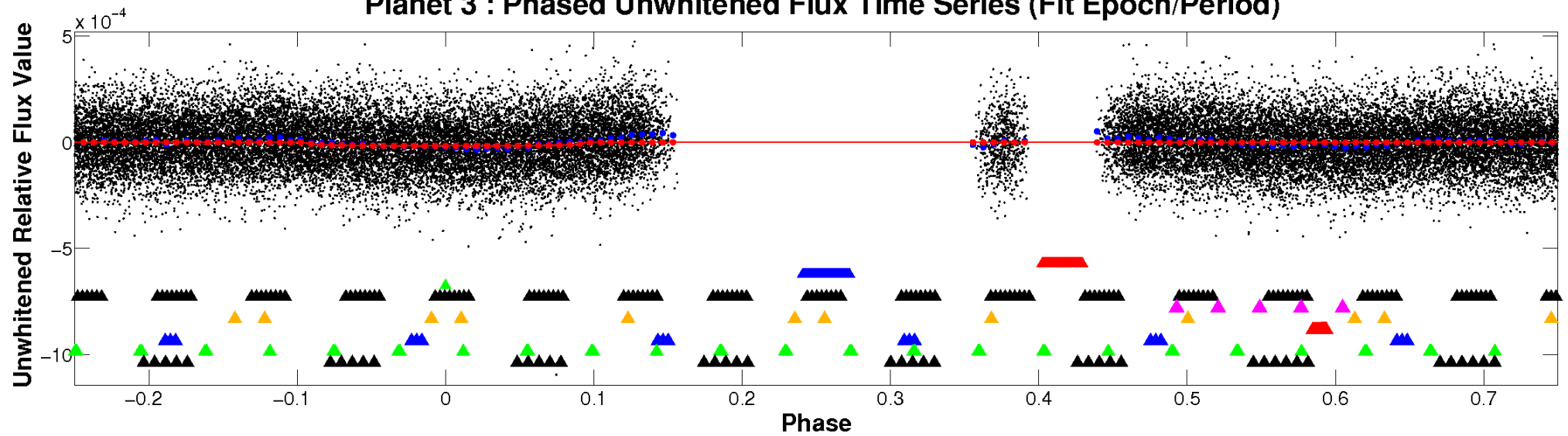
# ALT Odd/Even

TCE 011020521-03

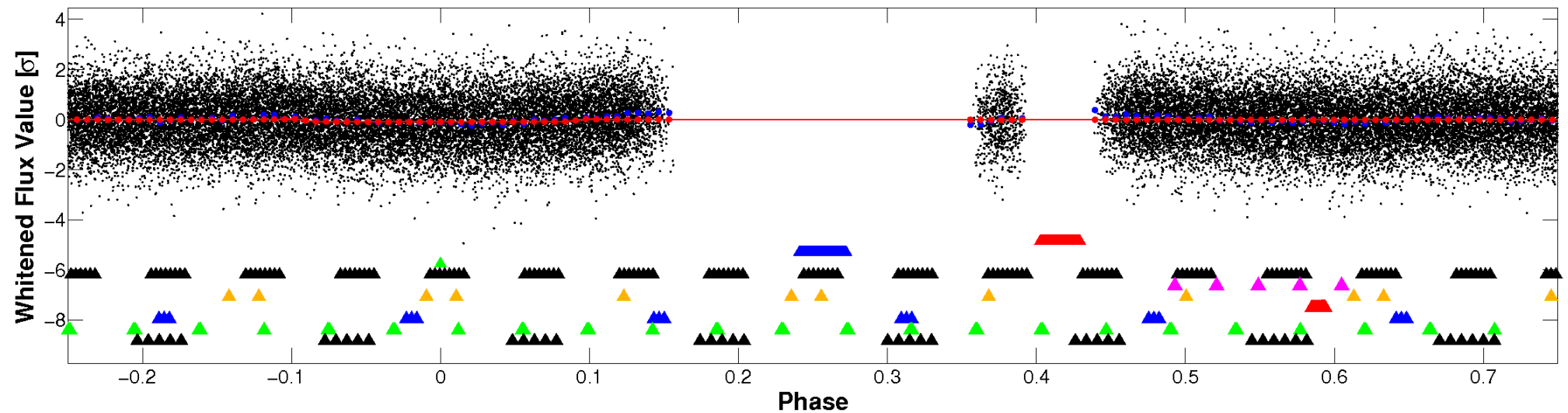


# Non-Whitened Vs. Whitened Light Curve

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



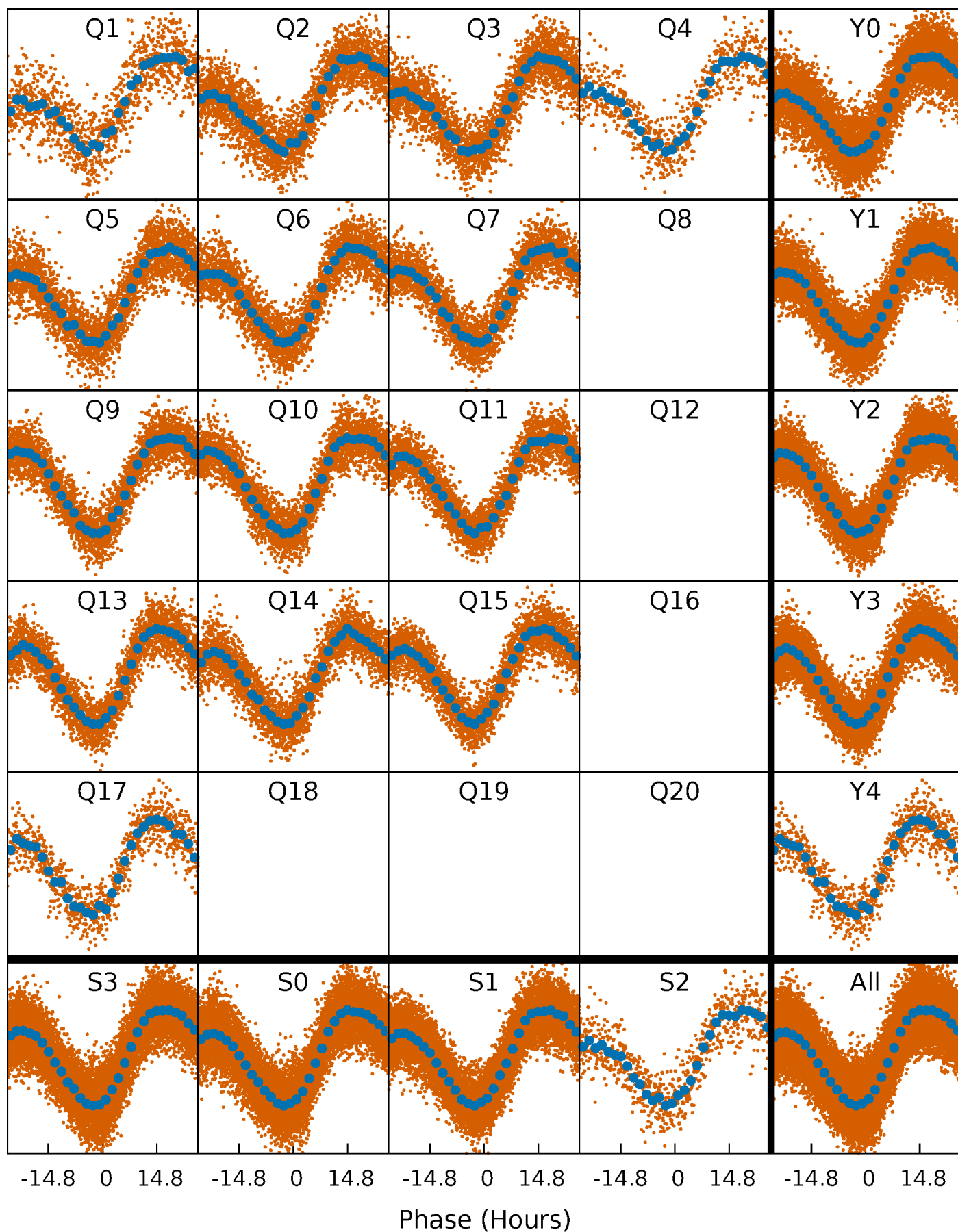
## Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)





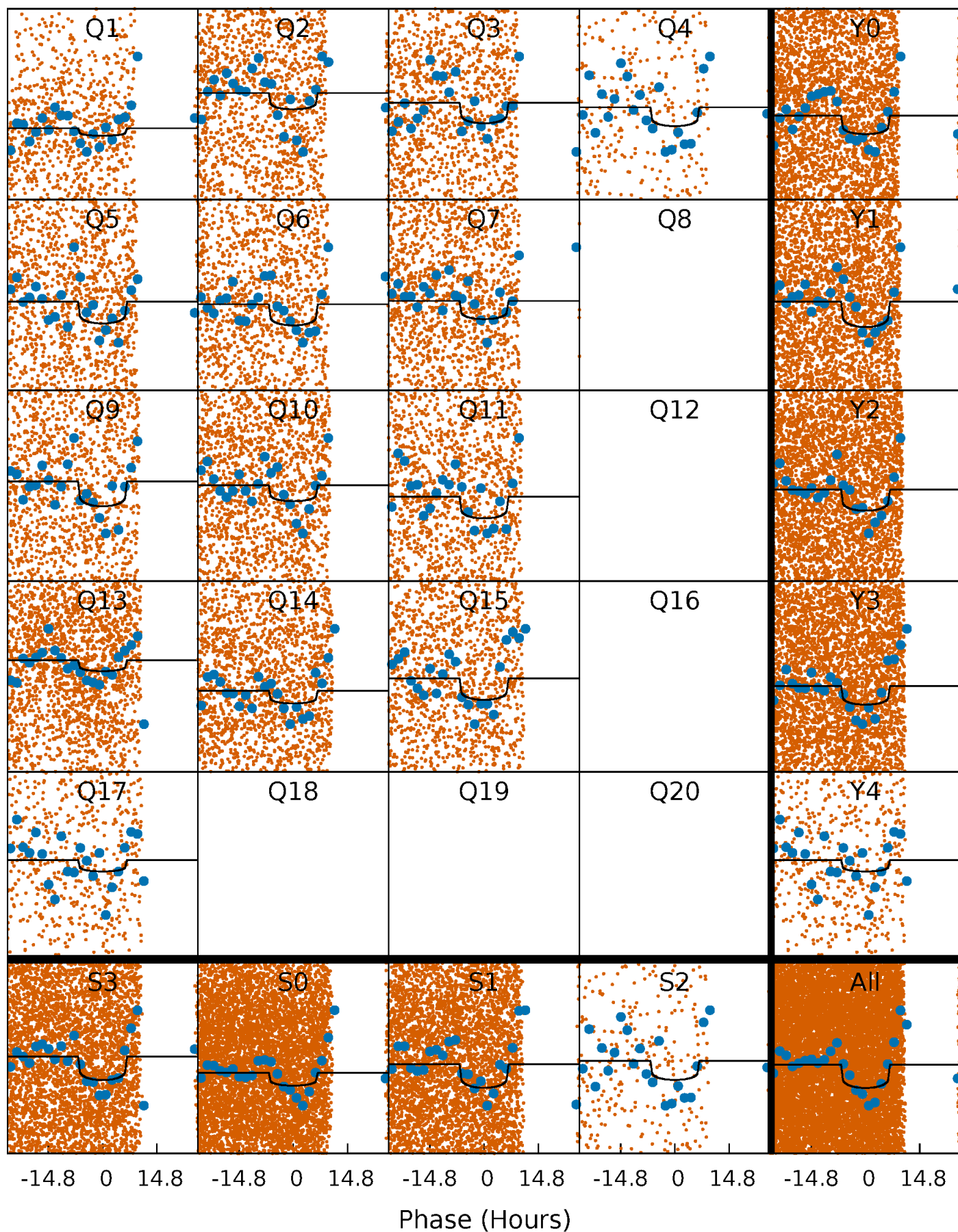
# PDC Quarter-Phased Transit Curves

TCE 011020521-03 P= 2.930137 Days  $T_0=132.855754$  (BKJD)



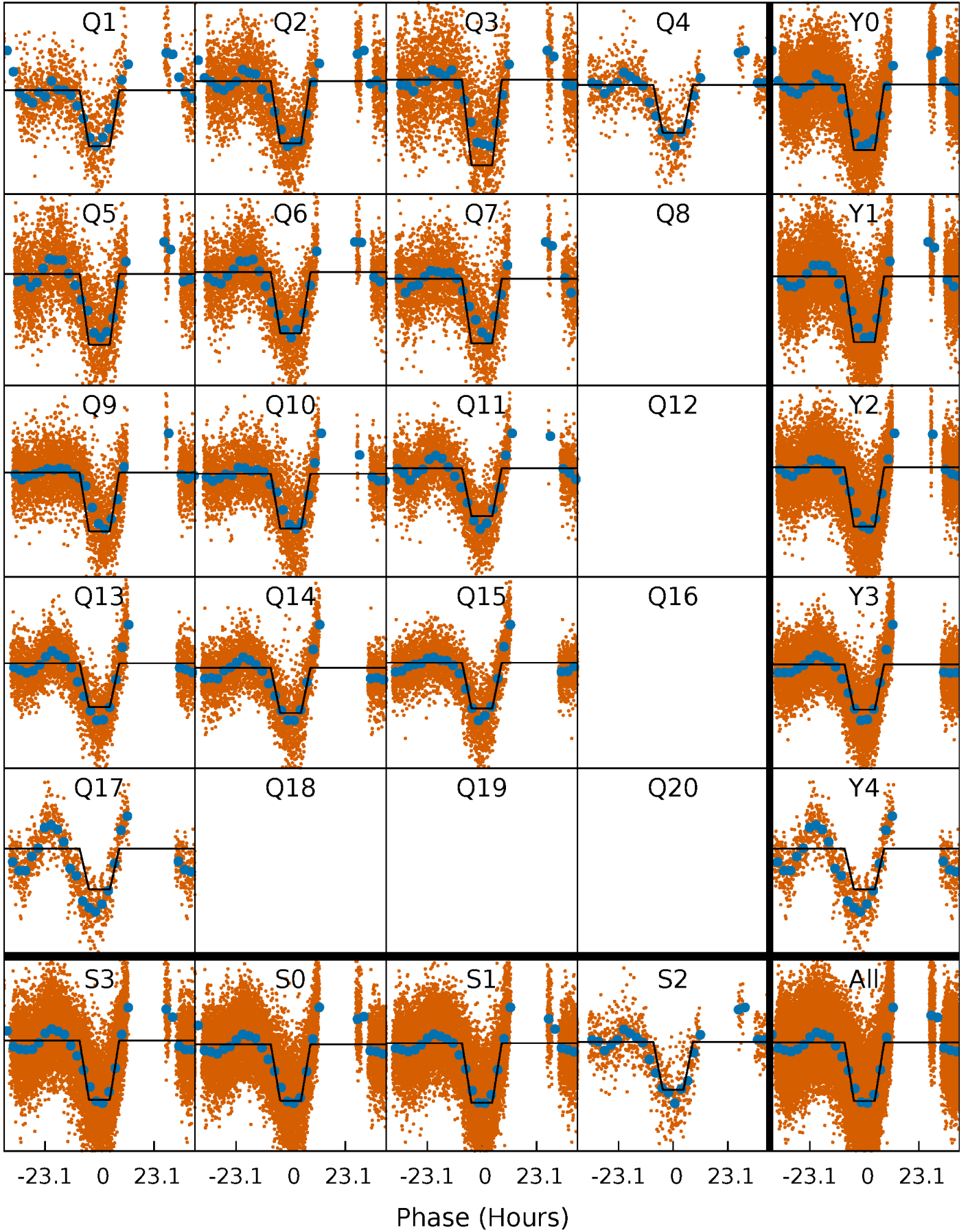
# DV Quarter-Phased Transit Curves

TCE 011020521-03 P= 2.930137 Days  $T_0=132.855754$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

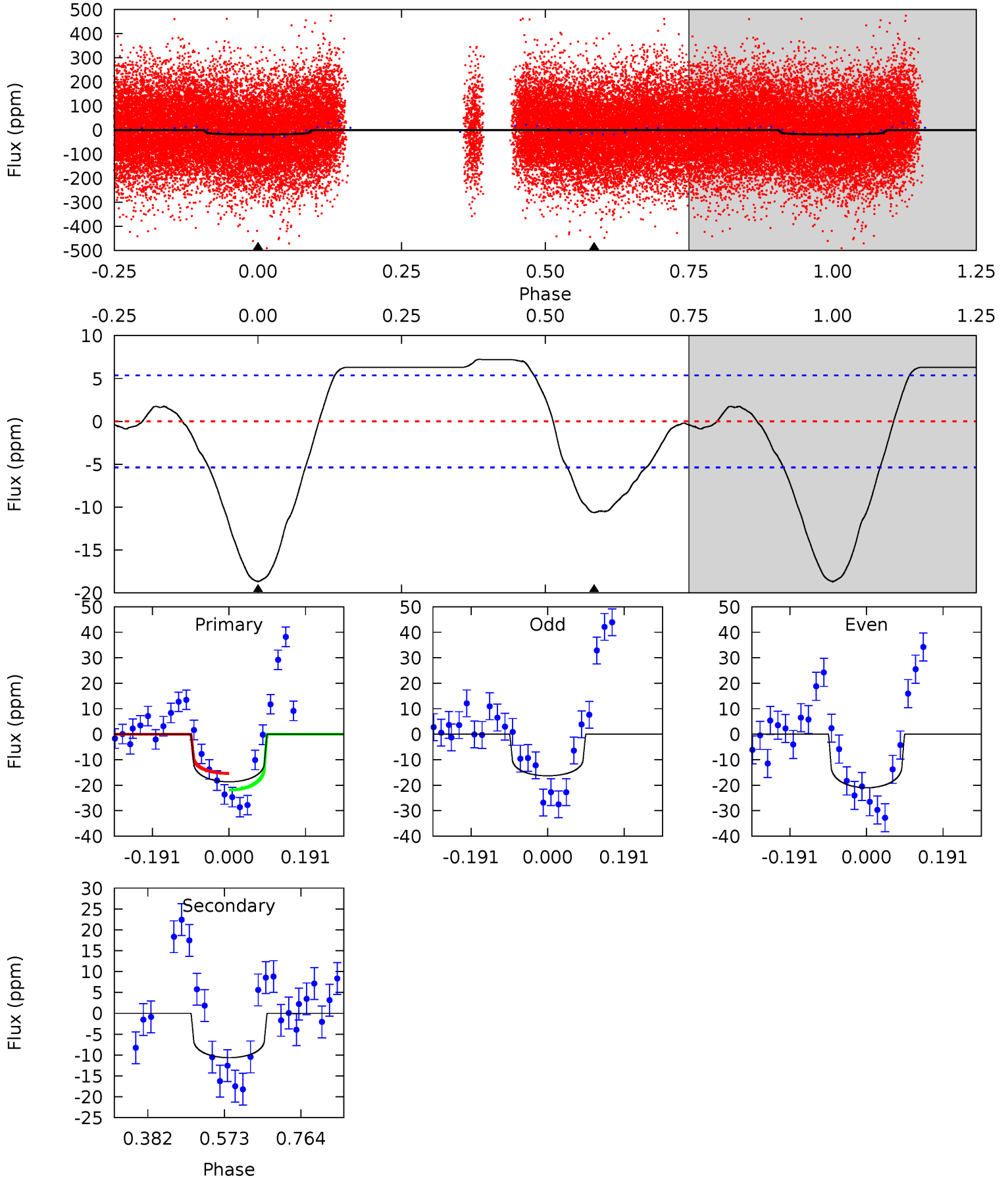
TCE 011020521-03 P= 2.930221 Days  $T_0=132.756518$  (BKJD)



# DV Model-Shift Uniqueness Test

011020521-03, P = 2.930137 Days, E = 129.925617 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	8.77	0	0	4.43	1.31	2.28	15.4	15.4	8.77	8.77	1.94	0.98	0.28	2.69

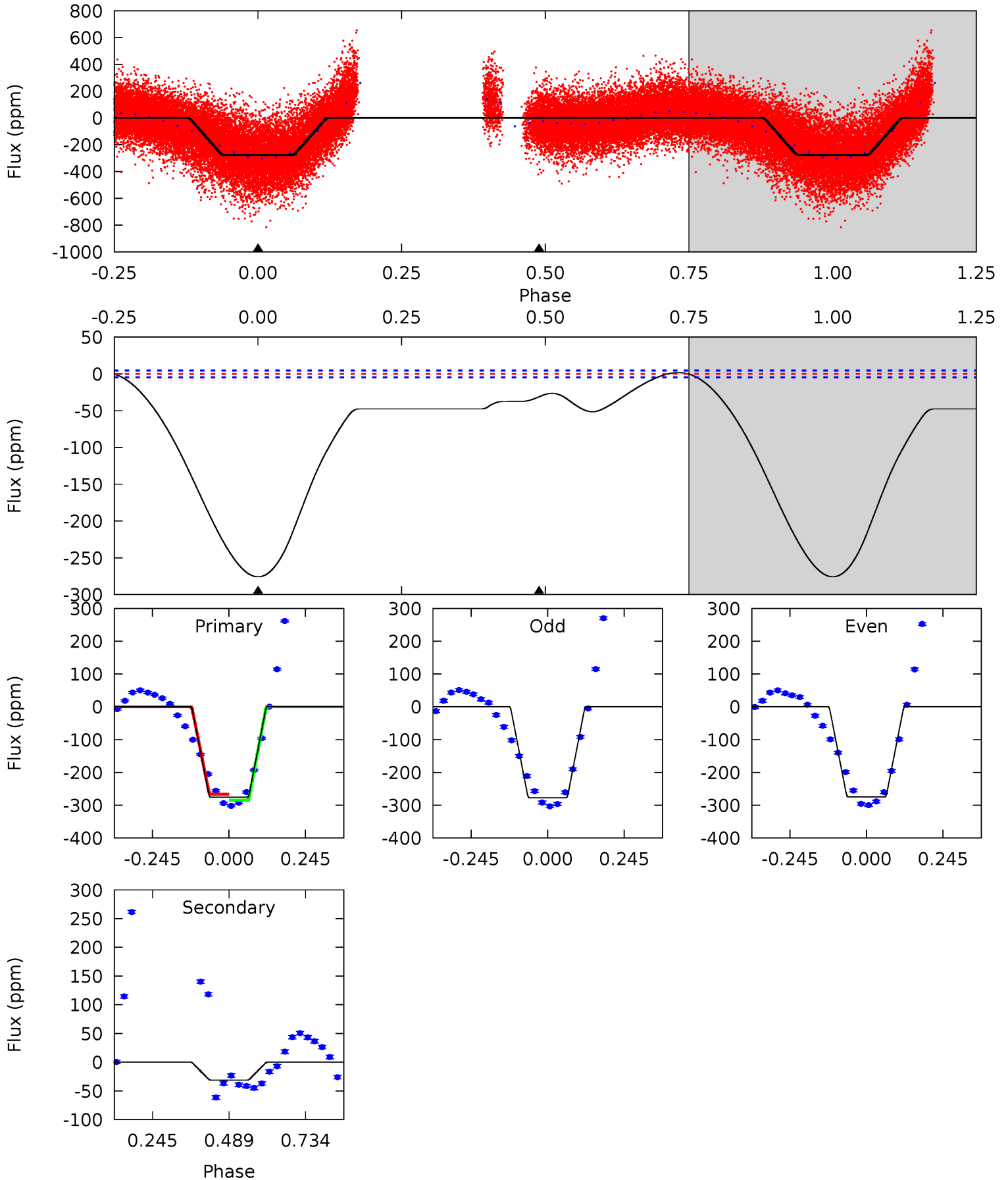




# Alt Model-Shift Uniqueness Test

011020521-03, P = 2.930221 Days, E = 129.826297 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
263.9	29.8	0	0	4.37	1.16	3.97	263.9	263.9	29.8	29.8	1.41	0.99	0.01	6.02



### Stellar Parameters For KIC 011020521

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6877^{+170}_{-204}$	$3.632^{+0.304}_{-0.076}$	$-0.320^{+0.300}_{-0.250}$	$3.219^{+0.406}_{-1.217}$	$1.619^{+0.227}_{-0.312}$	$0.068^{+0.149}_{-0.017}$
	+2%/-3%	+8%/-2%	+94%/-78%	+13%/-38%	+14%/-19%	+218%/-25%
Source	PHO1	FLK73	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 011020521-03 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-11 \pm 1$	$1.32^{+0.44}_{-0.40}$	$3426^{+195}_{-279}$	$6072^{+1227}_{-720}$	$7.218^{+7.869}_{-3.049}$
Alt.	$-31 \pm 1$	$5.71^{+0.76}_{-1.07}$	$3438^{+191}_{-295}$	$3990^{+171}_{-158}$	$1.179^{+0.533}_{-0.246}$

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

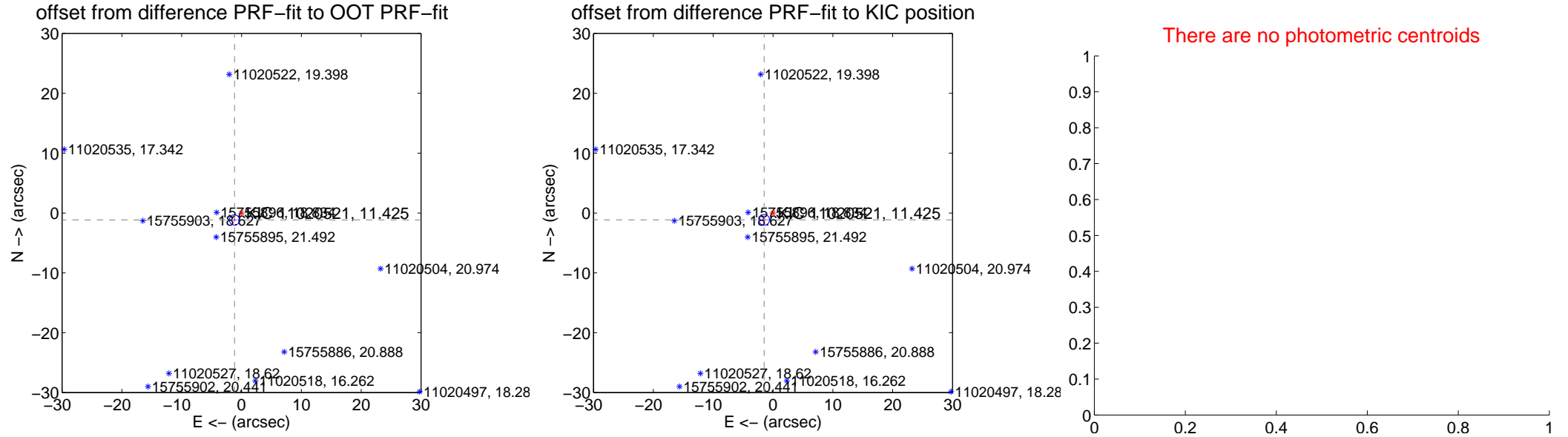
## DV Centroid Data

Supplemental centroid analysis for 011020521-03. **Kepler magnitude: 11.43.** Transit SNR 7.87

There are 14 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.19 arcsec

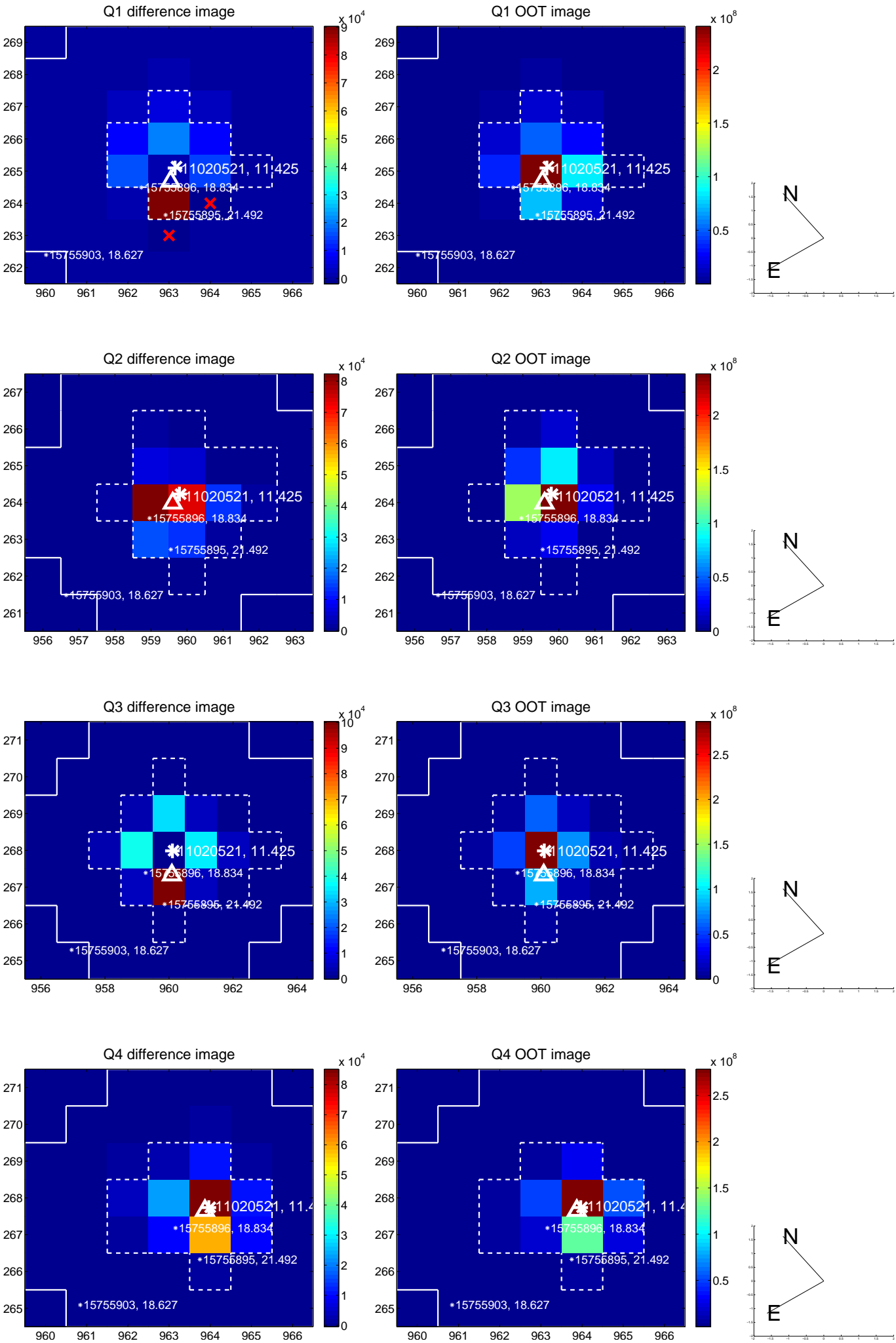
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	<b>1.648 <math>\pm</math> 0.285</b>	<b>5.79</b>	1.175 $\pm$ 0.177	-1.155 $\pm$ 0.247
PRF-fit source offset from KIC position	<b>1.870 <math>\pm</math> 0.301</b>	<b>6.22</b>	1.485 $\pm$ 0.189	-1.137 $\pm$ 0.270
photometric centroid source offset	—	—	—	—



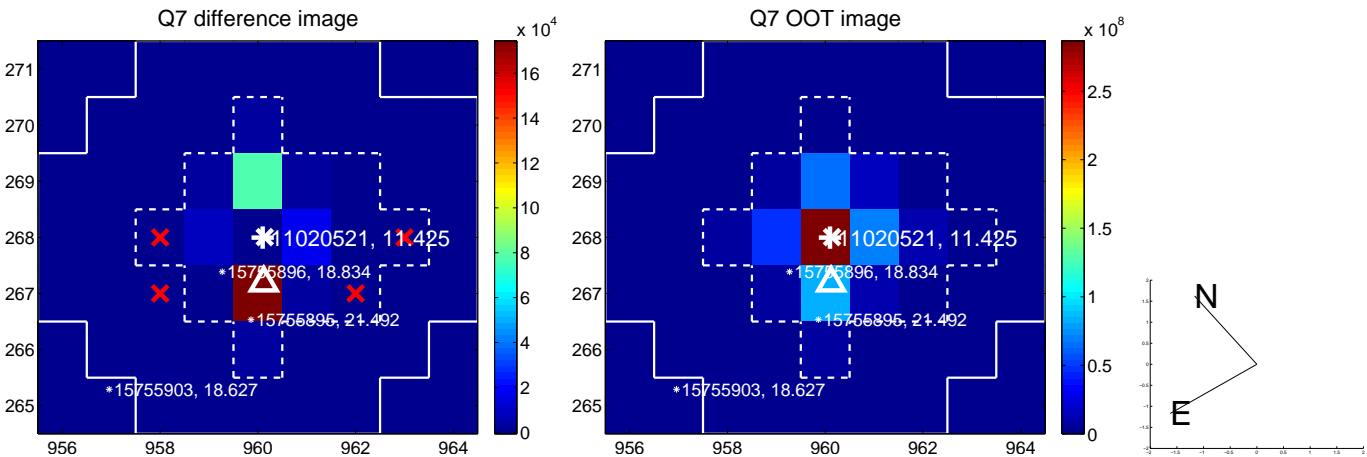
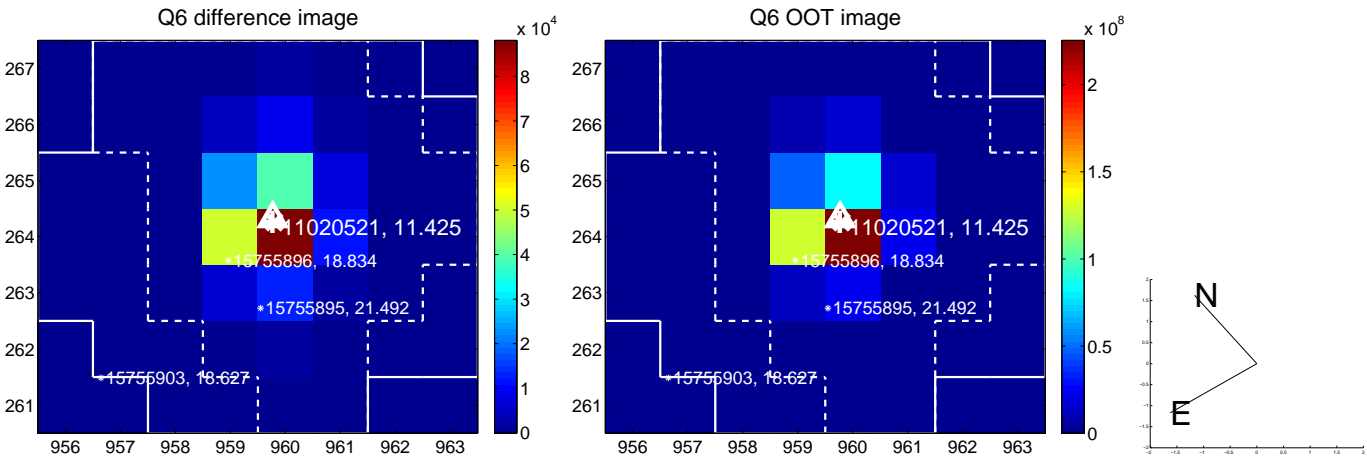
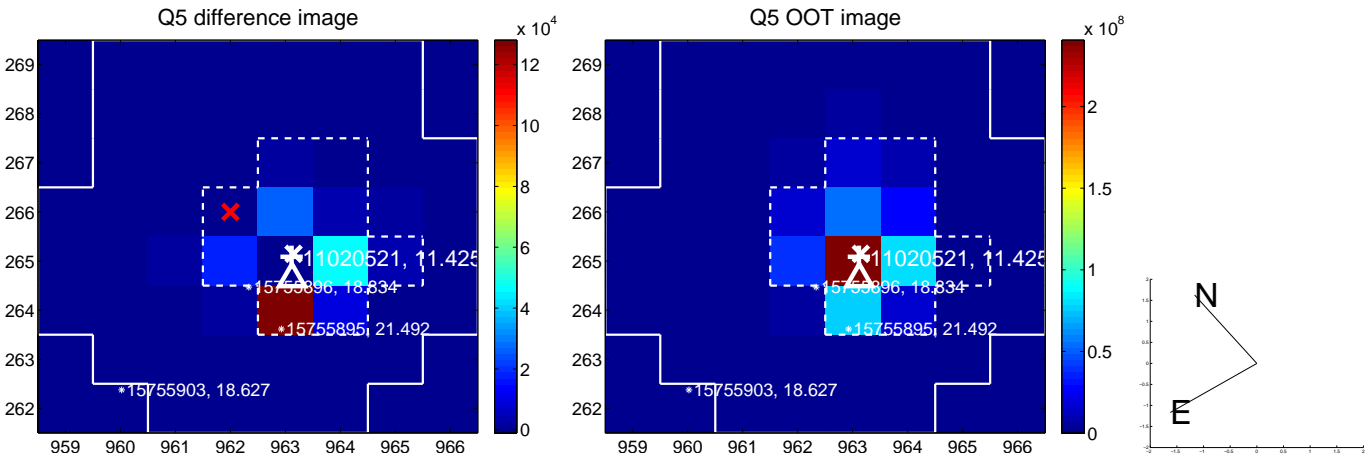
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



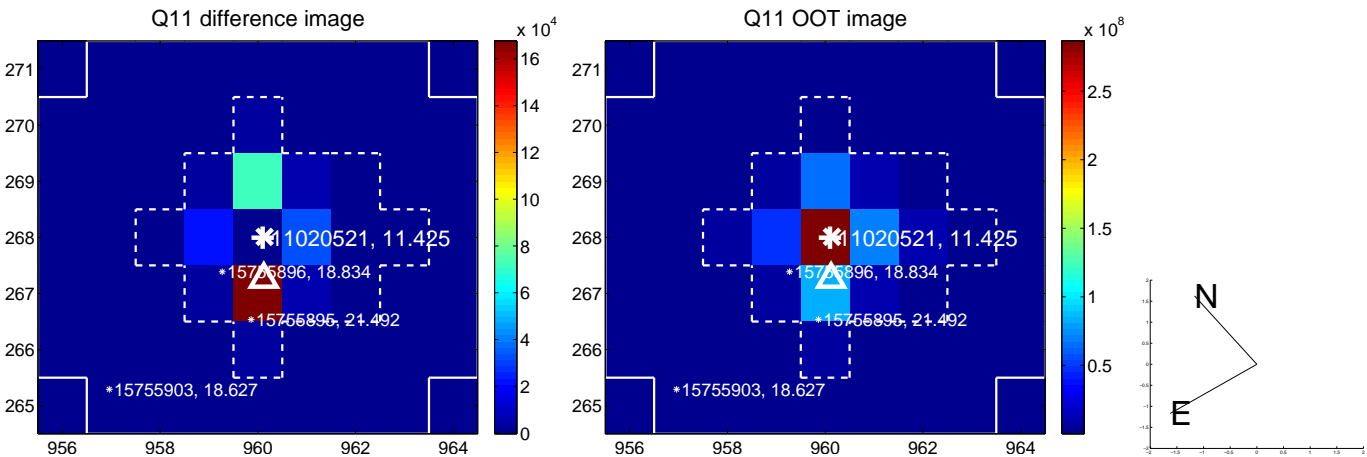
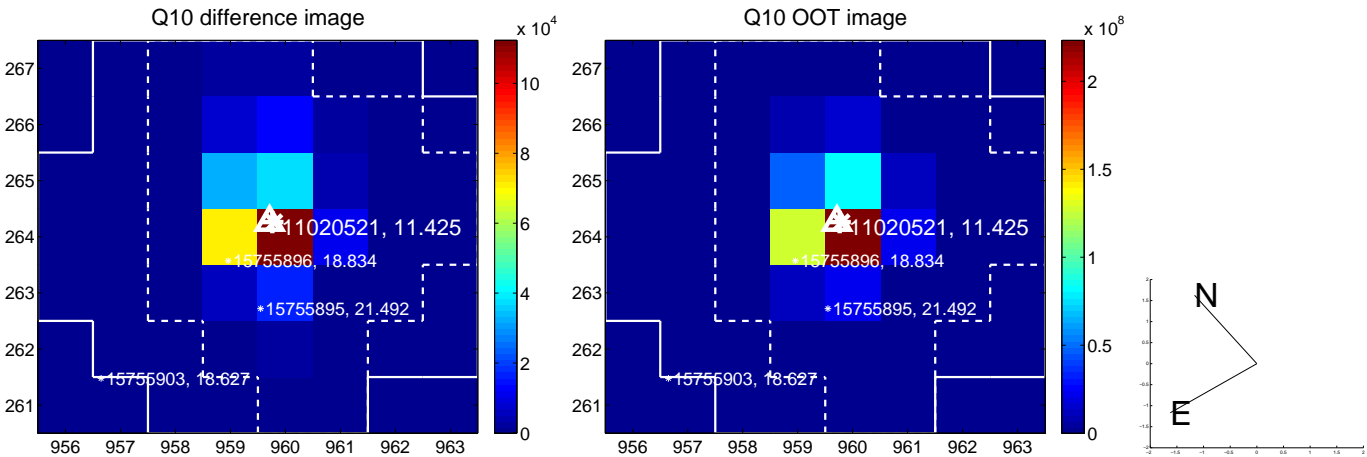
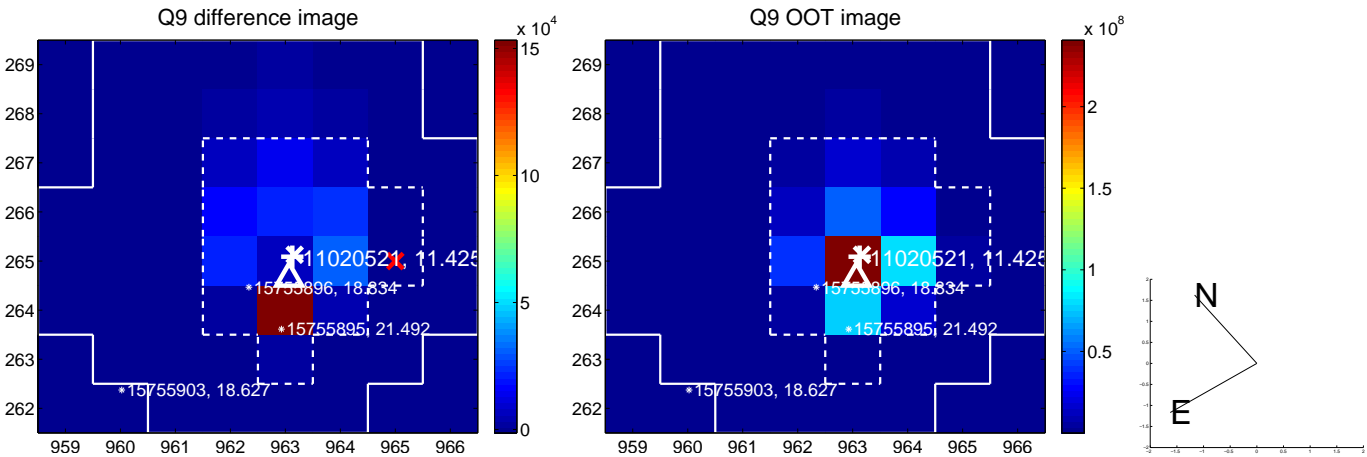
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



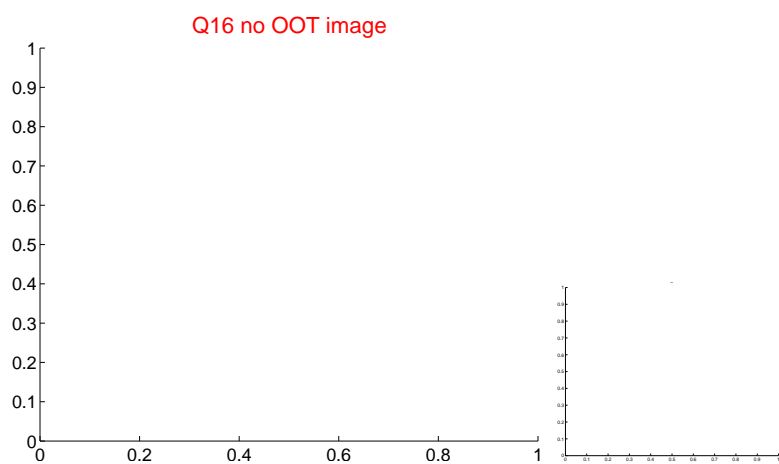
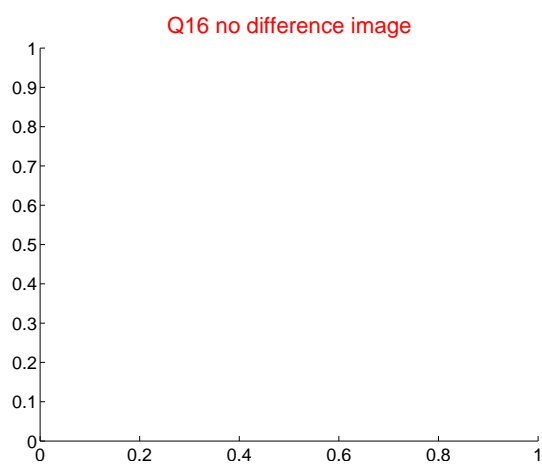
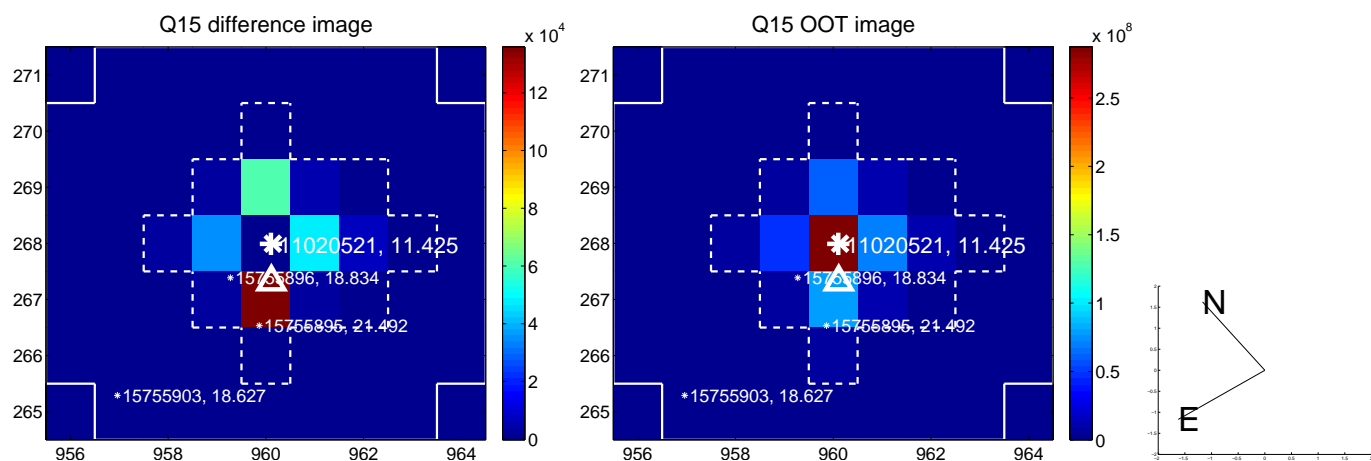
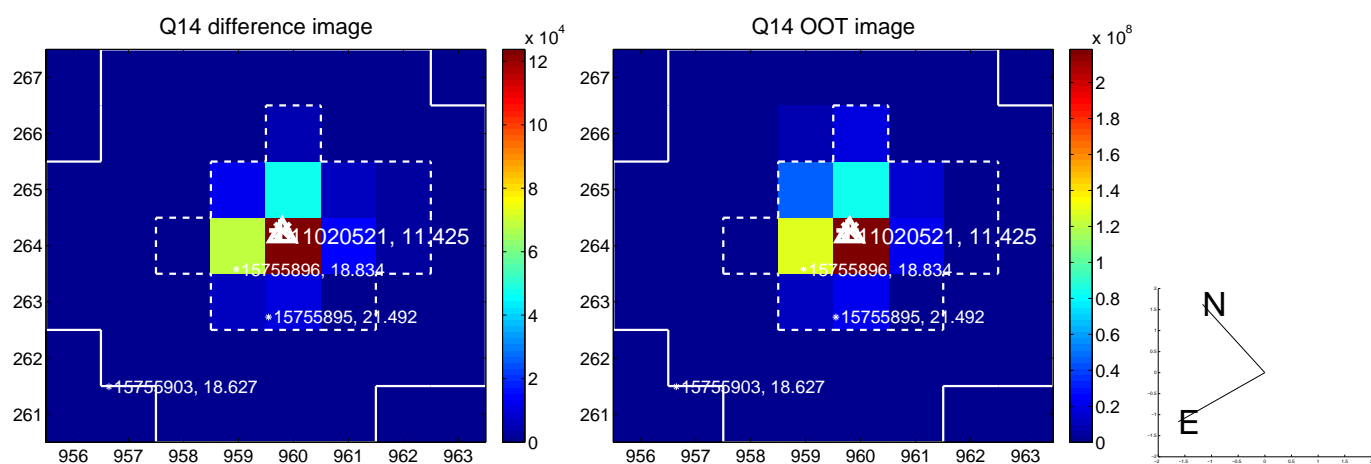
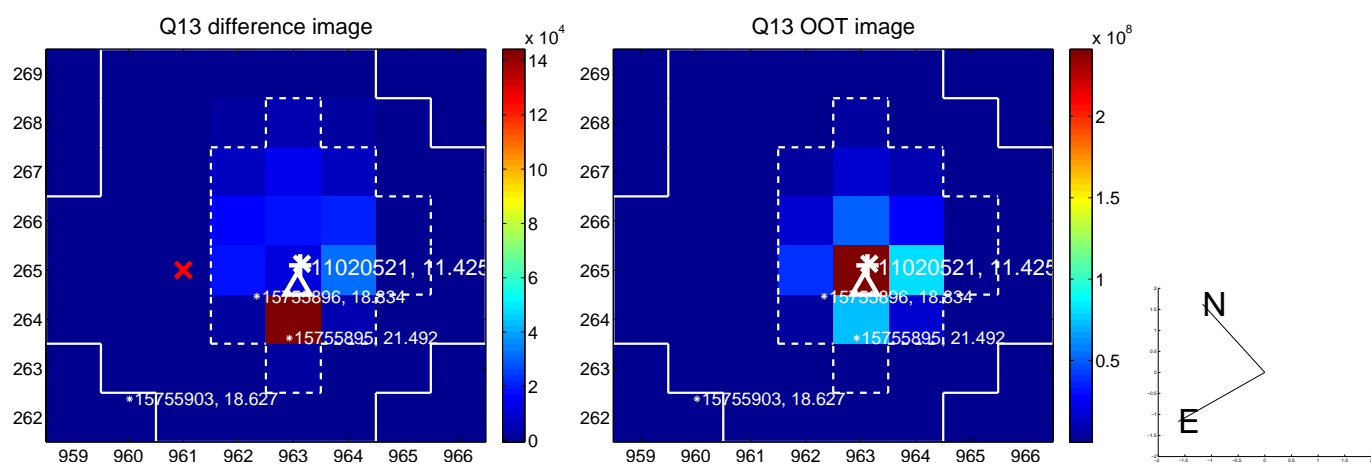
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



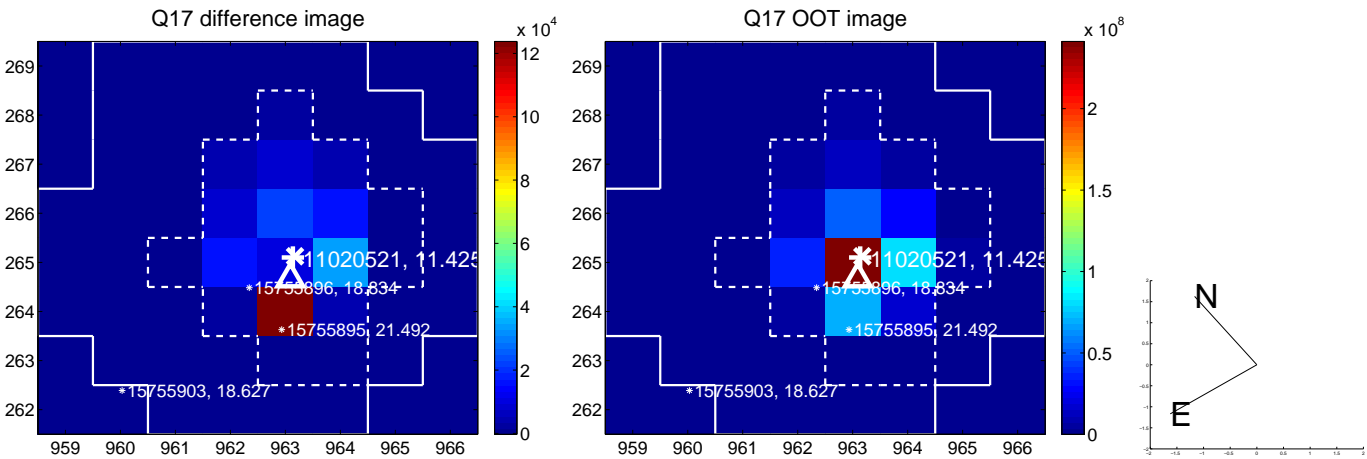
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



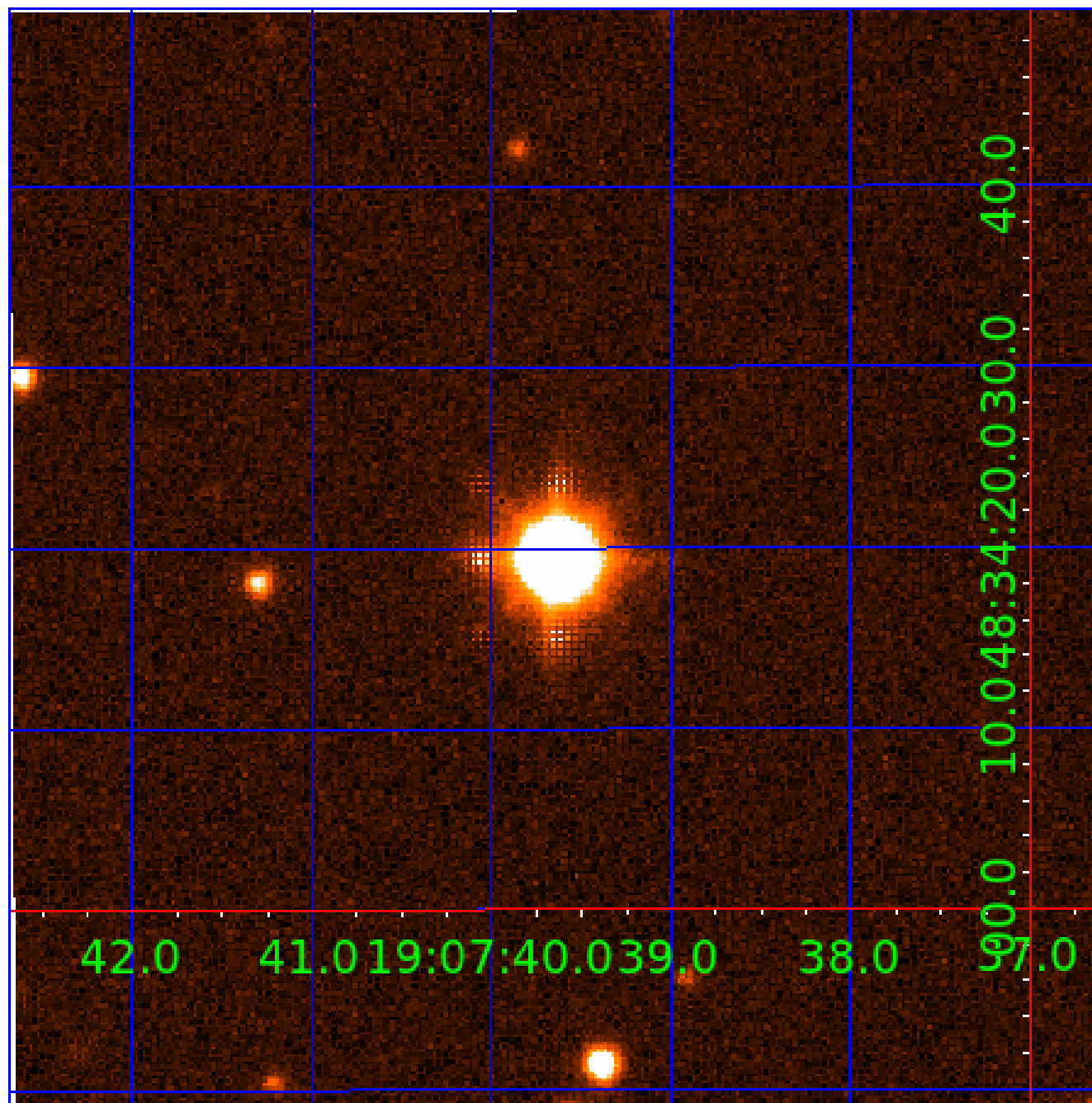
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



folded centroid time series figure for this object.

UKIRT Image

Declination



## KIC 011020521

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
011020521-01	OBS	No	2.929979	134.113706	0.1	0.514	8.2	0.0	3.22	6877	0.10	9371.70
011020521-02	OBS	No	2.930323	133.561397	22.1	5.264	8.1	6.6	3.22	6877	1.78	9370.24
011020521-03	OBS	No	2.930137	132.855754	16.9	12.993	9.2	7.9	3.22	6877	1.42	9371.03
011020521-04	OBS	No	11.171739	137.960832	85.1	3.597	8.7	9.1	3.22	6877	3.48	1573.30
011020521-05	OBS	No	293.095640	157.741380	193.4	6.042	8.2	8.1	3.22	6877	4.96	20.18
011020521-06	OBS	No	118.311612	211.553500	182.8	4.659	8.4	8.4	3.22	6877	5.08	67.65
011020521-07	OBS	No	131.858819	143.359611	66.9	9.614	8.3	5.6	3.22	6877	2.71	58.55
011020521-08	OBS	No	81.557176	178.687435	165.2	4.488	8.1	7.6	3.22	6877	4.58	111.09
011020521-09	OBS	No	36.435749	160.151233	162.1	3.382	8.0	9.4	3.22	6877	4.66	325.29
011020521-10	OBS	No	34.792680	149.579268	94.8	5.285	7.8	7.4	3.22	6877	3.67	345.93

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
011020521-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-04	OBS	FP	0.00	1	0	1	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
011020521-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-07	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-09	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_ALT—CENT_SATURATED
011020521-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—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.

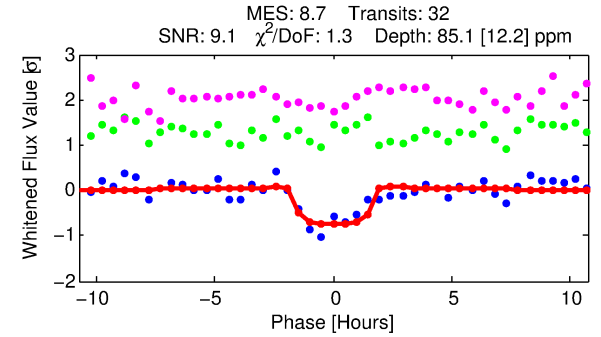
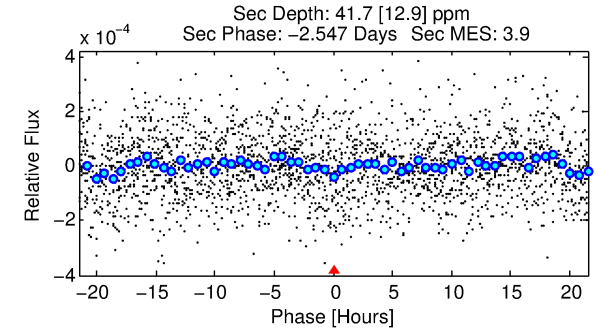
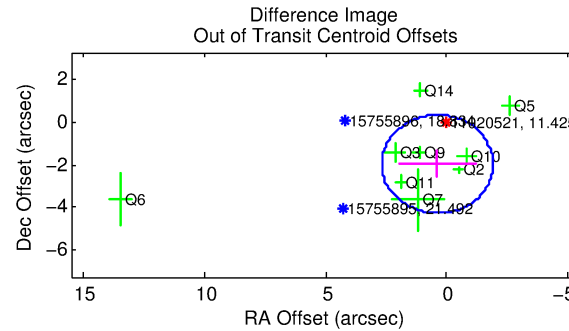
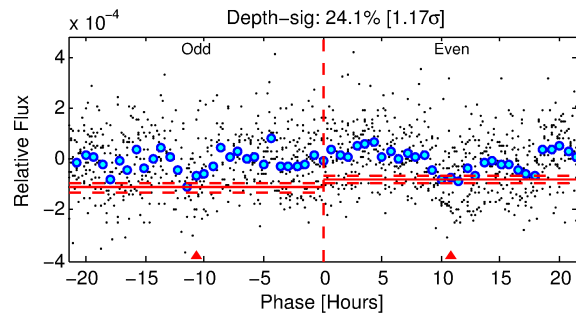
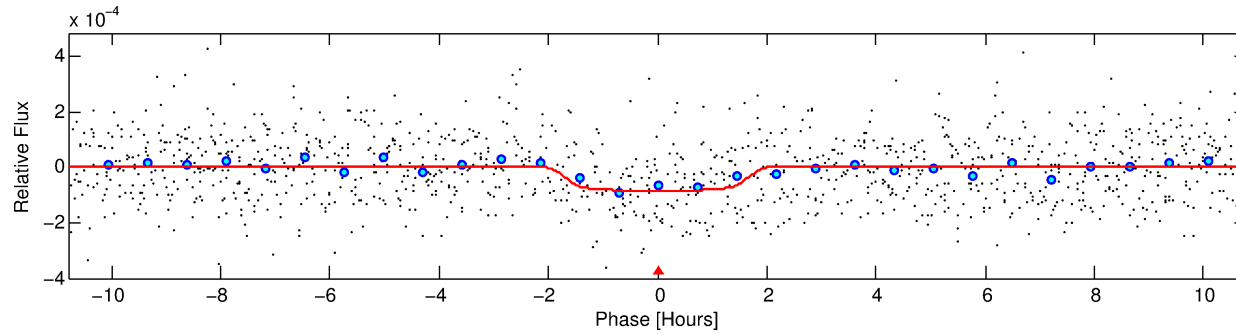
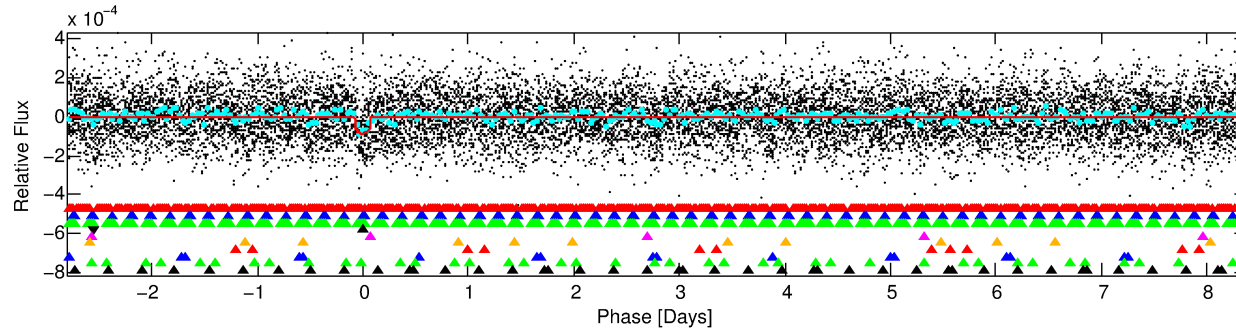
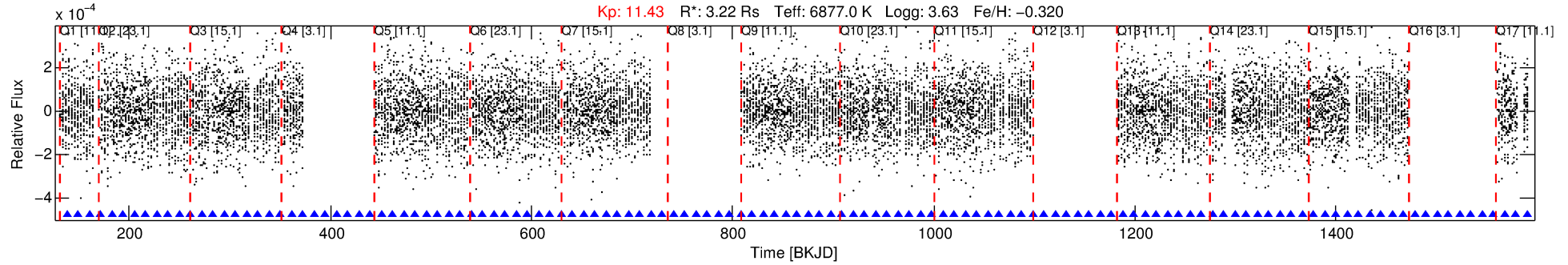
Ephemeris Match Information For 011020521-04

No Significant Match Found



# DV One-Page Summary

KIC: 11020521 Candidate: 4 of 10 Period: 11.172 d



## DV Fit Results:

Period = 11.17174 [0.00012] d  
Epoch = 137.9608 [0.0088] BKJD  
Rp/R\* = 0.0099 [0.0051]  
a/R\* = 10.51 [32.62]  
b = 0.91 [0.61]  
Seff = 1573.29 [855.06]  
Teq = 1606 [218] K  
Rp = 3.48 [2.23] Re  
a = 0.1149 [0.0395] AU  
Ag = 25.09 [30.17] [0.80 $\sigma$ ]  
Teffp = 5557 [1509] K [2.59 $\sigma$ ]

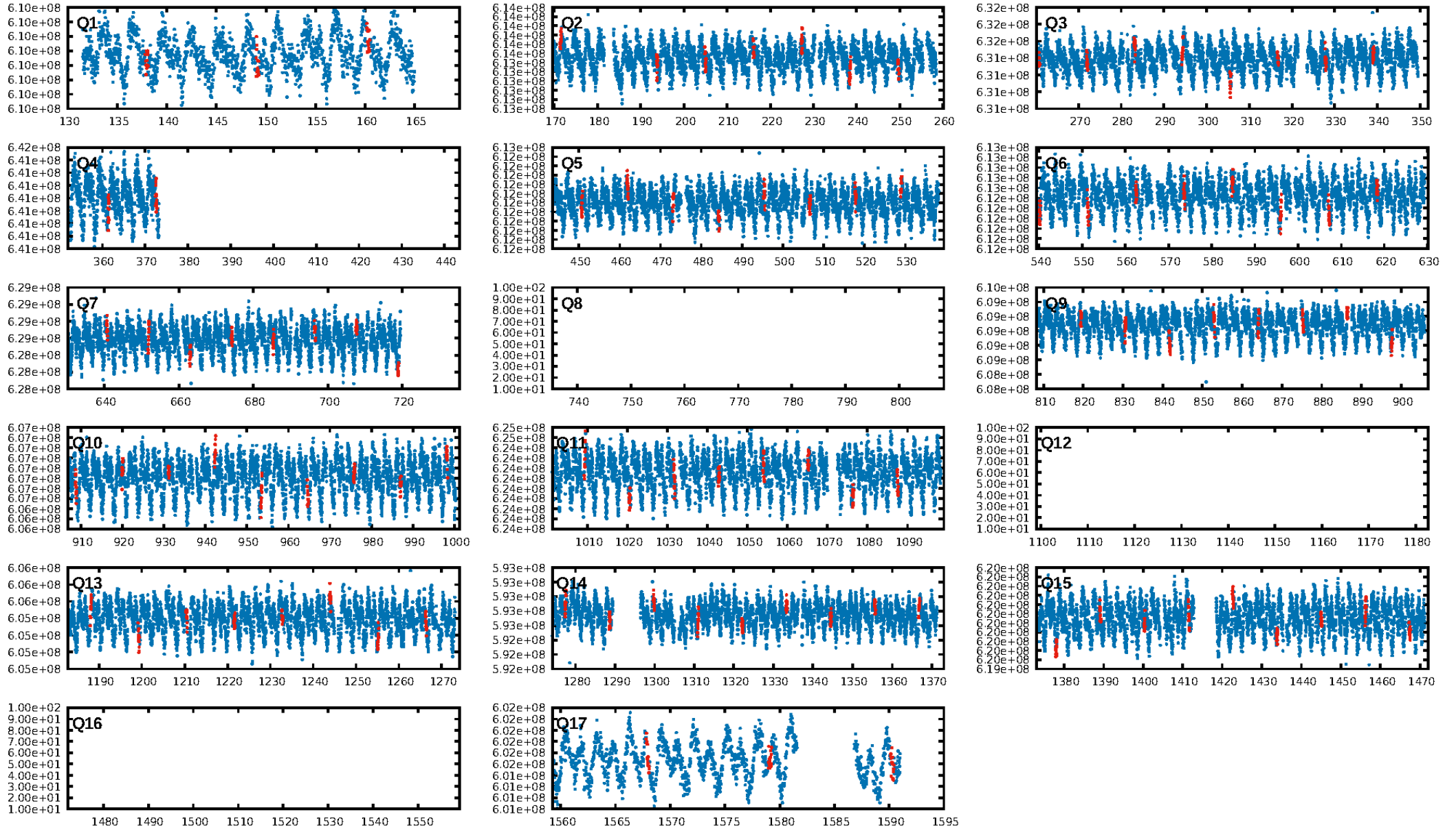
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [31.02 $\sigma$ ]  
LongPeriod-sig: 100.0% [88.67 $\sigma$ ]  
ModelChiSquare2-sig: 18.7%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [28/28]  
**GhostDiagnostic-chr: -0.005429**  
Centroid-sig: N/A  
Centroid-so: N/A  
OotOffset-rm: 2.010 arcsec [2.62 $\sigma$ ]  
KicOffset-rm: 2.001 arcsec [2.97 $\sigma$ ]  
OotOffset-st: 4/3/0/2 [9]  
KicOffset-st: 4/3/0/2 [9]  
DiffImageQuality-fgm: 0.33 [3/9]  
DiffImageOverlap-fno: 1.00 [13/13]

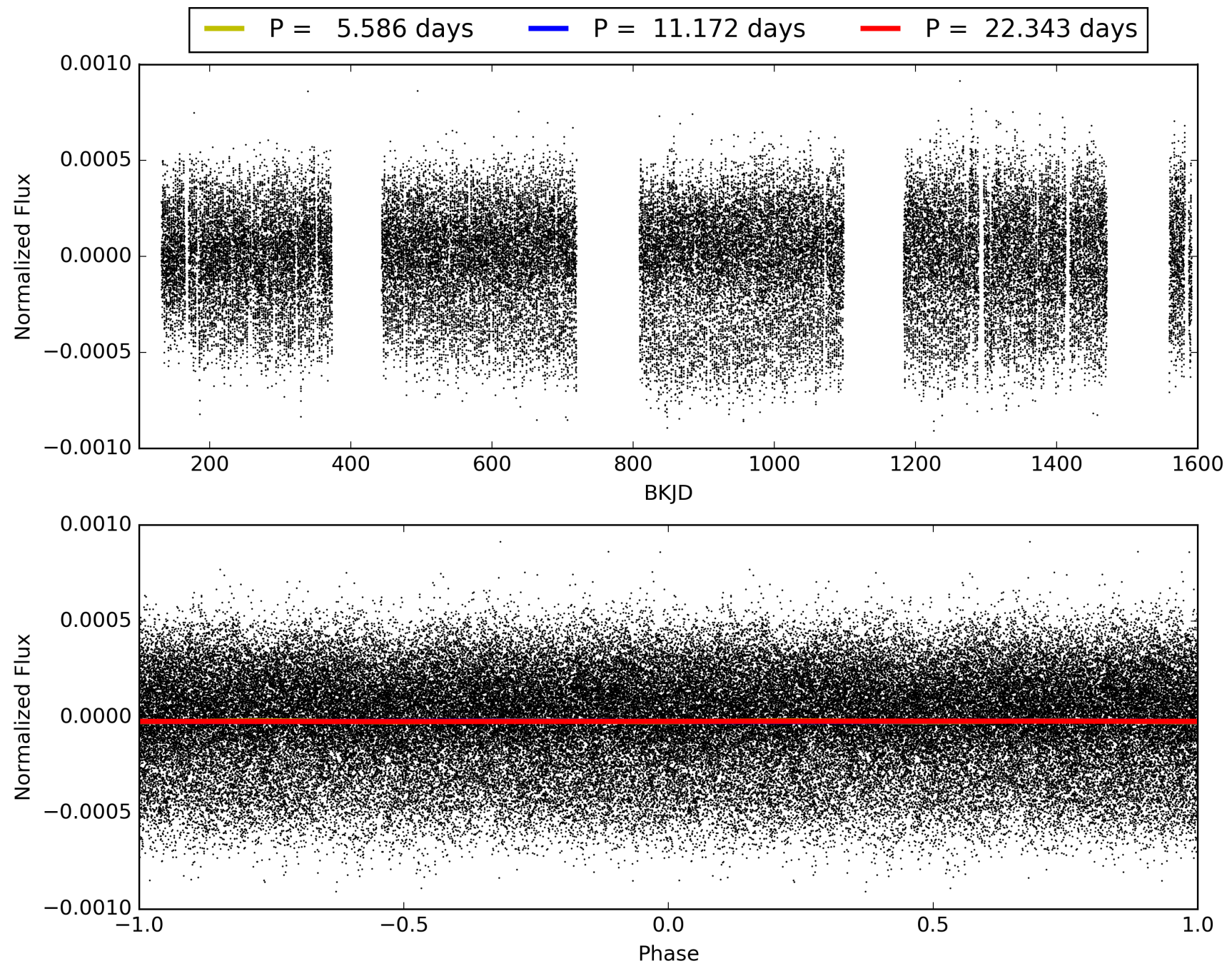
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 05:44:59 Z

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

# TCE 011020521-04, PDC Light Curves

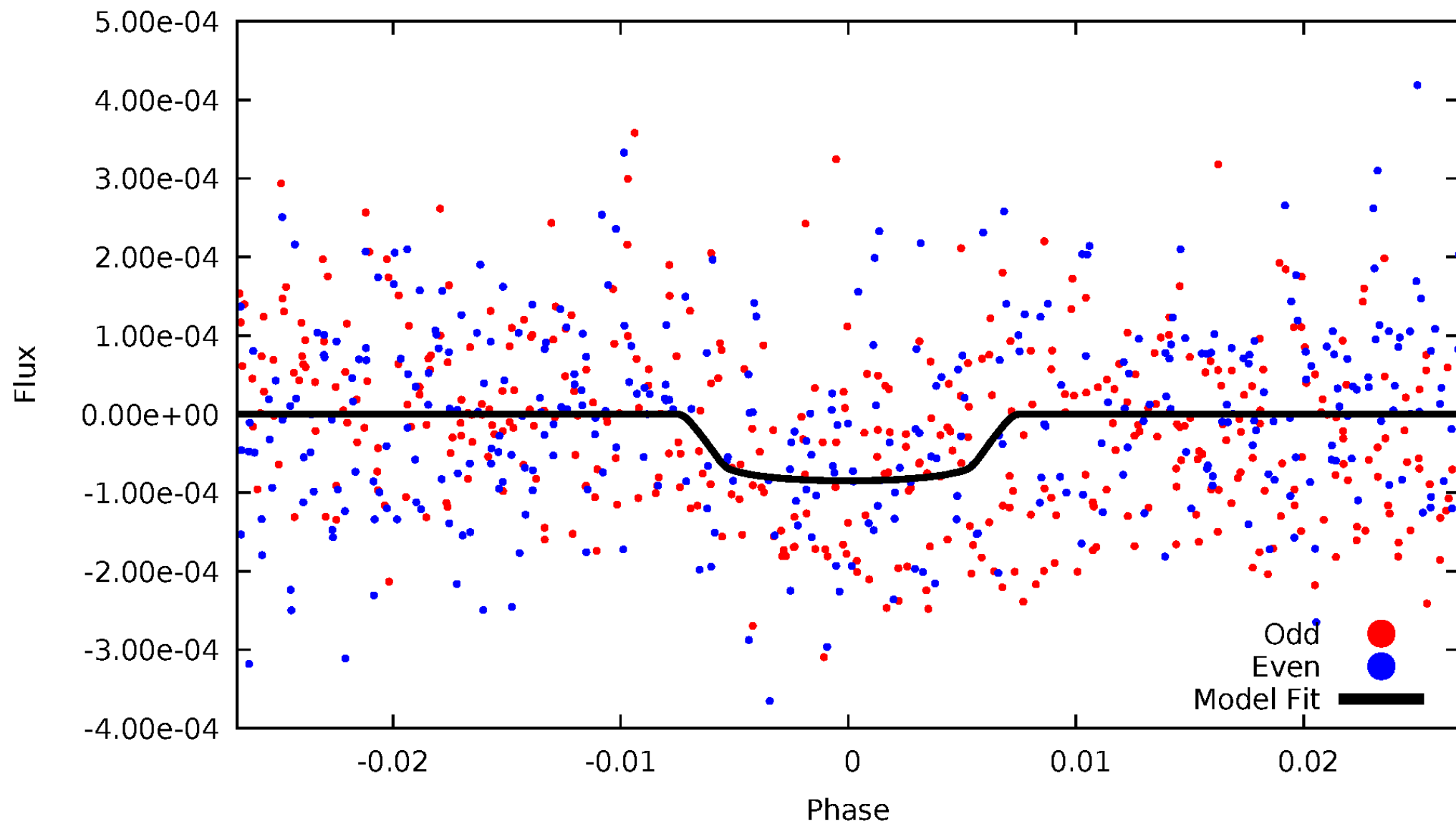


TCE 011020521-04



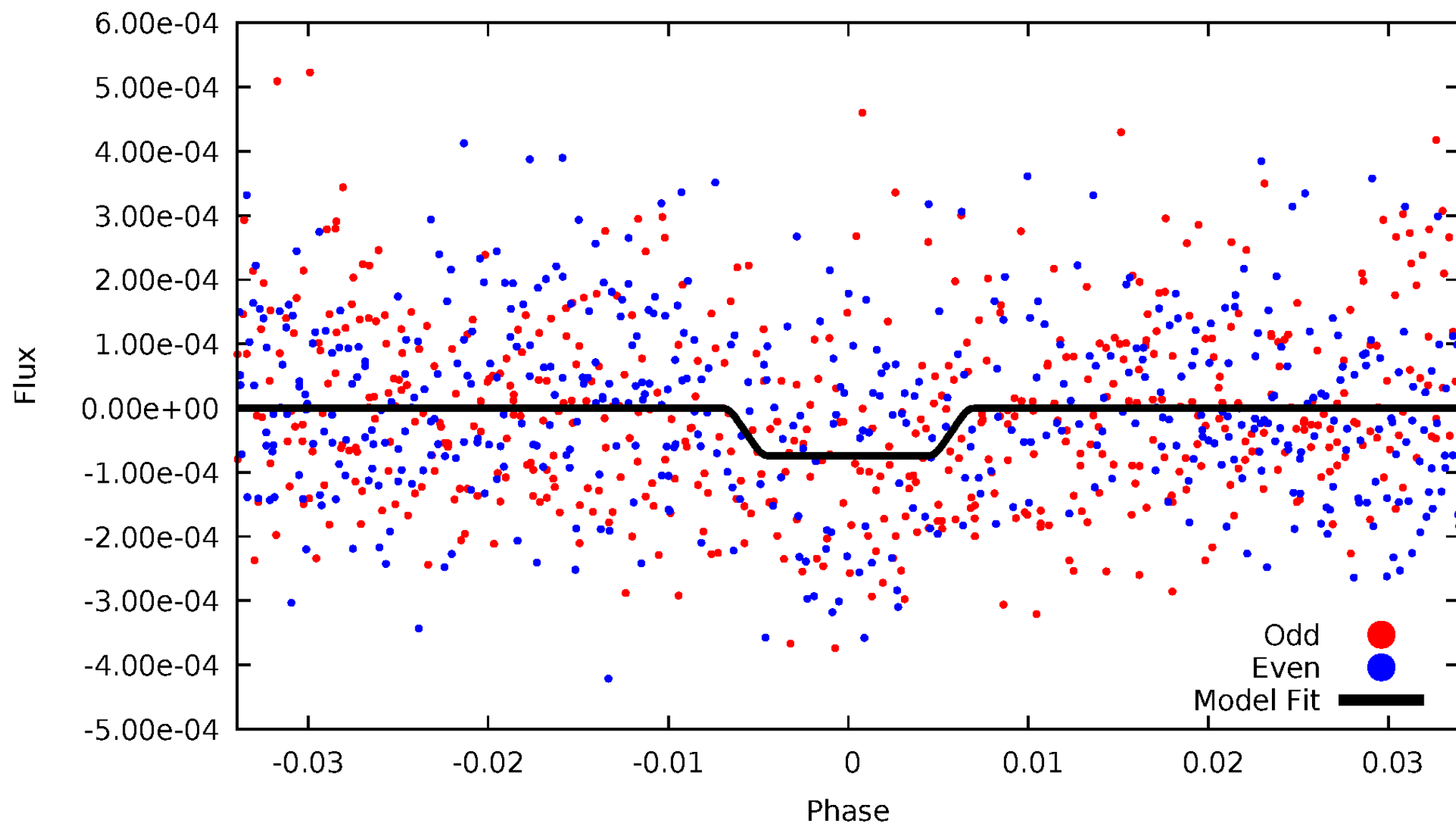
# DV Odd/Even

TCE 011020521-04



# ALT Odd/Even

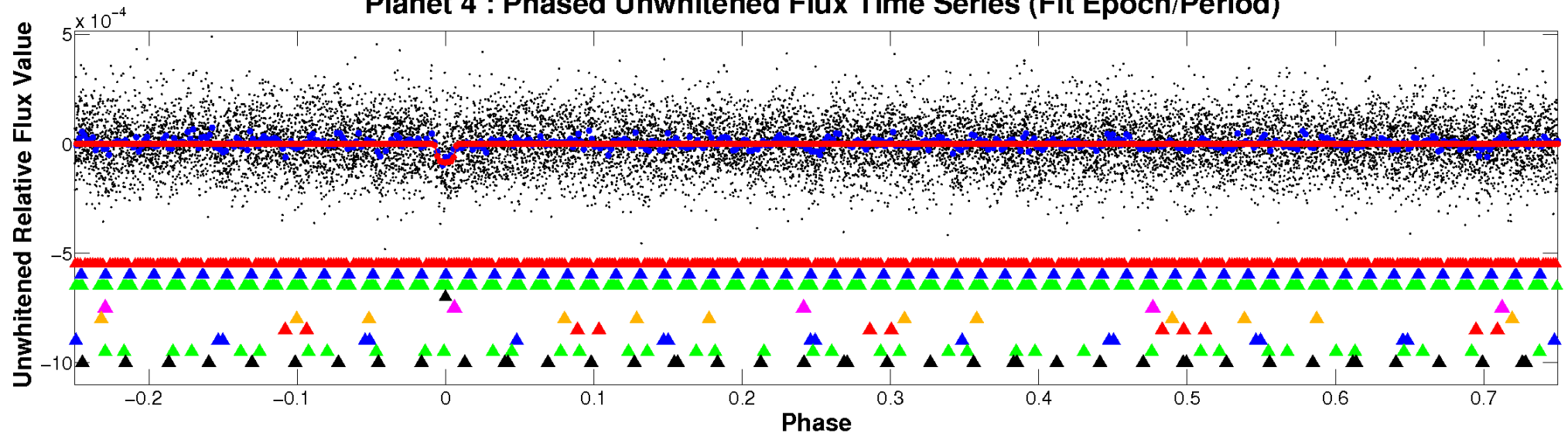
TCE 011020521-04



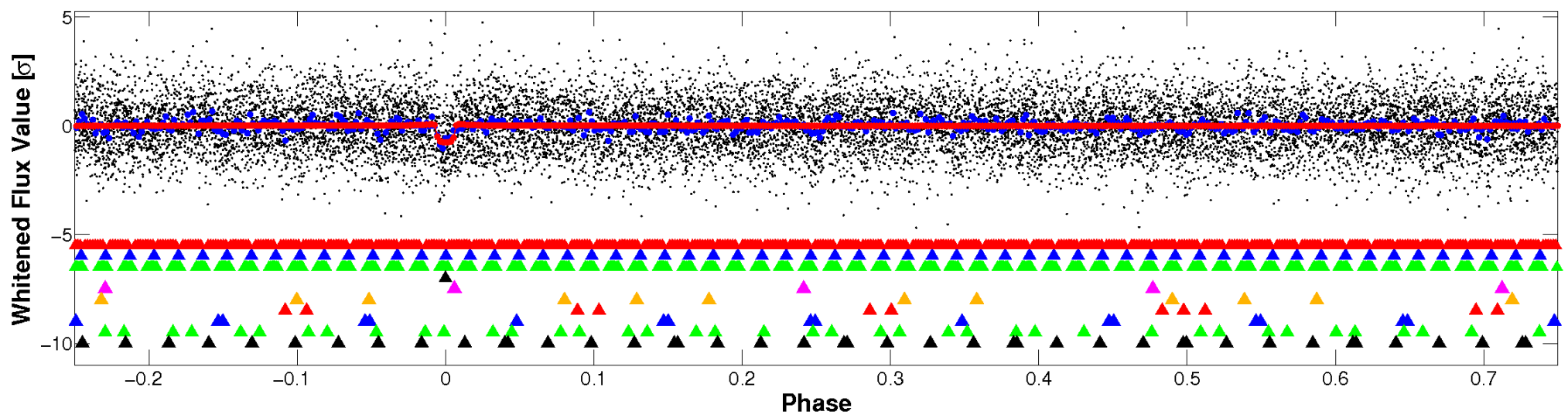


# Non-Whitened Vs. Whitened Light Curve

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



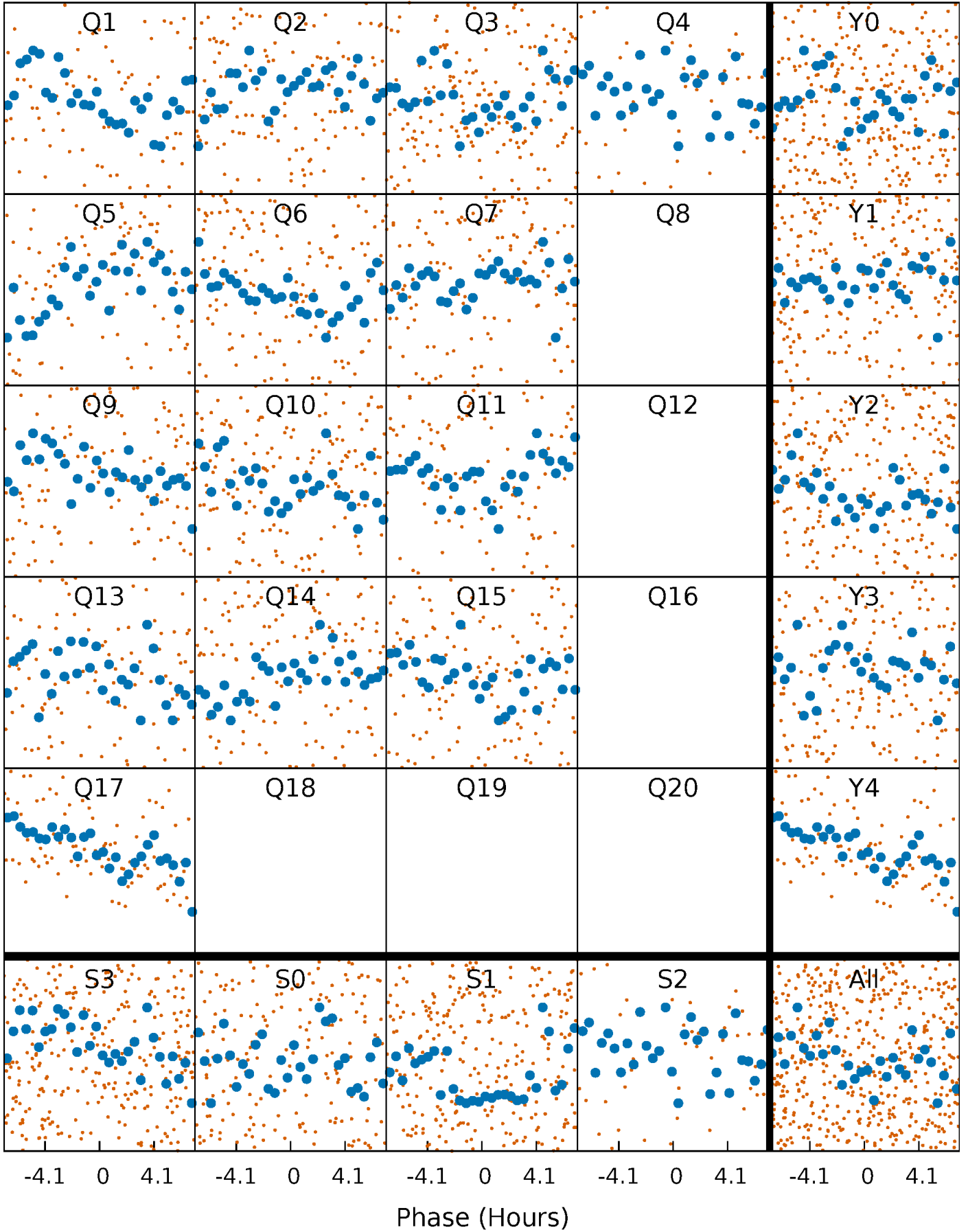
## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)





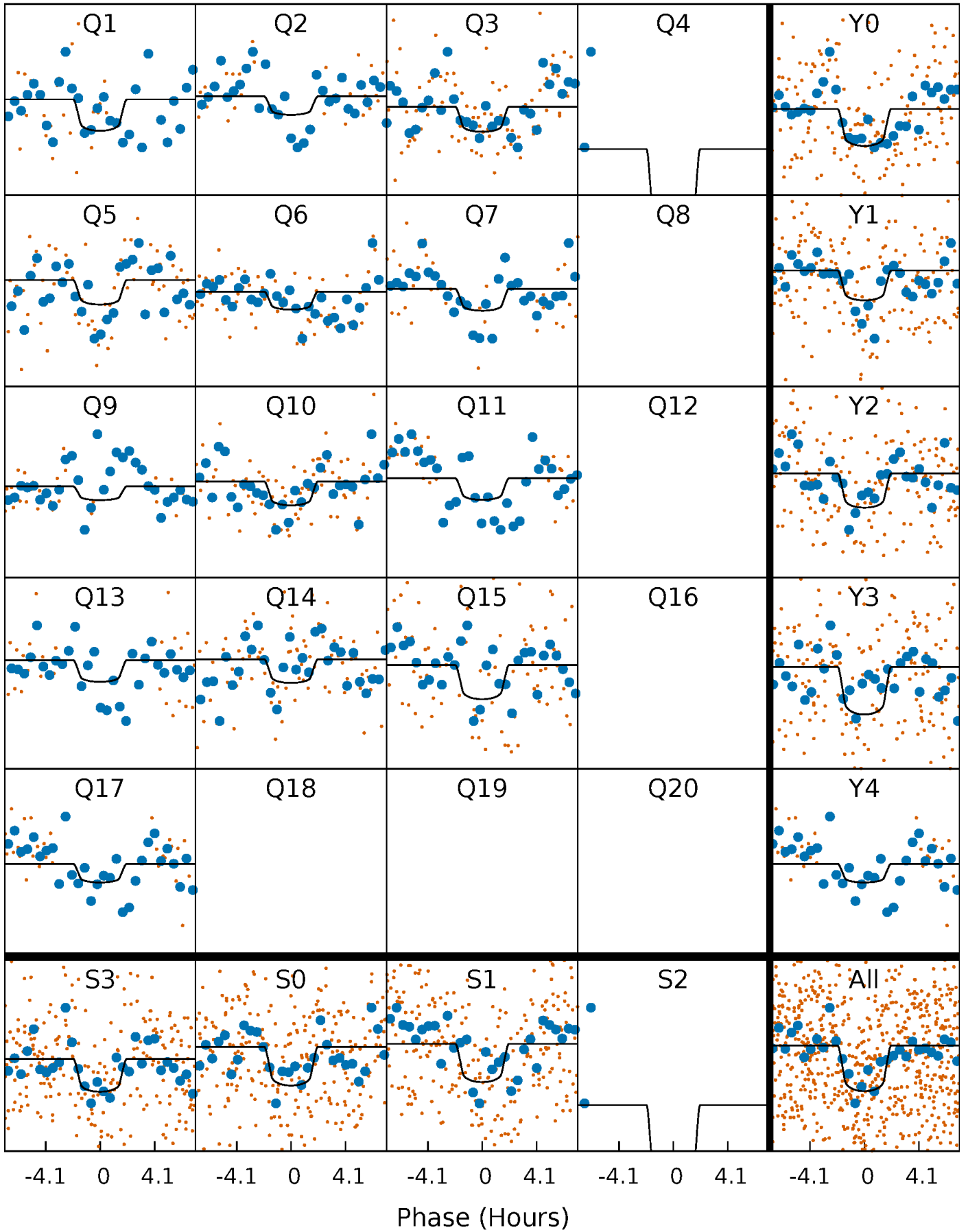
# PDC Quarter-Phased Transit Curves

TCE 011020521-04    P= 11.171739 Days     $T_0=137.960832$  (BKJD)



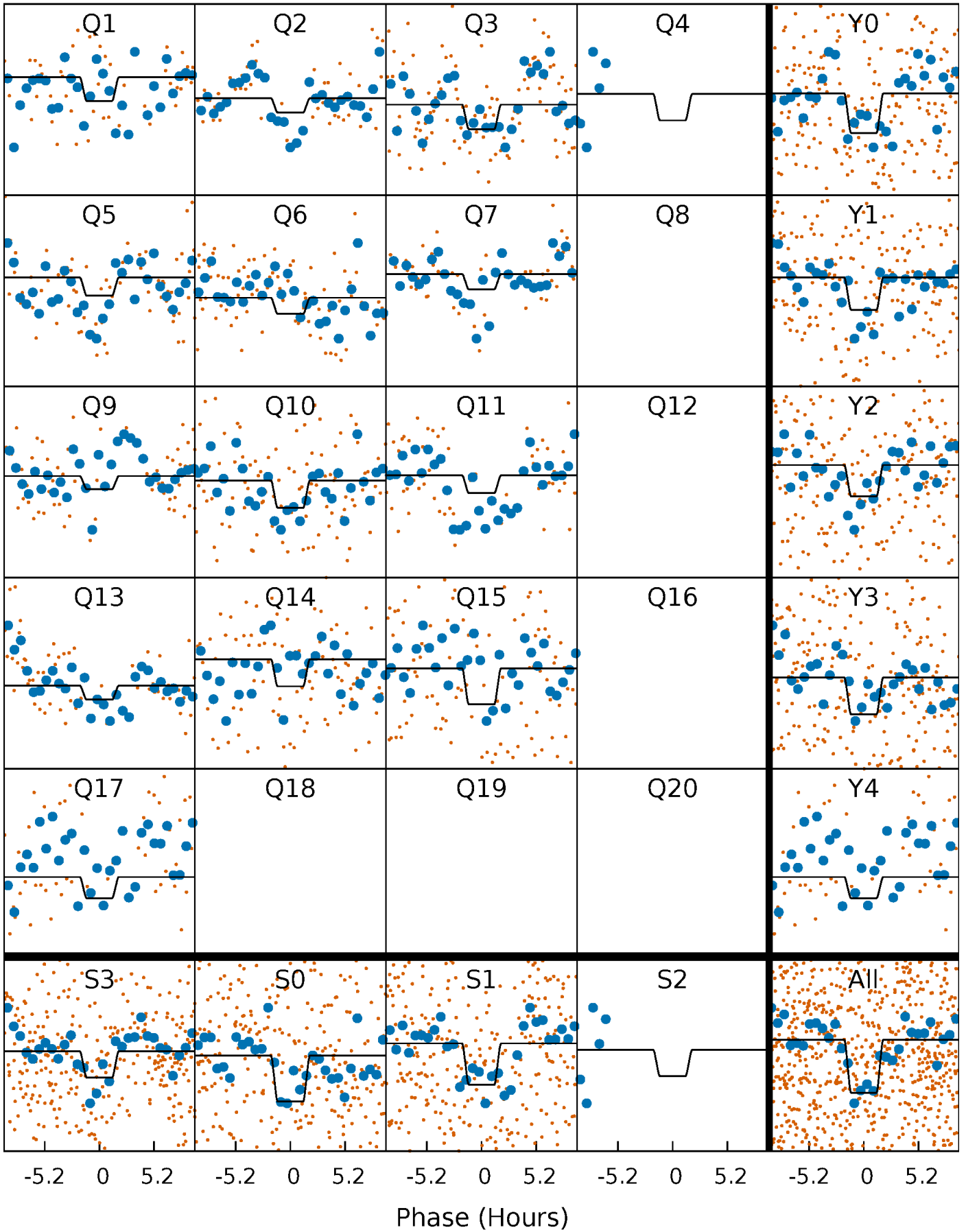
# DV Quarter-Phased Transit Curves

TCE 011020521-04 P= 11.171739 Days  $T_0=137.960832$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

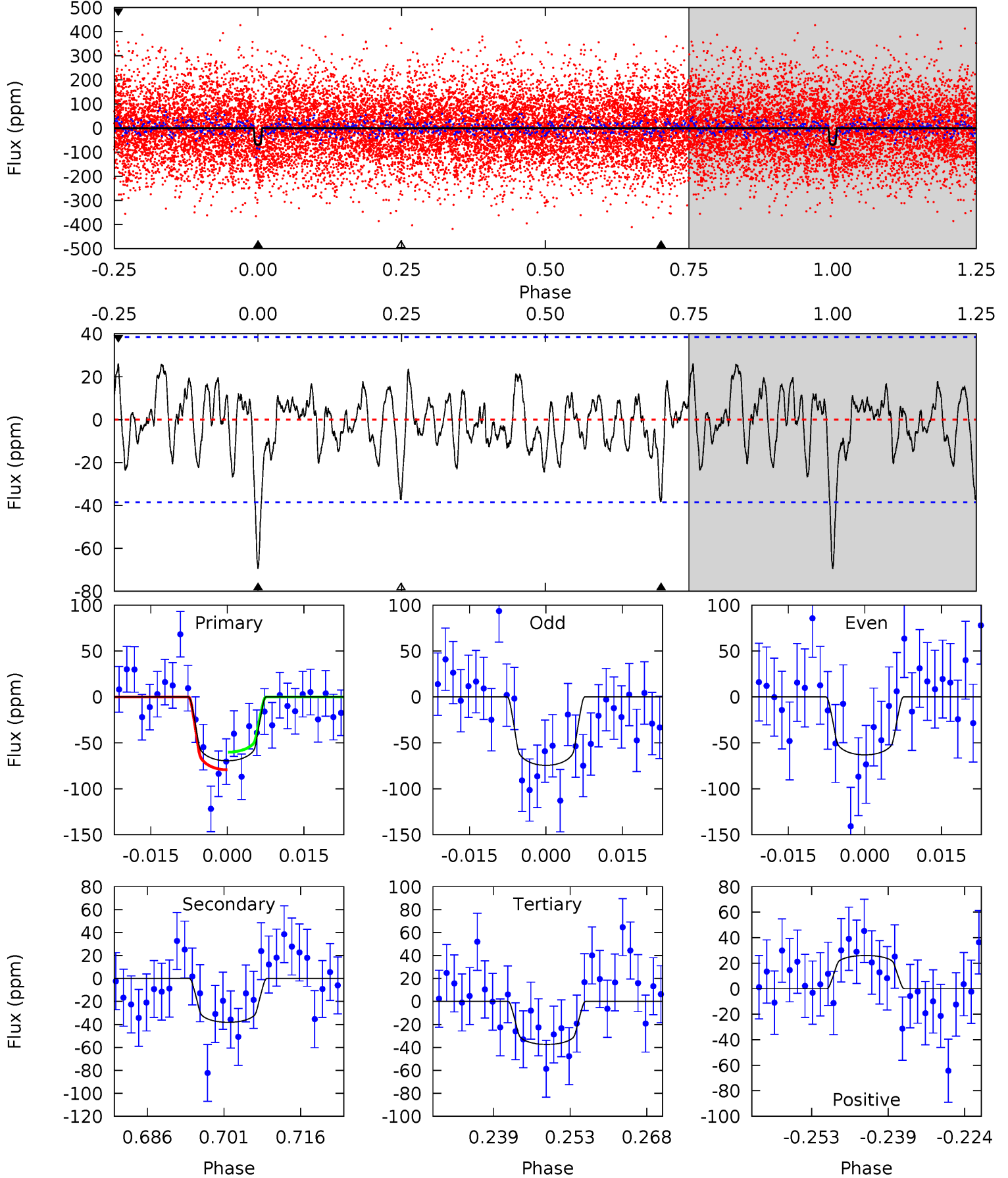
TCE 011020521-04 P= 11.171291 Days  $T_0=137.978976$  (BKJD)



# DV Model-Shift Uniqueness Test

011020521-04, P = 11.171739 Days, E = 126.789093 Days

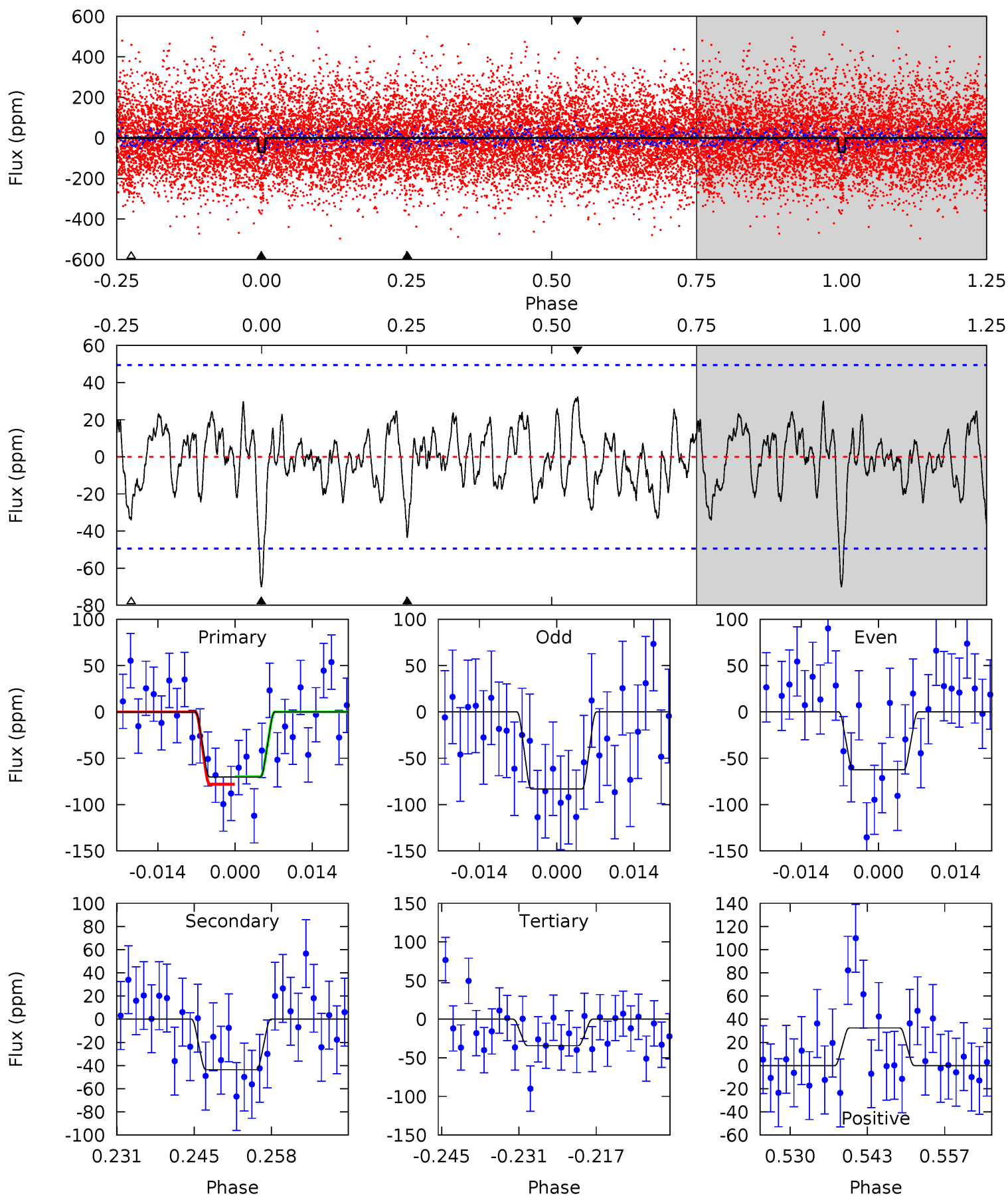
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.95	4.91	4.82	3.35	4.95	2.43	1.41	4.13	5.60	0.09	1.56	0.72	0.74	0.27	1.23



# Alt Model-Shift Uniqueness Test

011020521-04, P = 11.171291 Days, E = 126.807685 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
7.05	4.37	3.44	3.25	4.97	2.47	1.33	3.61	3.79	0.93	1.12	1.03	0.72	0.32	0.41



### Stellar Parameters For KIC 011020521

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6877^{+170}_{-204}$	$3.632^{+0.304}_{-0.076}$	$-0.320^{+0.300}_{-0.250}$	$3.219^{+0.406}_{-1.217}$	$1.619^{+0.227}_{-0.312}$	$0.068^{+0.149}_{-0.017}$
	+2%/-3%	+8%/-2%	+94%/-78%	+13%/-38%	+14%/-19%	+218%/-25%
Source	PHO1	FLK73	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 011020521-04 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-38 \pm 8$	$3.25^{+1.98}_{-1.68}$	$2202^{+120}_{-186}$	$5390^{+2348}_{-900}$	$26^{+90}_{-16}$
Alt.	$-44 \pm 10$	$2.90^{+1.80}_{-1.48}$	$2205^{+121}_{-189}$	$5923^{+2982}_{-1174}$	$39^{+110}_{-25}$

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



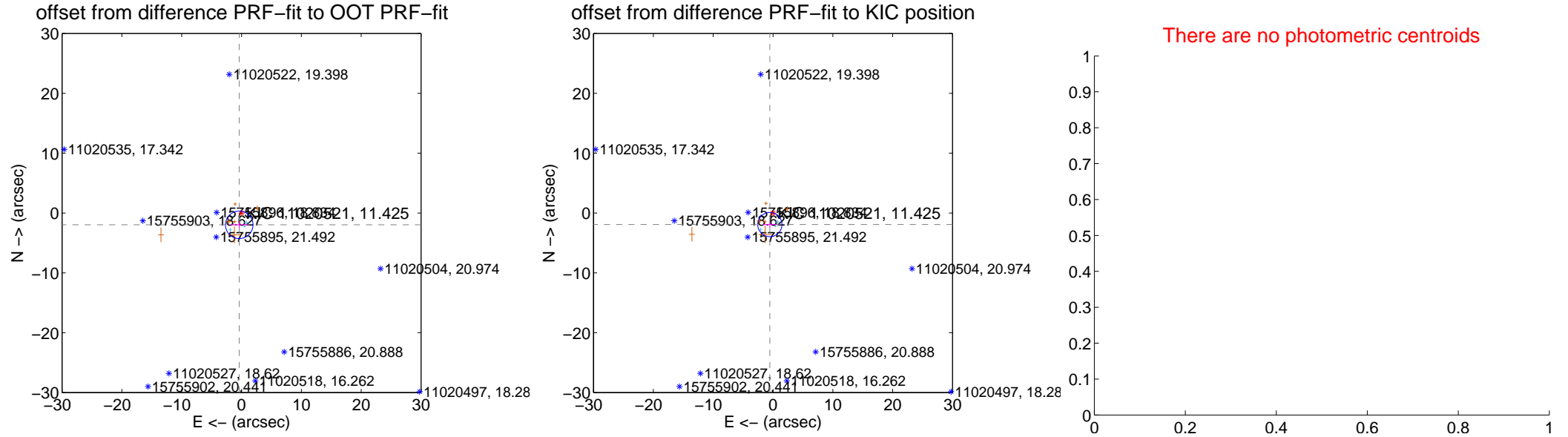
## DV Centroid Data

Supplemental centroid analysis for 011020521-04. **Kepler magnitude: 11.43.** Transit SNR 9.06

**There are 3 quarters with good PRF difference image offsets**

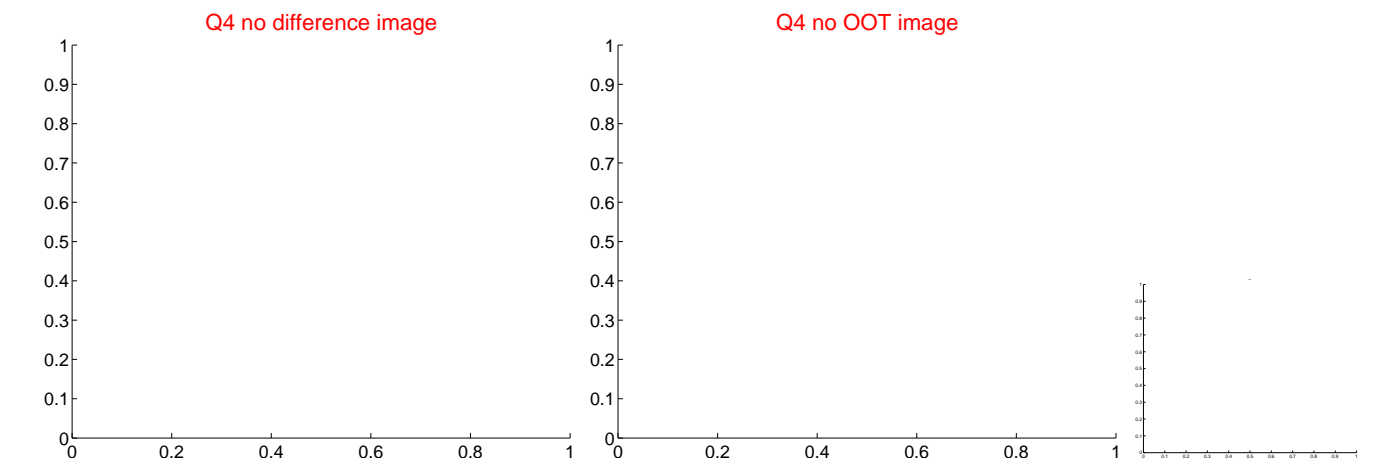
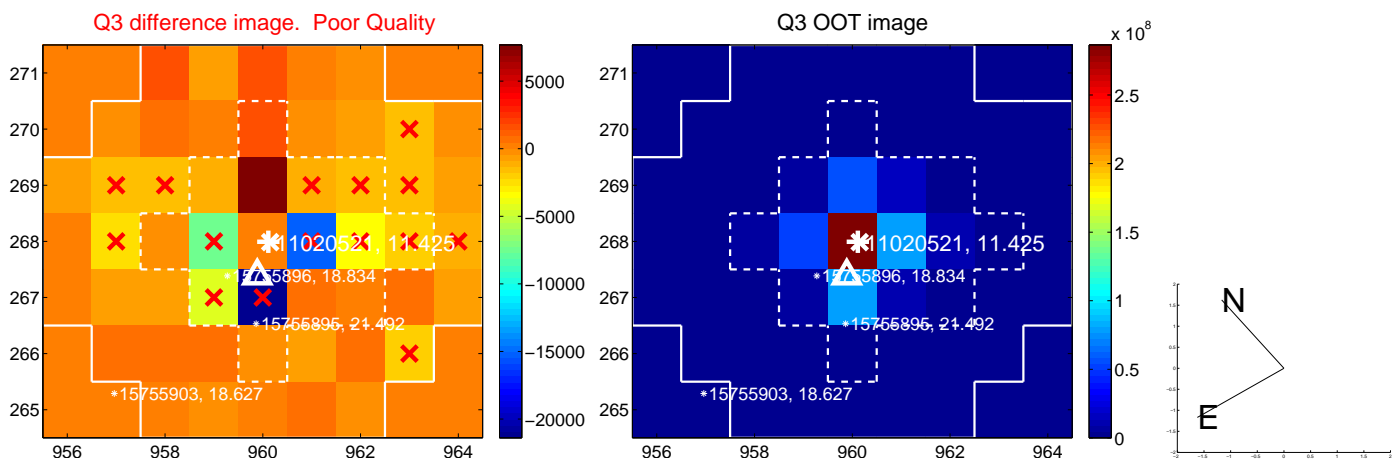
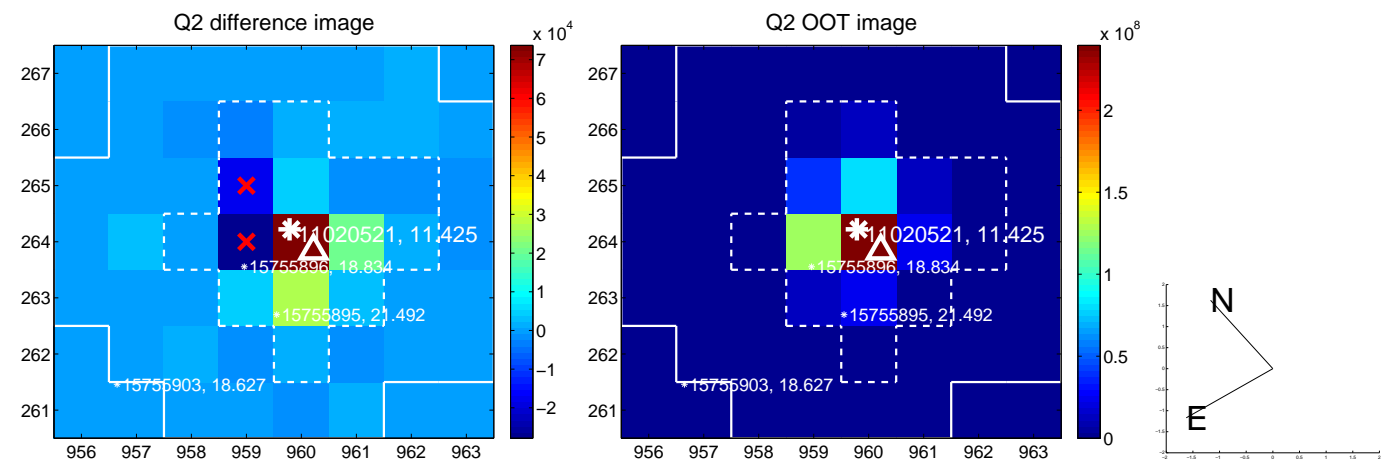
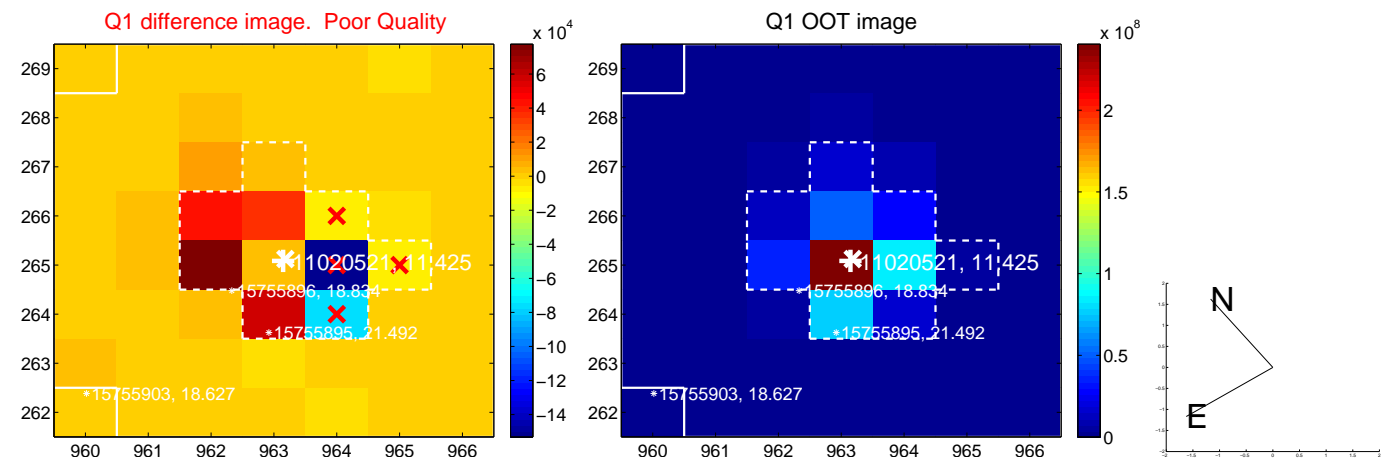
The direct PRF centroid is offset from the target star catalog position by about 0.17 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.010 \pm 0.766$	2.62	$0.385 \pm 1.595$	$-1.973 \pm 0.599$
PRF-fit source offset from KIC position	$2.001 \pm 0.675$	2.97	$0.527 \pm 1.177$	$-1.930 \pm 0.504$
photometric centroid source offset	—	—	—	—

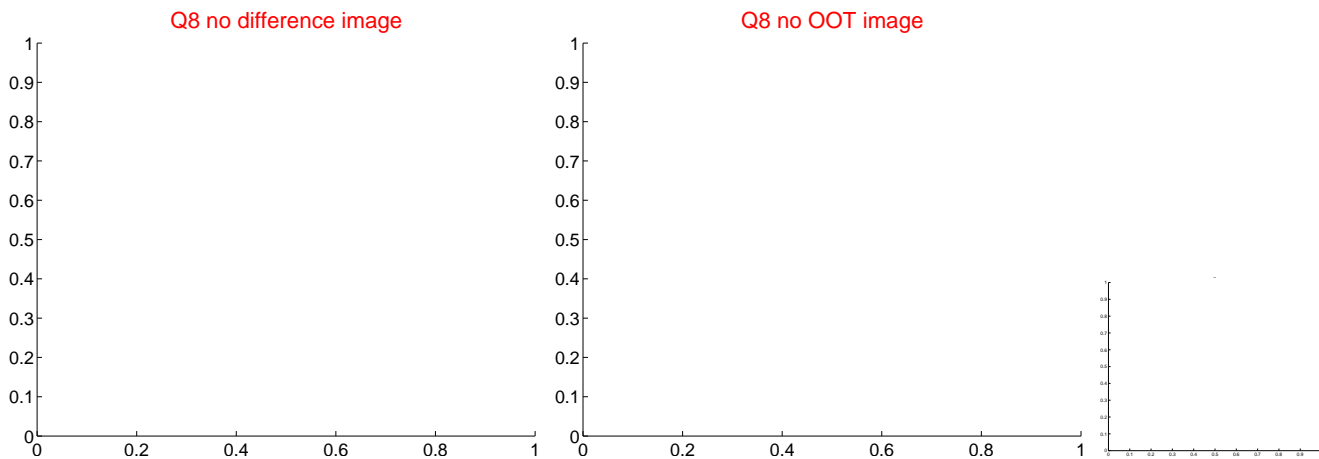
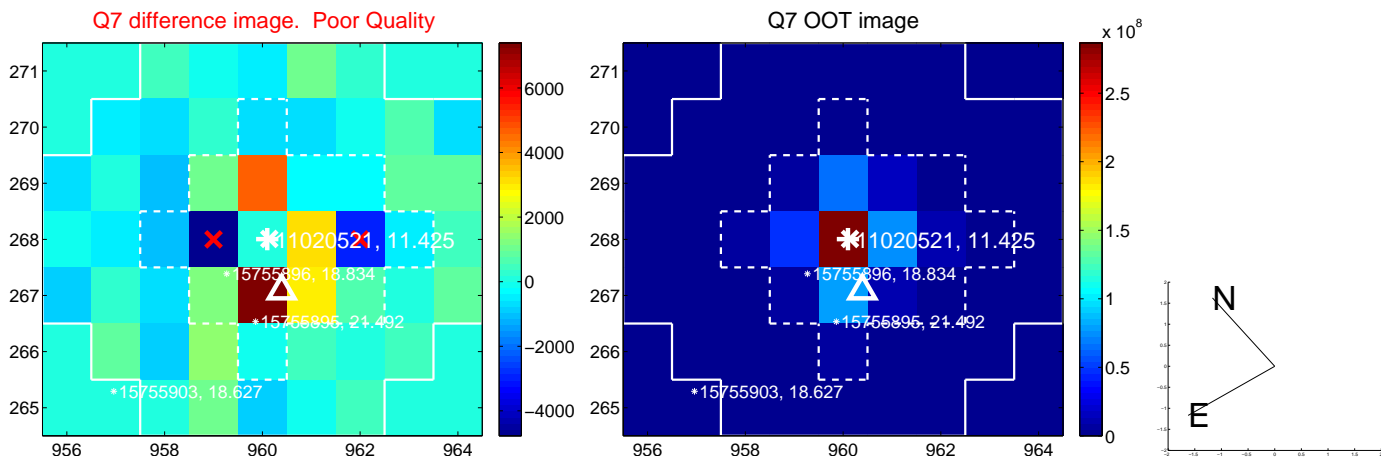
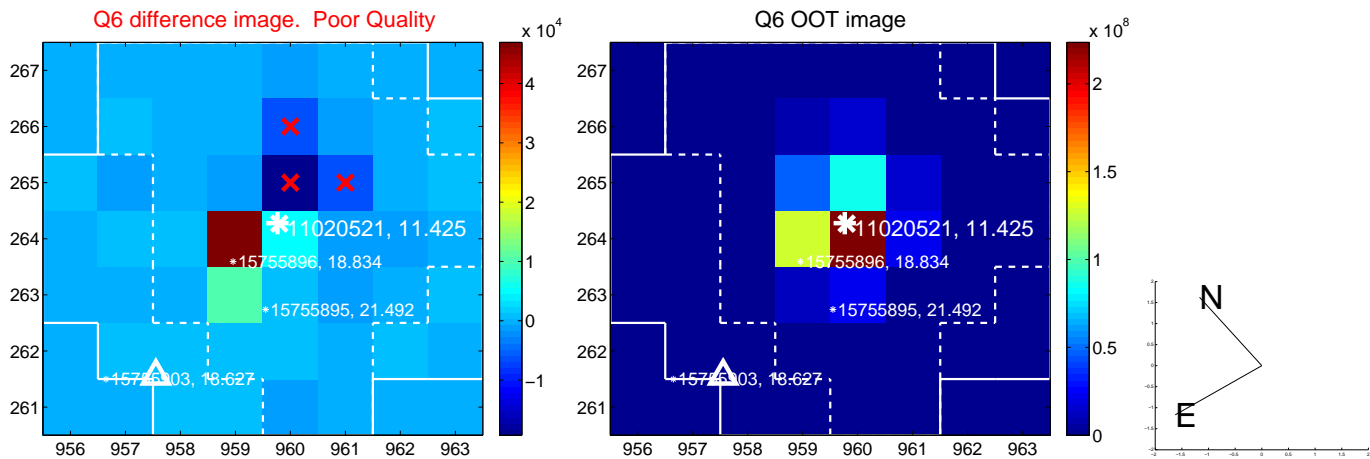
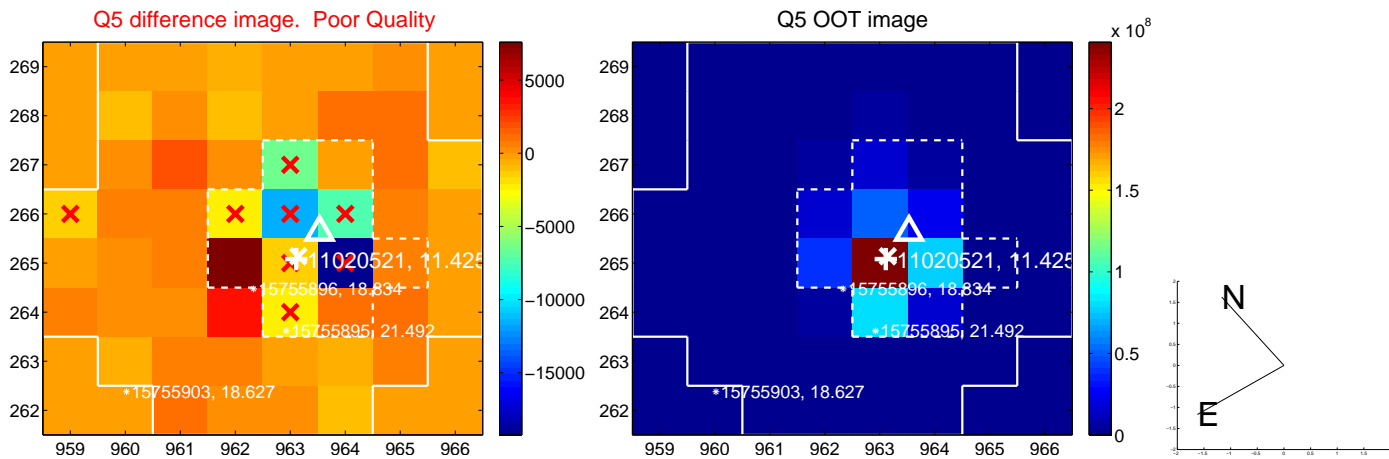


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

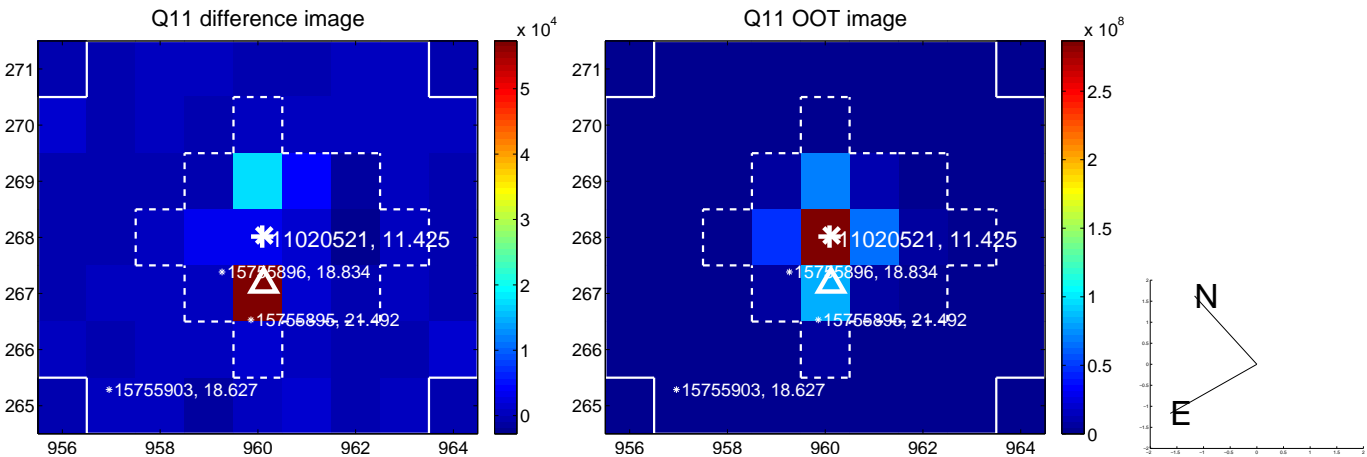
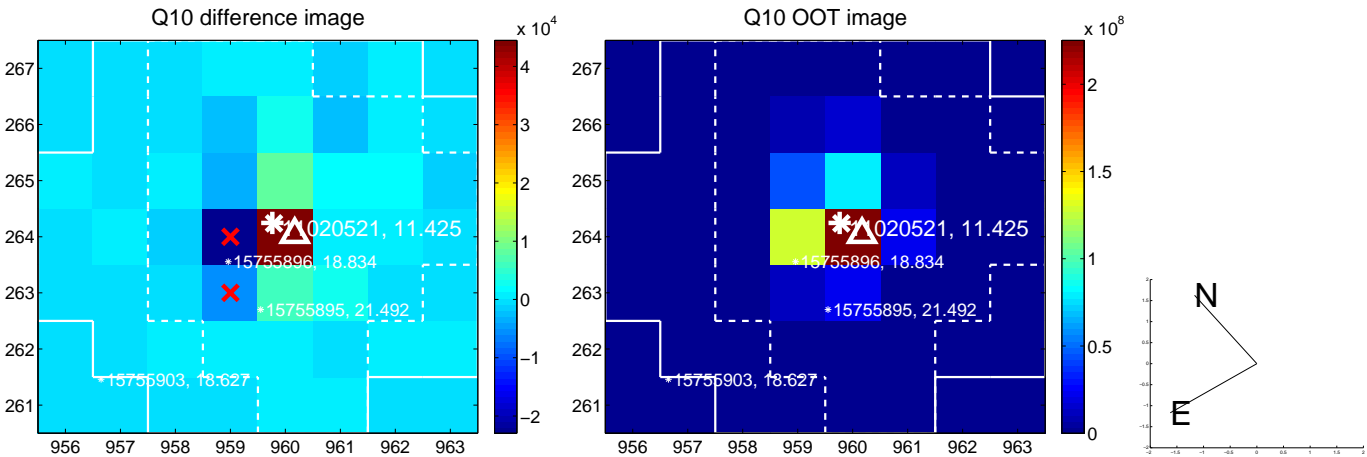
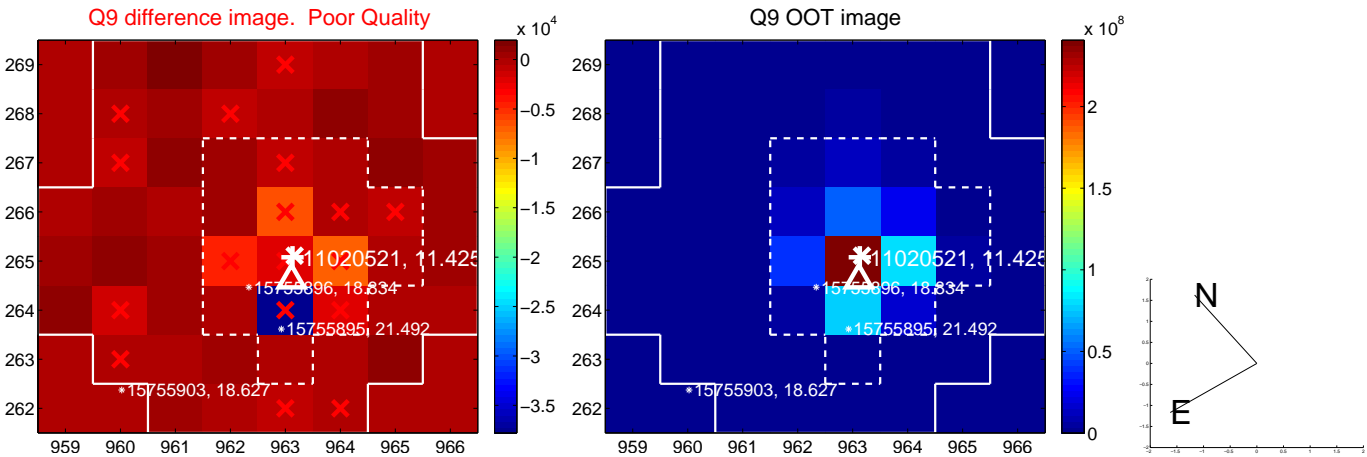
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



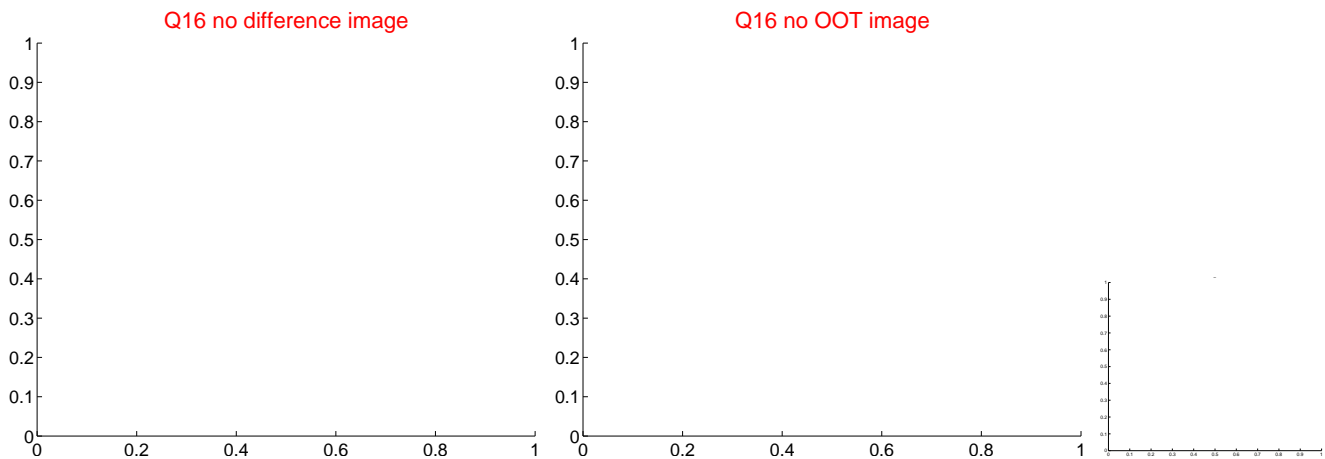
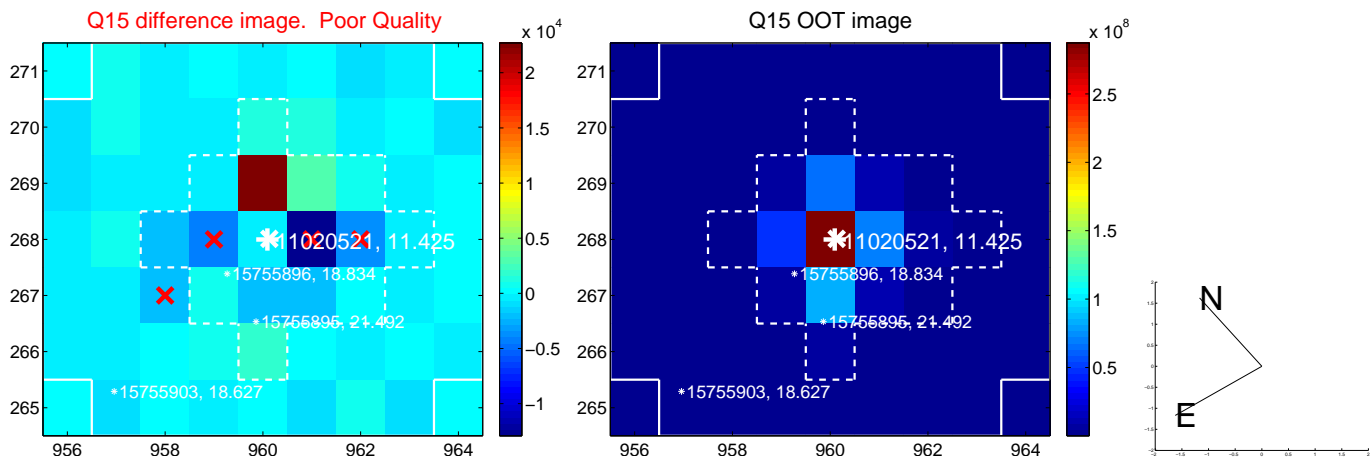
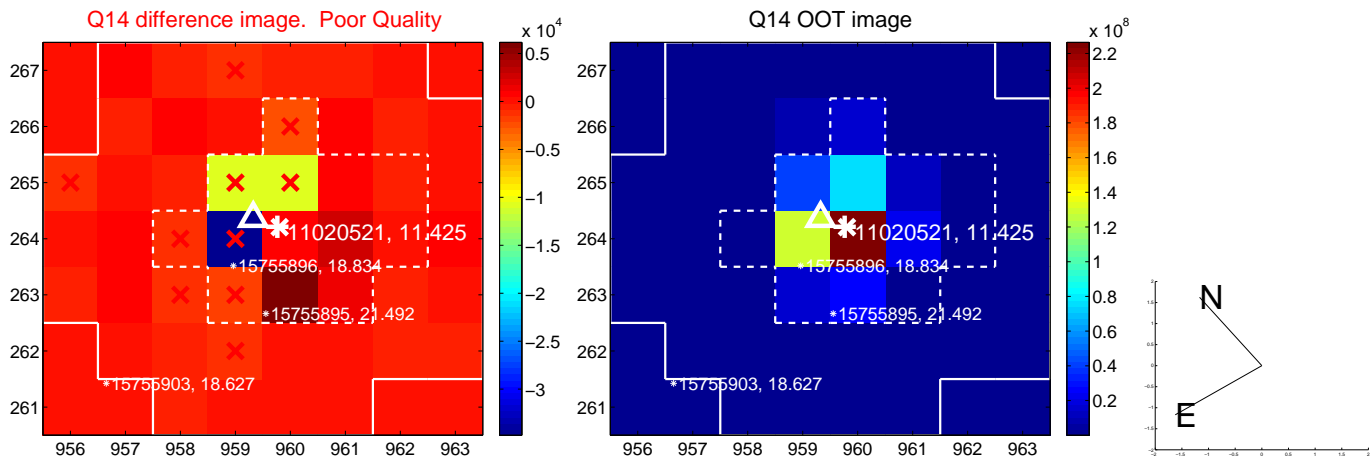
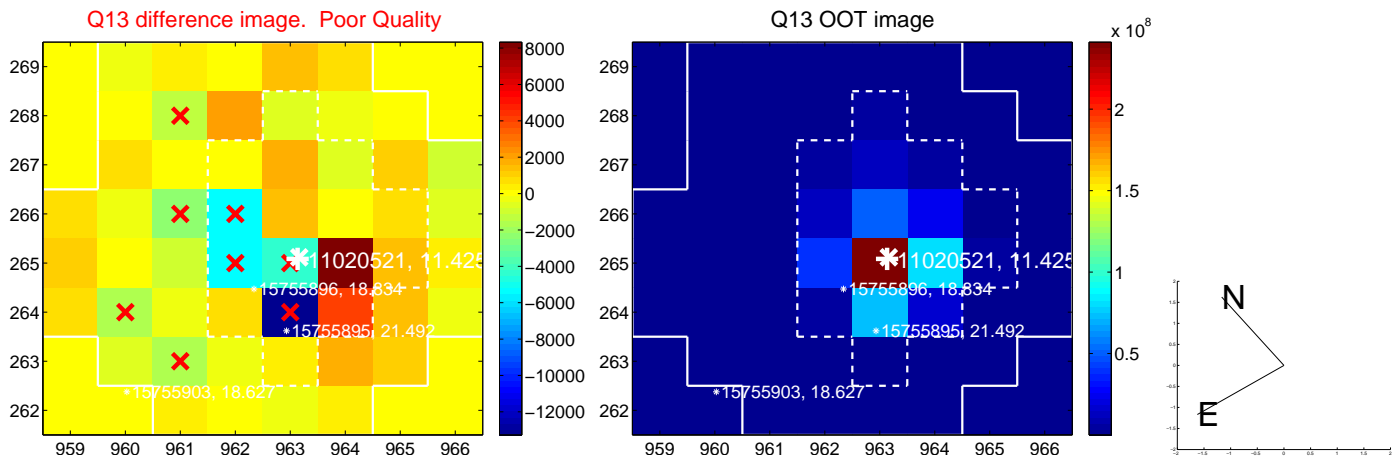
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



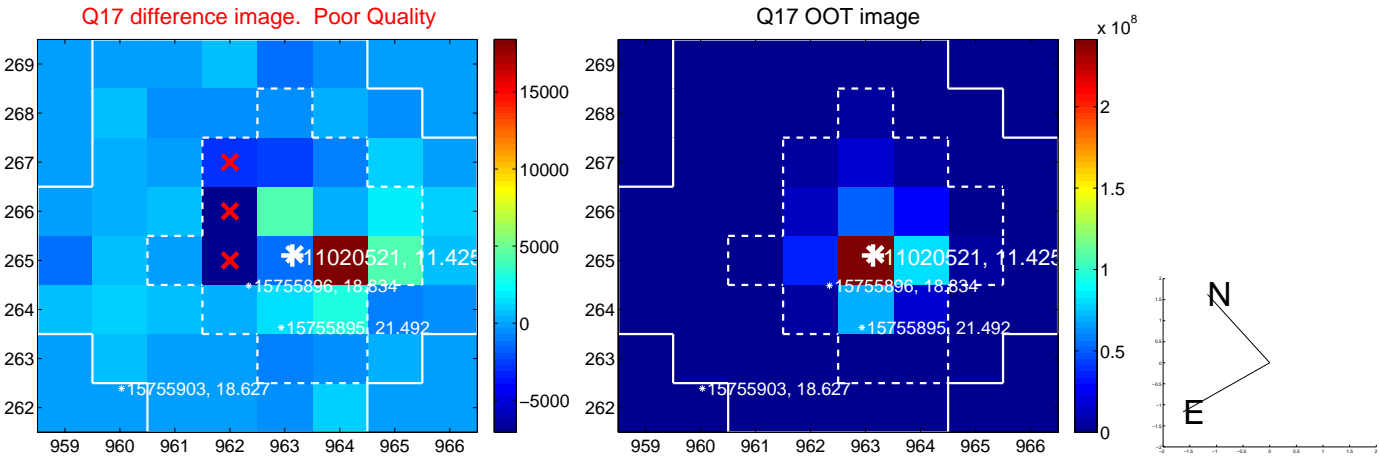
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



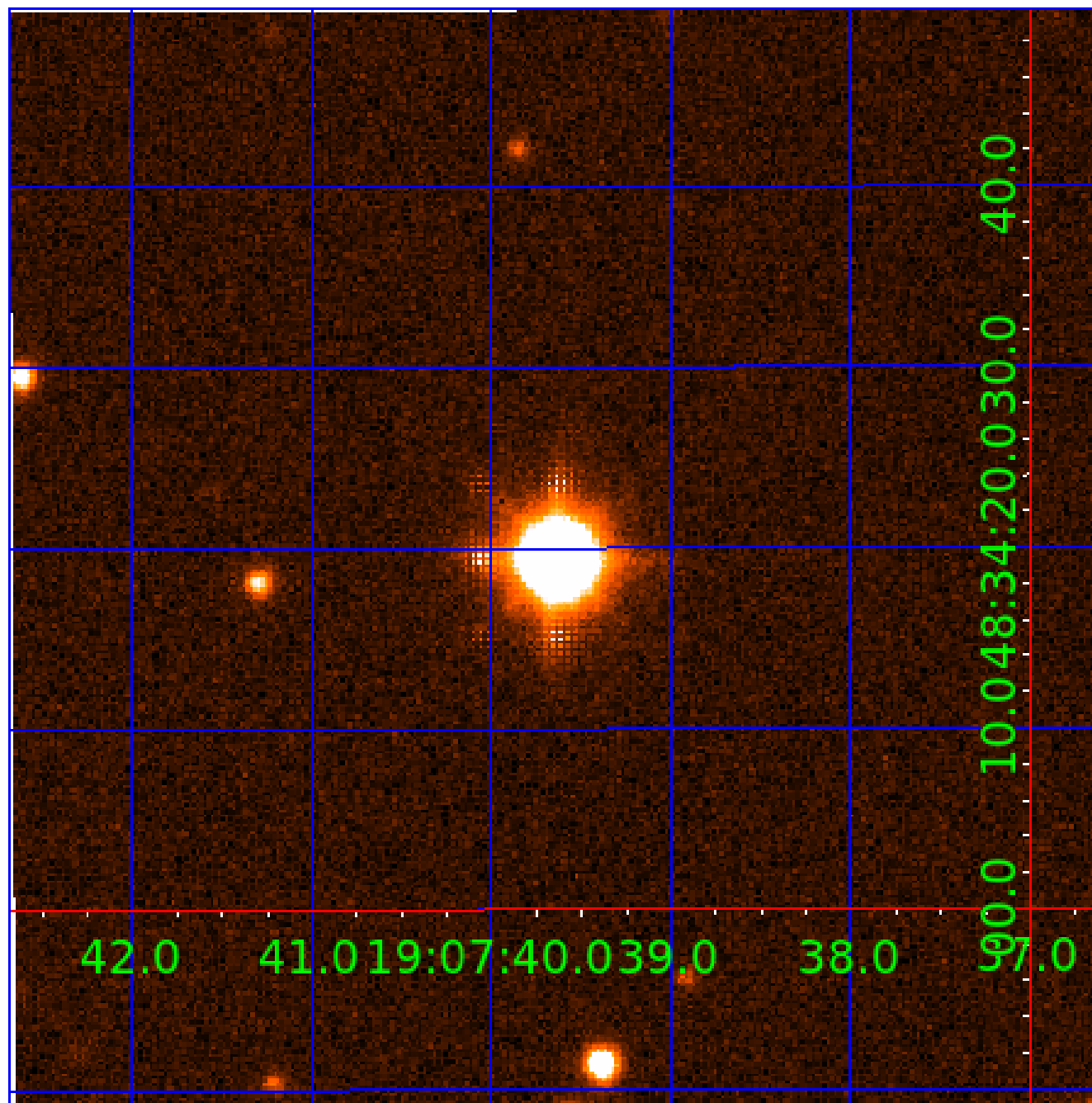
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



folded centroid time series figure for this object.

UKIRT Image

Declination





## KIC 011020521

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
011020521-01	OBS	No	2.929979	134.113706	0.1	0.514	8.2	0.0	3.22	6877	0.10	9371.70
011020521-02	OBS	No	2.930323	133.561397	22.1	5.264	8.1	6.6	3.22	6877	1.78	9370.24
011020521-03	OBS	No	2.930137	132.855754	16.9	12.993	9.2	7.9	3.22	6877	1.42	9371.03
011020521-04	OBS	No	11.171739	137.960832	85.1	3.597	8.7	9.1	3.22	6877	3.48	1573.30
011020521-05	OBS	No	293.095640	157.741380	193.4	6.042	8.2	8.1	3.22	6877	4.96	20.18
011020521-06	OBS	No	118.311612	211.553500	182.8	4.659	8.4	8.4	3.22	6877	5.08	67.65
011020521-07	OBS	No	131.858819	143.359611	66.9	9.614	8.3	5.6	3.22	6877	2.71	58.55
011020521-08	OBS	No	81.557176	178.687435	165.2	4.488	8.1	7.6	3.22	6877	4.58	111.09
011020521-09	OBS	No	36.435749	160.151233	162.1	3.382	8.0	9.4	3.22	6877	4.66	325.29
011020521-10	OBS	No	34.792680	149.579268	94.8	5.285	7.8	7.4	3.22	6877	3.67	345.93

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
011020521-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-04	OBS	FP	0.00	1	0	1	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
011020521-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-07	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-09	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_ALT—CENT_SATURATED
011020521-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

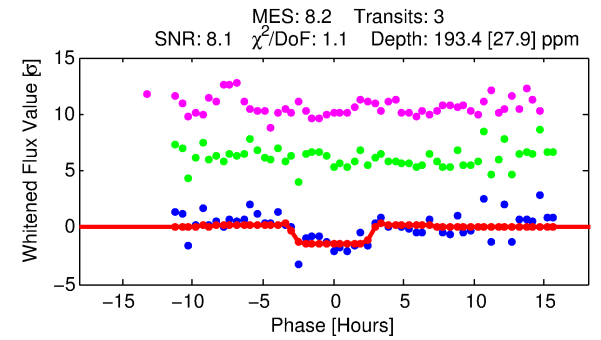
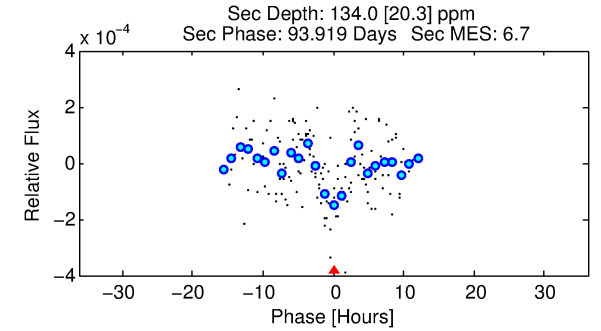
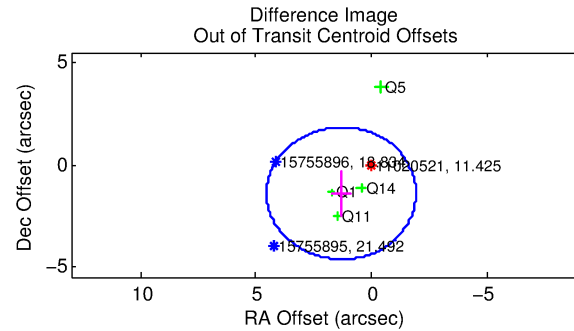
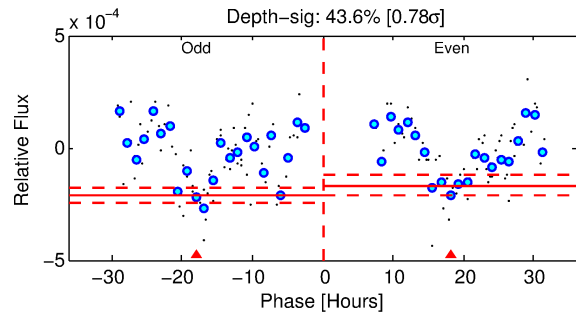
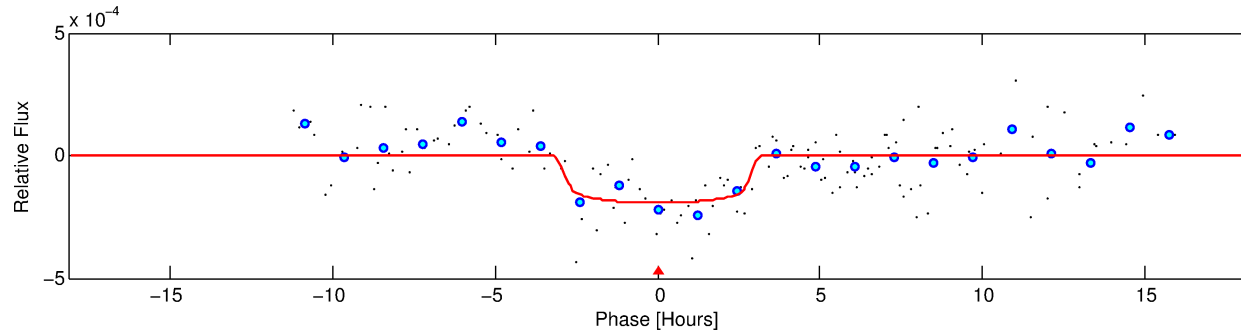
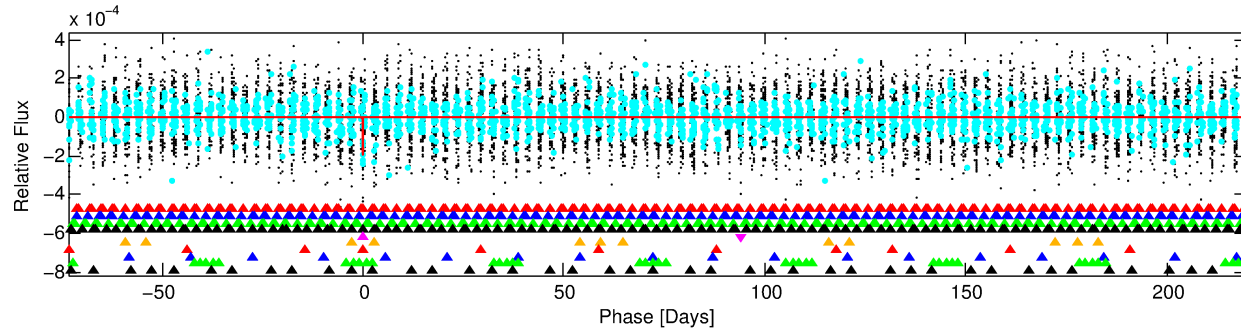
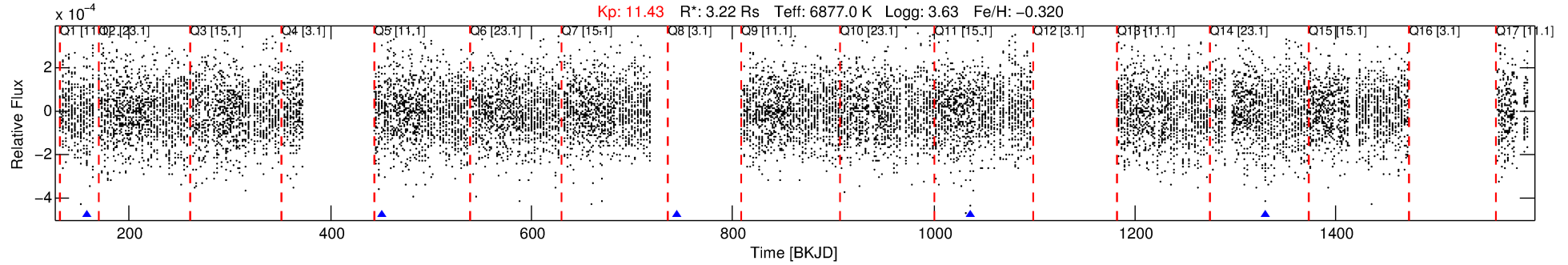
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 011020521-05

No Significant Match Found

# DV One-Page Summary

KIC: 11020521 Candidate: 5 of 10 Period: 293.096 d



## DV Fit Results:

Period = 293.09564 [0.00633] d  
Epoch = 157.7414 [0.0201] BKJD  
Rp/R\* = 0.0141 [0.0072]  
a/R\* = 225.52 [674.22]  
b = 0.81 [1.27]  
Seff = 20.18 [10.97]  
Teq = 540 [73] K  
Rp = 4.96 [3.16] Re  
a = 1.0143 [0.3484] AU  
Ag = 3086.31 [3590.55] [0.86 $\sigma$ ]  
Teffp = 6228 [1623] K [3.50 $\sigma$ ]

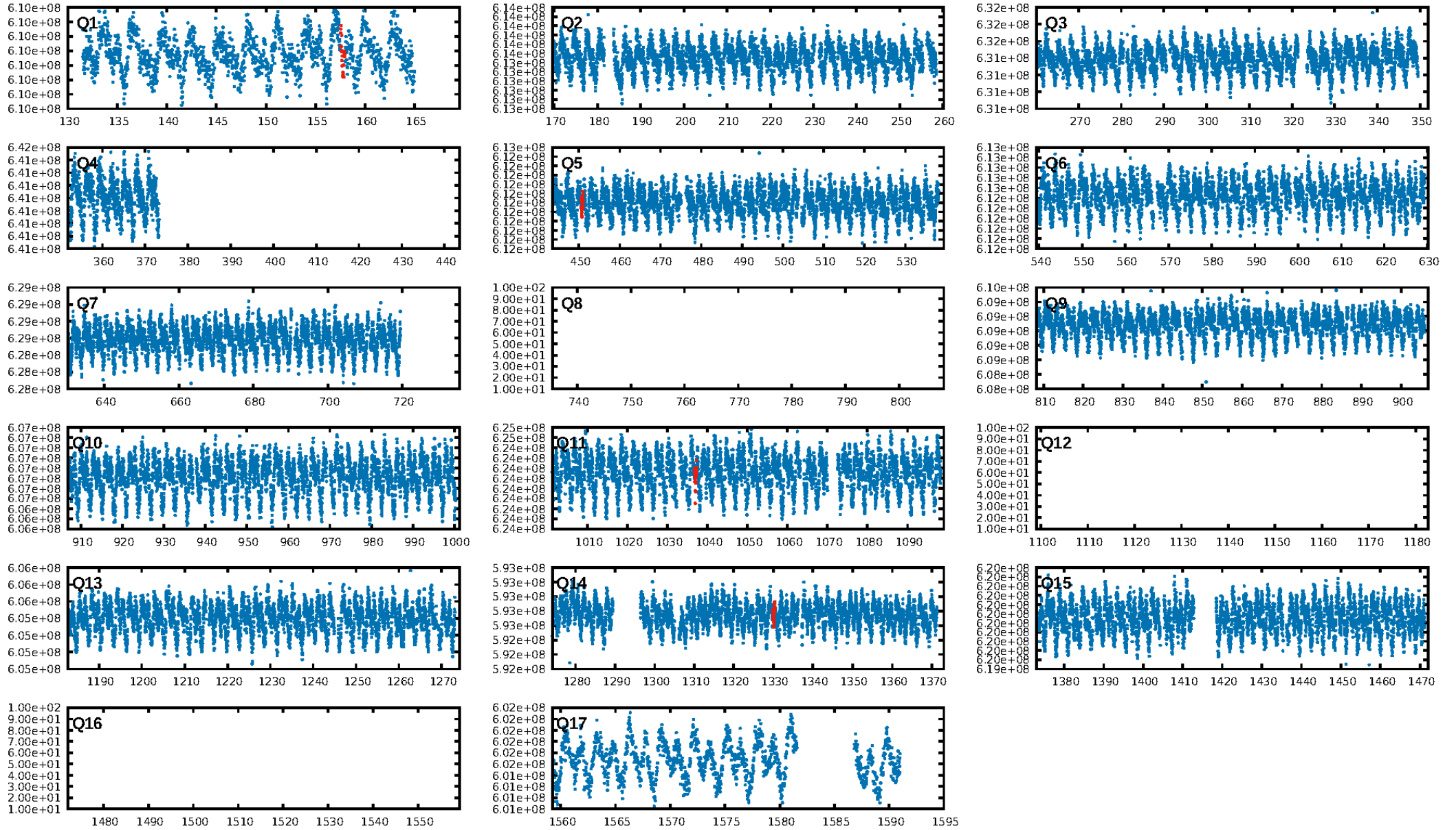
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [340.80 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 75.9%  
ModelChiSquareGof-sig: 97.6%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [2/2]  
GhostDiagnostic-chr: 1.544  
Centroid-sig: N/A  
Centroid-so: N/A  
OotOffset-rm: 1.924 arcsec [1.79 $\sigma$ ]  
KicOffset-rm: 2.035 arcsec [1.59 $\sigma$ ]  
OotOffset-st: 1/1/0/2 [4]  
KicOffset-st: 1/1/0/2 [4]  
DiffImageQuality-fgm: 0.75 [3/4]  
DiffImageOverlap-fno: 0.00 [0/4]

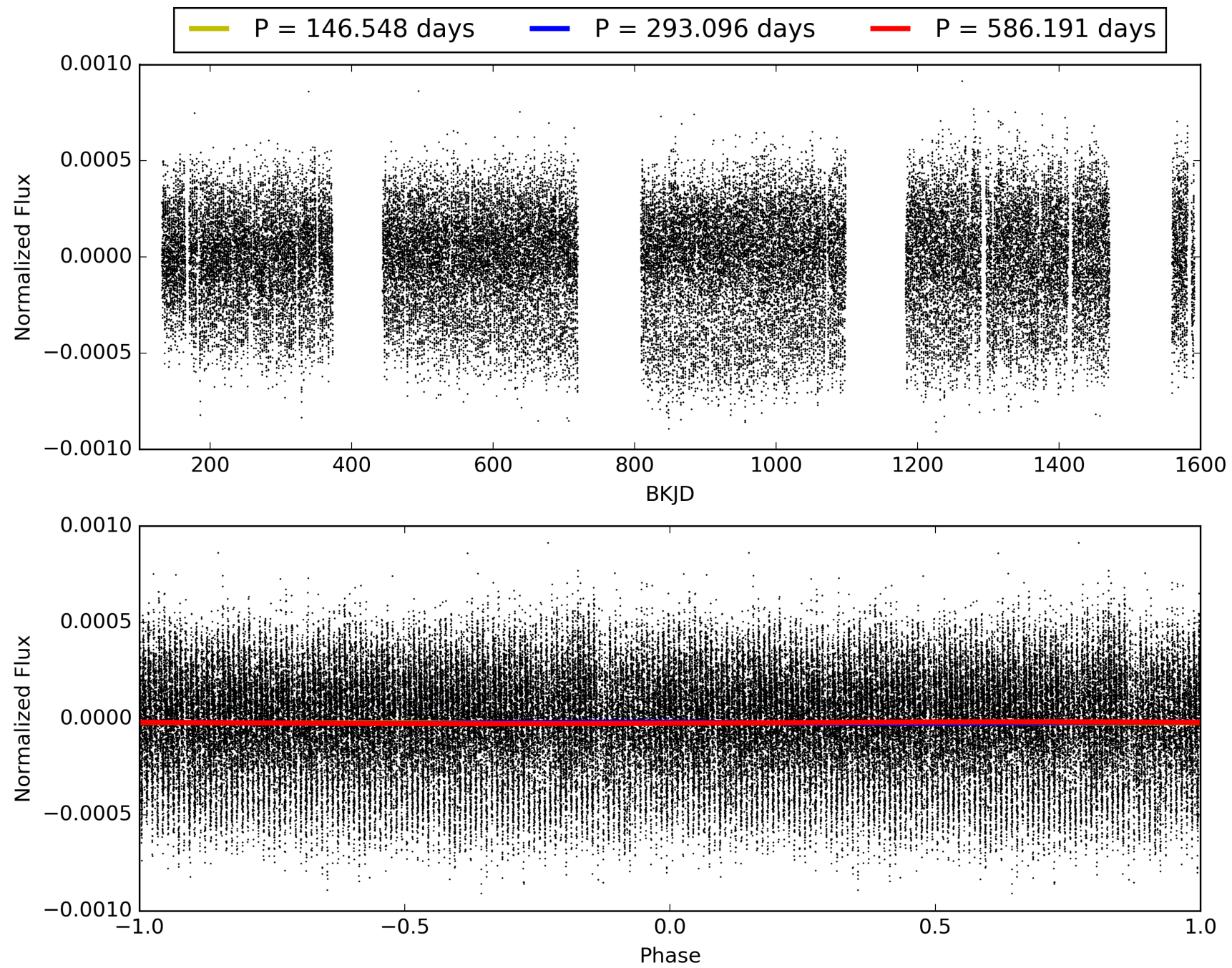
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 05:45:04 Z

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

# TCE 011020521-05, PDC Light Curves

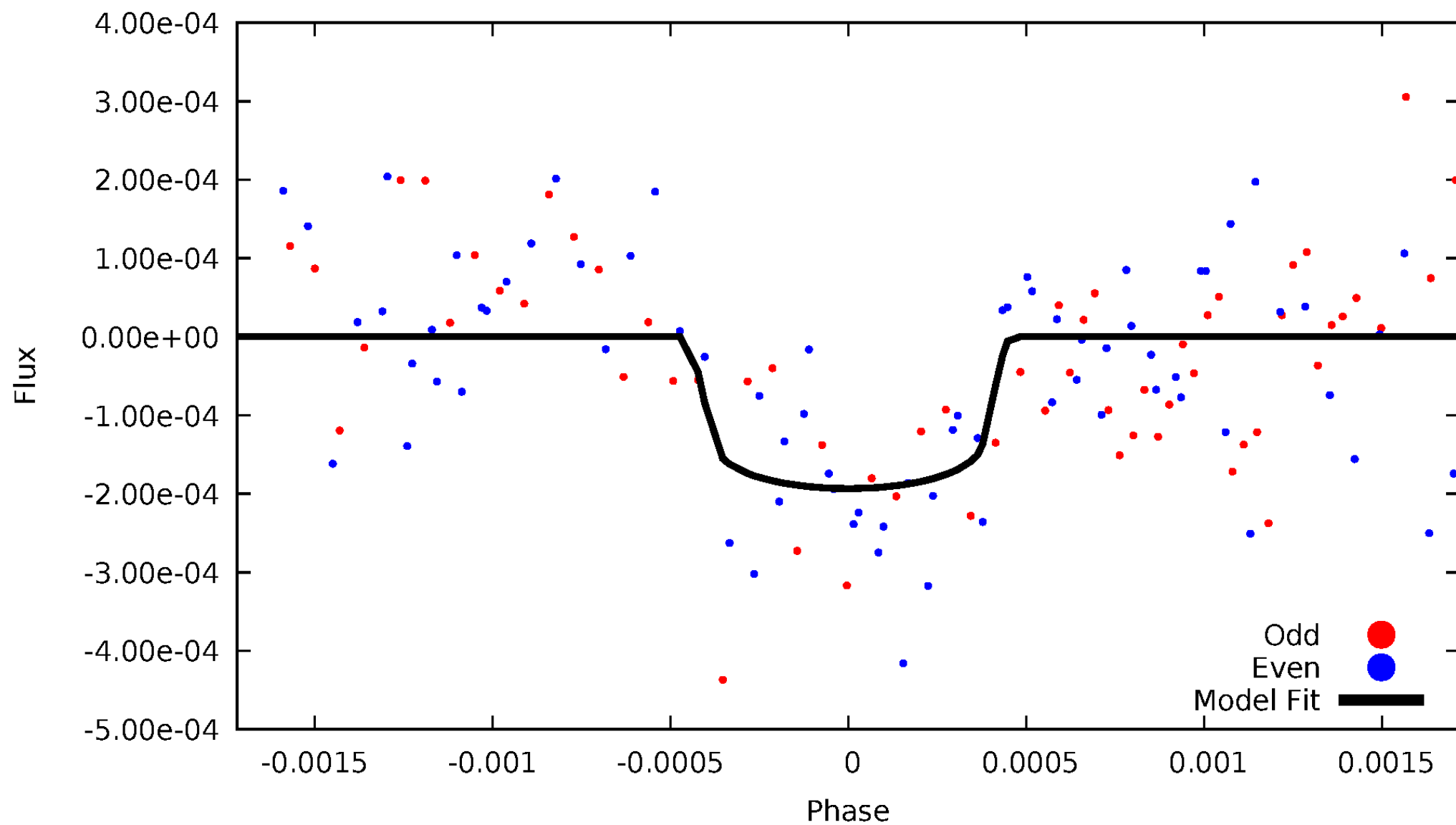


# TCE 011020521-05



# DV Odd/Even

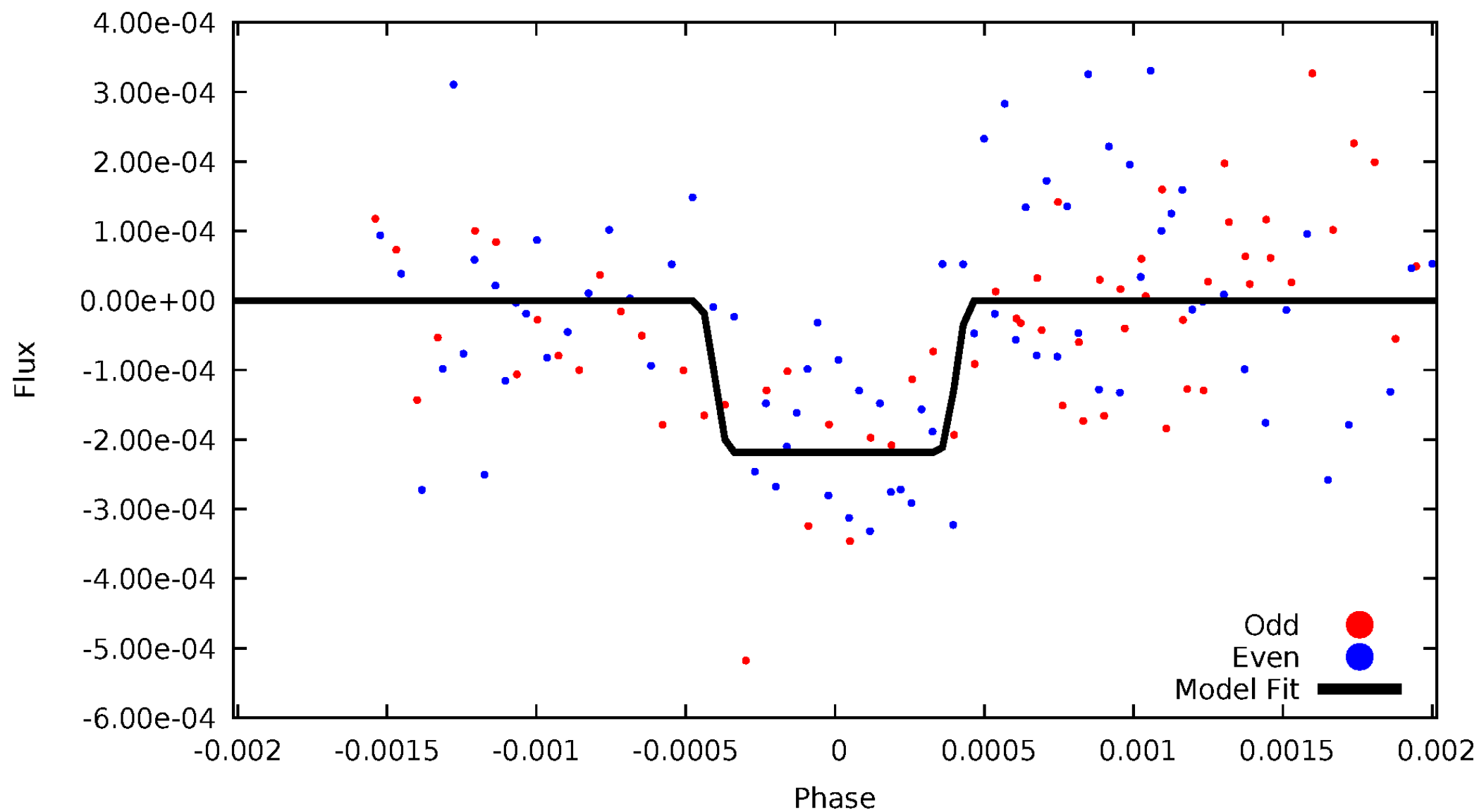
TCE 011020521-05





# ALT Odd/Even

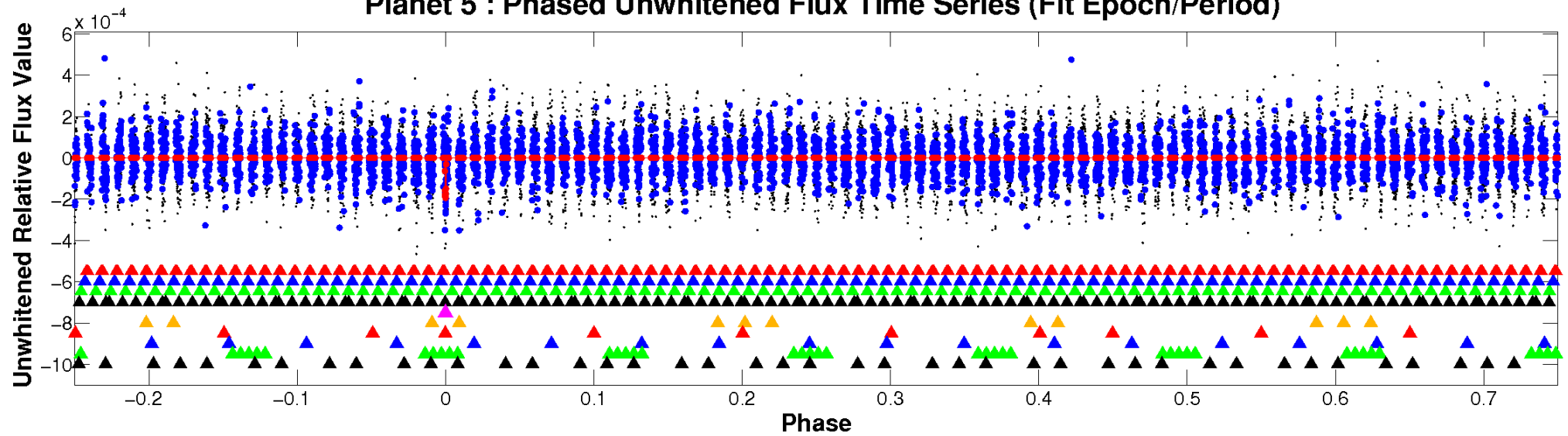
TCE 011020521-05



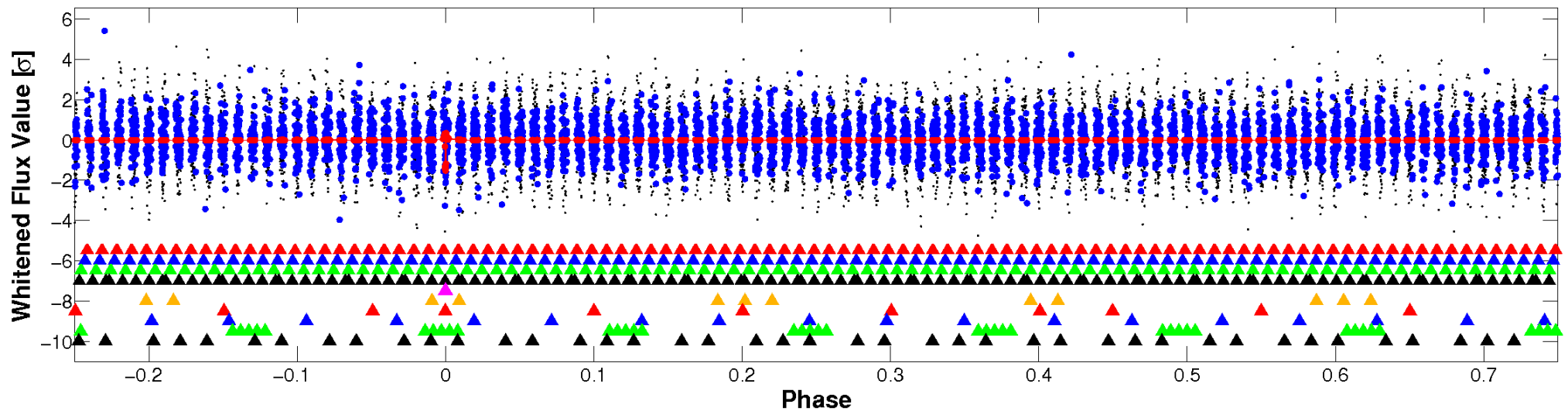


# Non-Whitened Vs. Whitened Light Curve

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

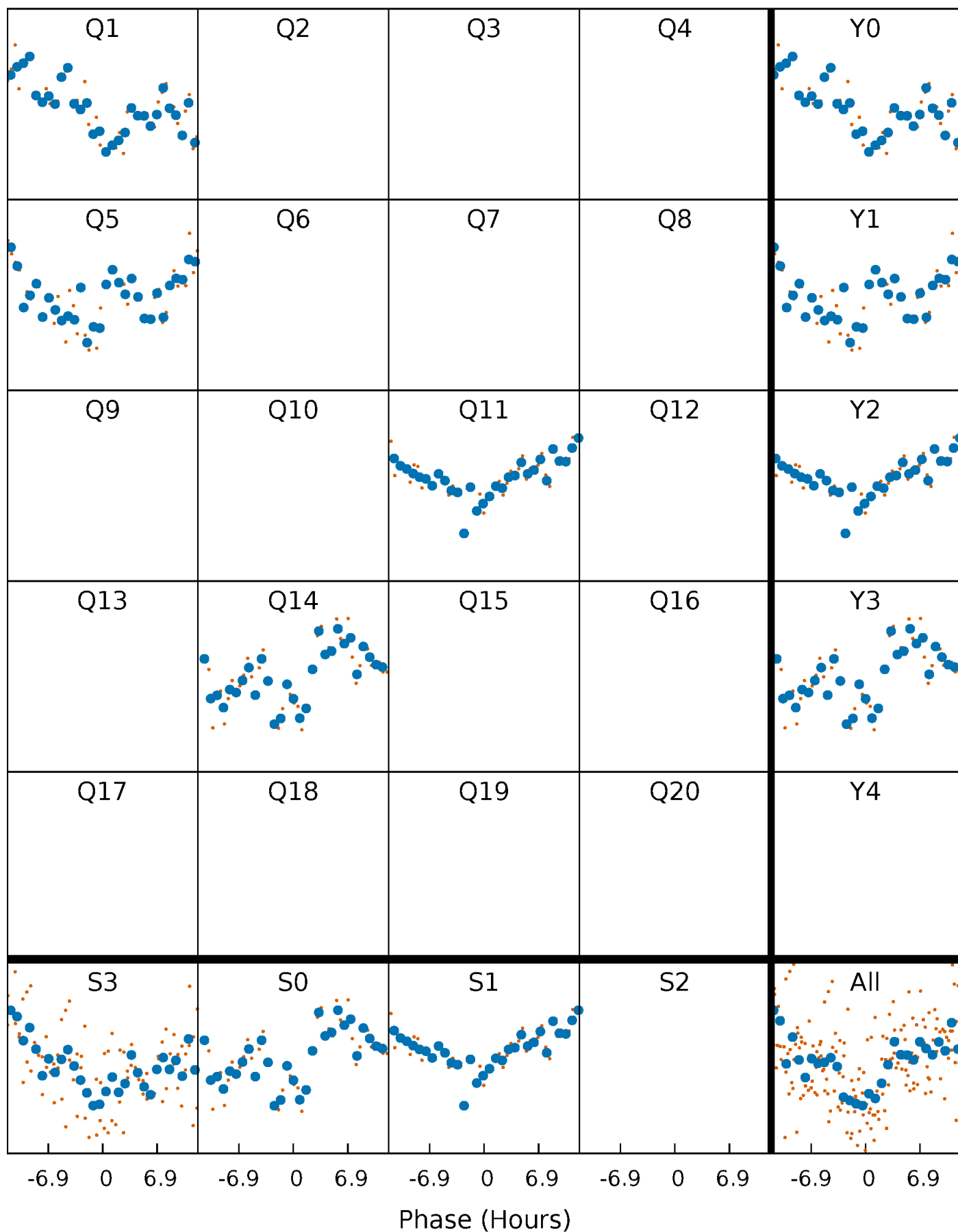


## Planet 5 : Phased Whitened Flux Time Series (Fit Epoch/Period)



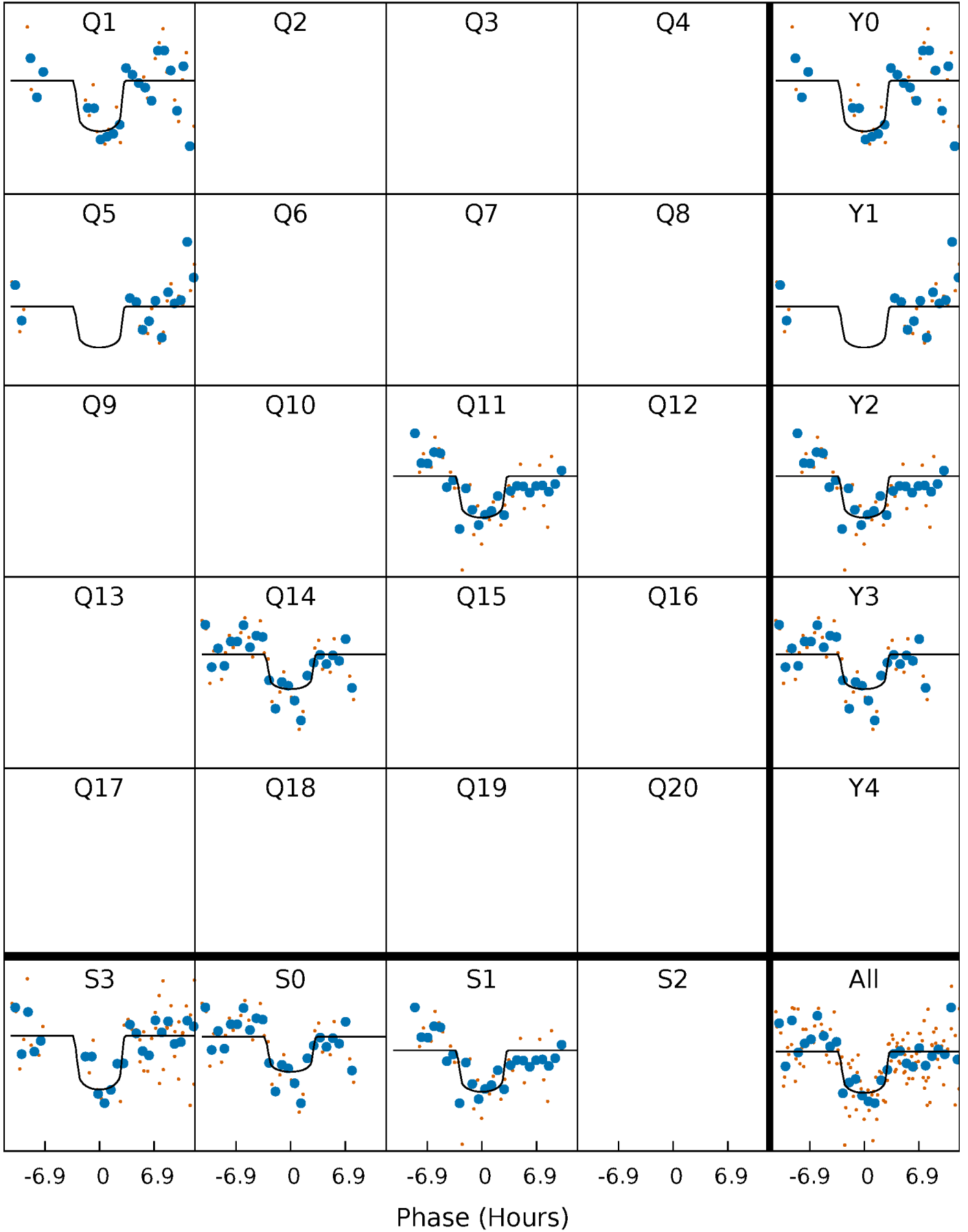
# PDC Quarter-Phased Transit Curves

TCE 011020521-05     $P=293.095640$  Days     $T_0=157.741380$  (BKJD)



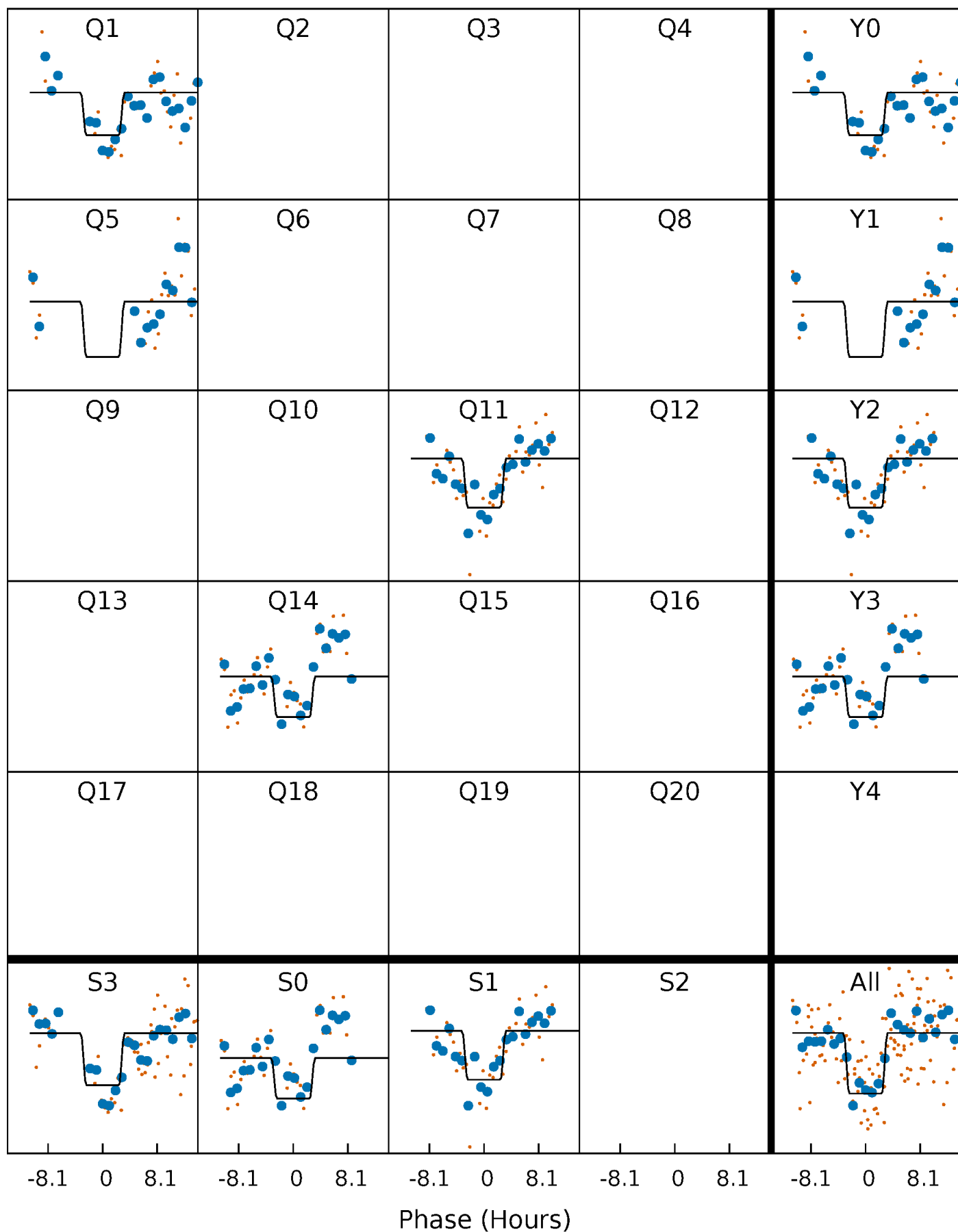
# DV Quarter-Phased Transit Curves

TCE 011020521-05     $P=293.095640$  Days     $T_0=157.741380$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

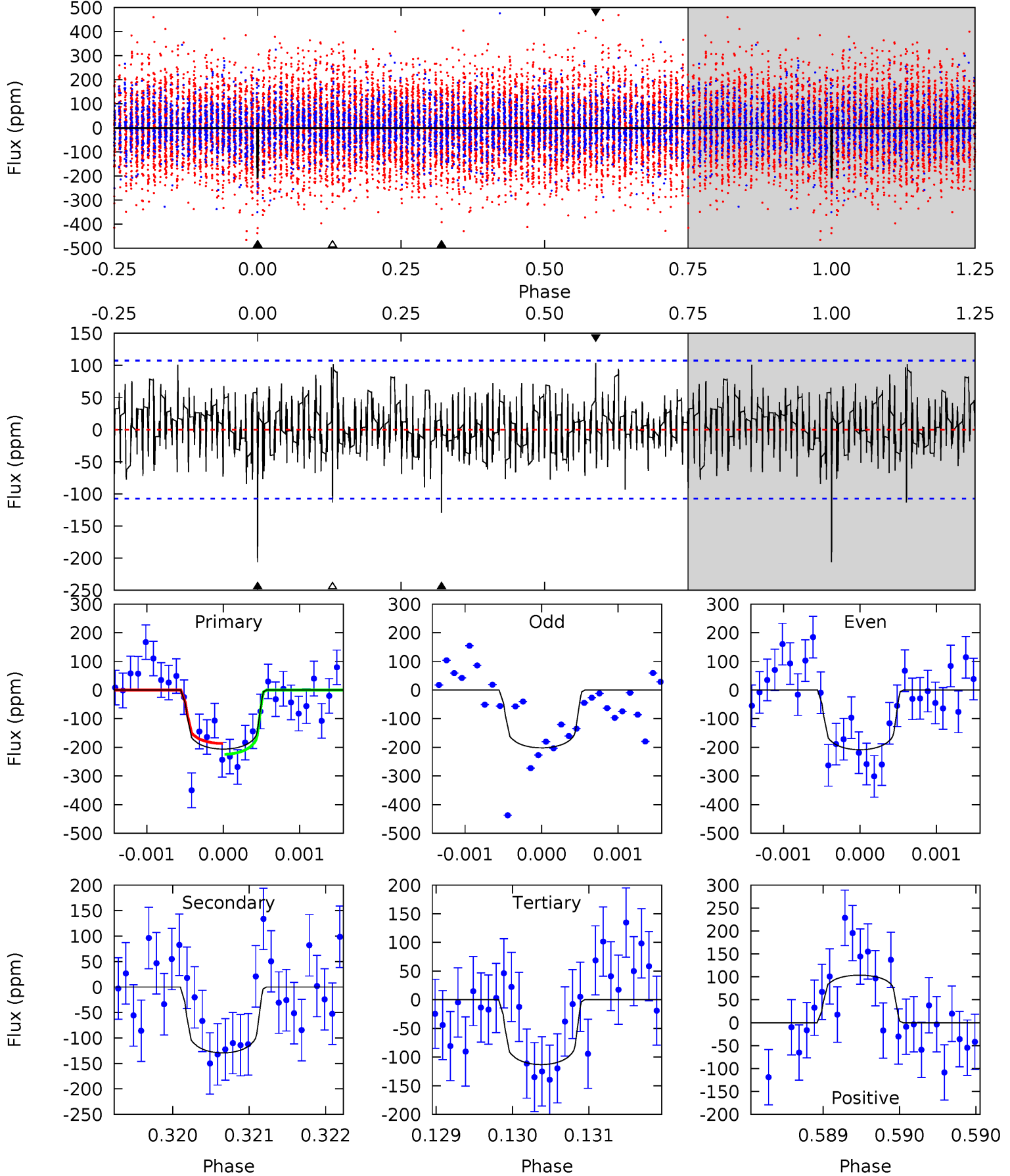
TCE 011020521-05 P=293.092173 Days  $T_0=157.735941$  (BKJD)



# DV Model-Shift Uniqueness Test

011020521-05, P = 293.095640 Days, E = 157.741380 Days

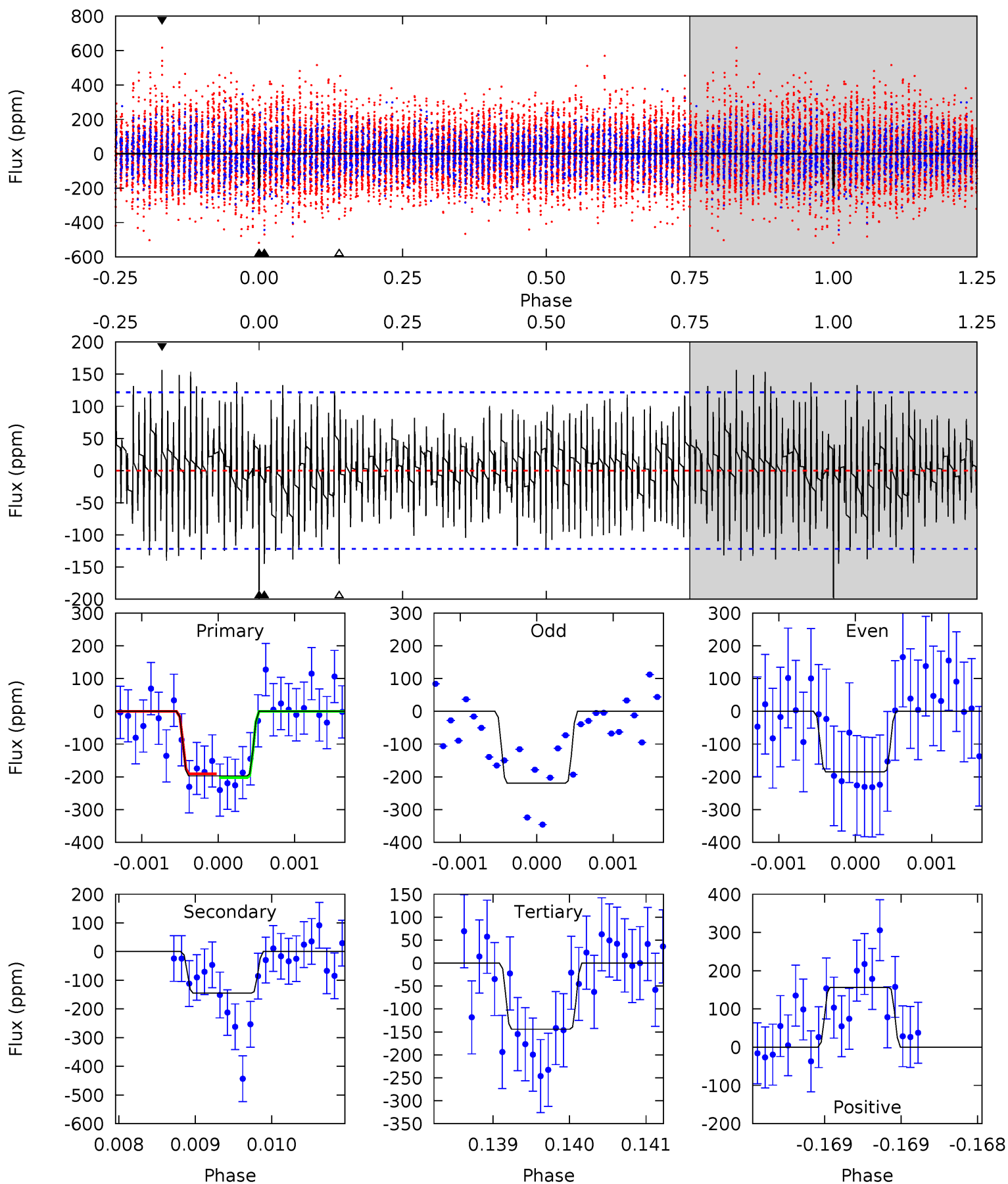
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
10.5	6.60	5.77	5.29	5.48	3.34	1.61	4.75	5.23	0.83	1.31	0.16	1.02	0.33	0.96



# Alt Model-Shift Uniqueness Test

011020521-05, P = 293.092173 Days, E = 157.735941 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
8.86	6.51	6.48	7.04	5.48	3.33	2.44	2.39	1.83	0.03	-0.53	0.74	0.91	0.44	0.26





### Stellar Parameters For KIC 011020521

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6877^{+170}_{-204}$	$3.632^{+0.304}_{-0.076}$	$-0.320^{+0.300}_{-0.250}$	$3.219^{+0.406}_{-1.217}$	$1.619^{+0.227}_{-0.312}$	$0.068^{+0.149}_{-0.017}$
	+2%/-3%	+8%/-2%	+94%/-78%	+13%/-38%	+14%/-19%	+218%/-25%
Source	PHO1	FLK73	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 011020521-05 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-129 \pm 20$	$4.41^{+2.89}_{-2.05}$	$738^{+41}_{-61}$	$6148^{+2775}_{-1061}$	$3715^{+9084}_{-2296}$
Alt.	$-145 \pm 22$	$4.90^{+2.76}_{-2.37}$	$740^{+38}_{-66}$	$6046^{+2726}_{-1004}$	$3399^{+9346}_{-2011}$

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

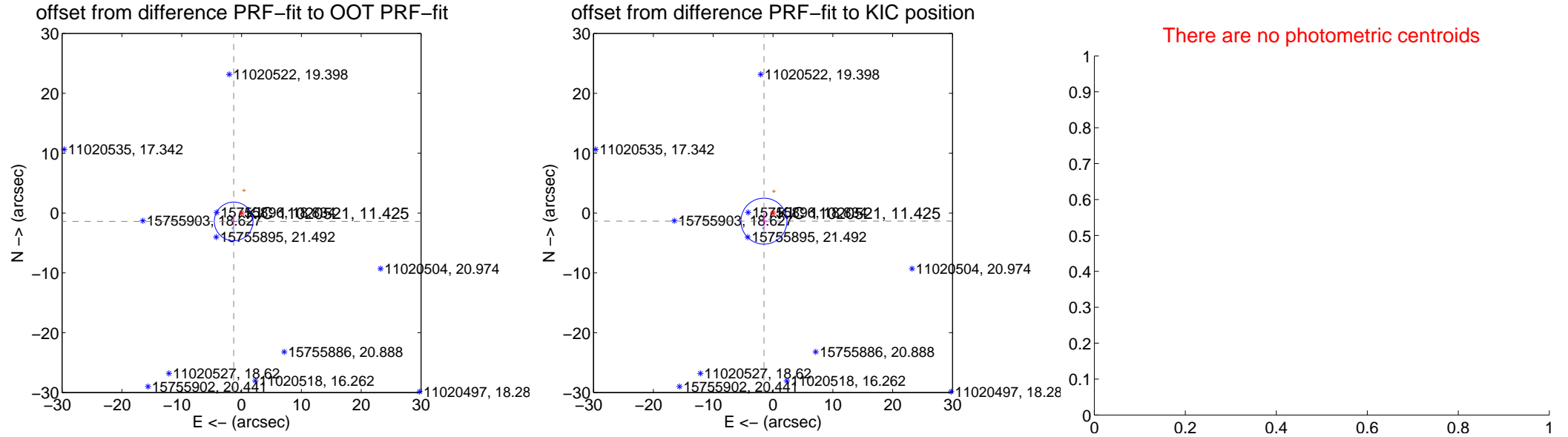
## DV Centroid Data

Supplemental centroid analysis for 011020521-05. **Kepler magnitude: 11.43.** Transit SNR 8.07

**There are 3 quarters with good PRF difference image offsets**

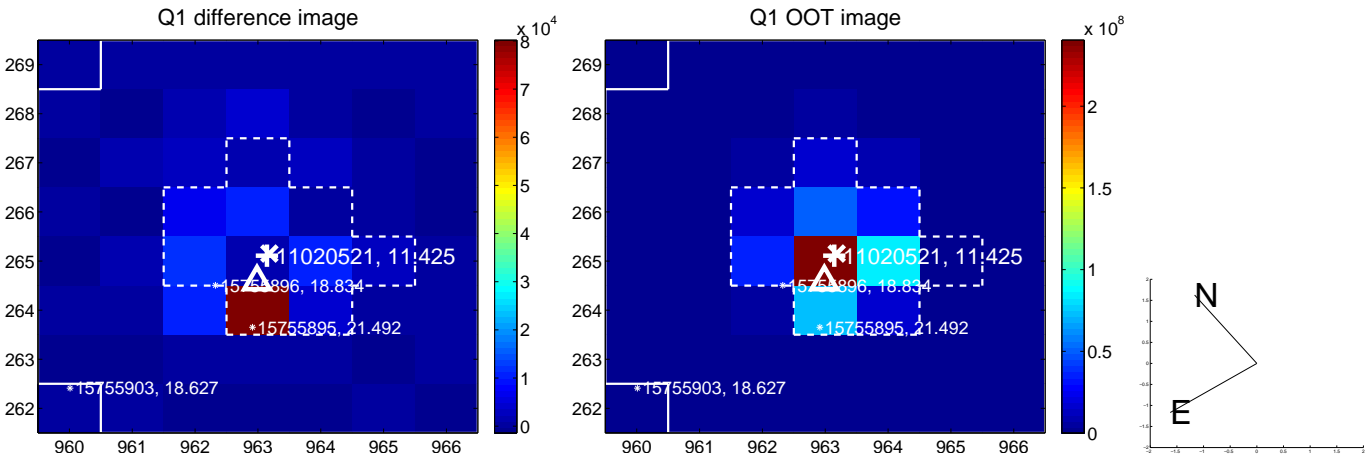
The direct PRF centroid is offset from the target star catalog position by about 0.18 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.924 \pm 1.078$	1.79	$1.315 \pm 0.440$	$-1.404 \pm 1.129$
PRF-fit source offset from KIC position	$2.035 \pm 1.281$	1.59	$1.514 \pm 0.486$	$-1.361 \pm 1.408$
photometric centroid source offset	—	—	—	—

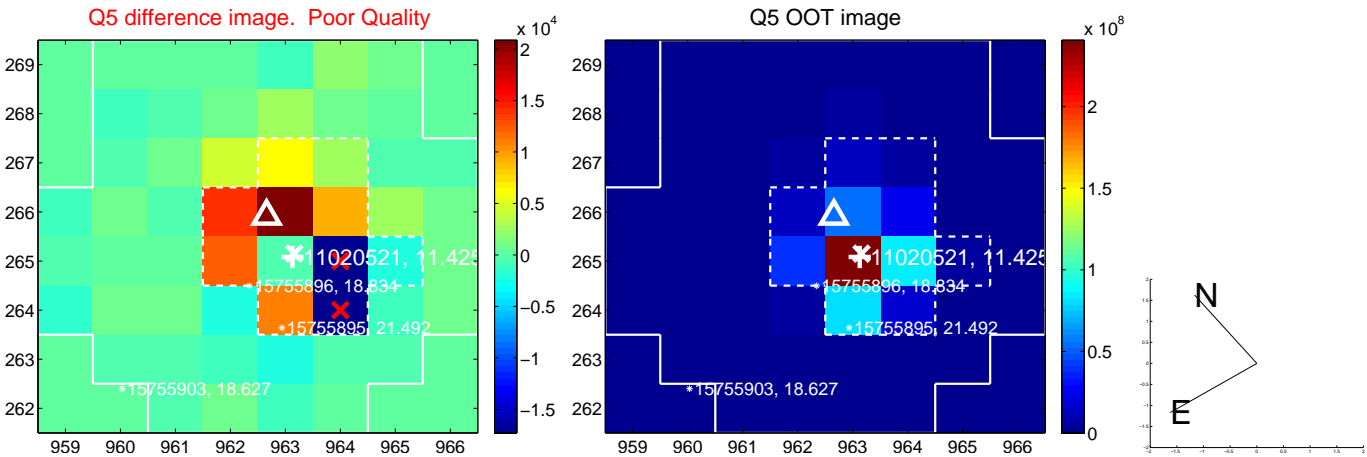


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

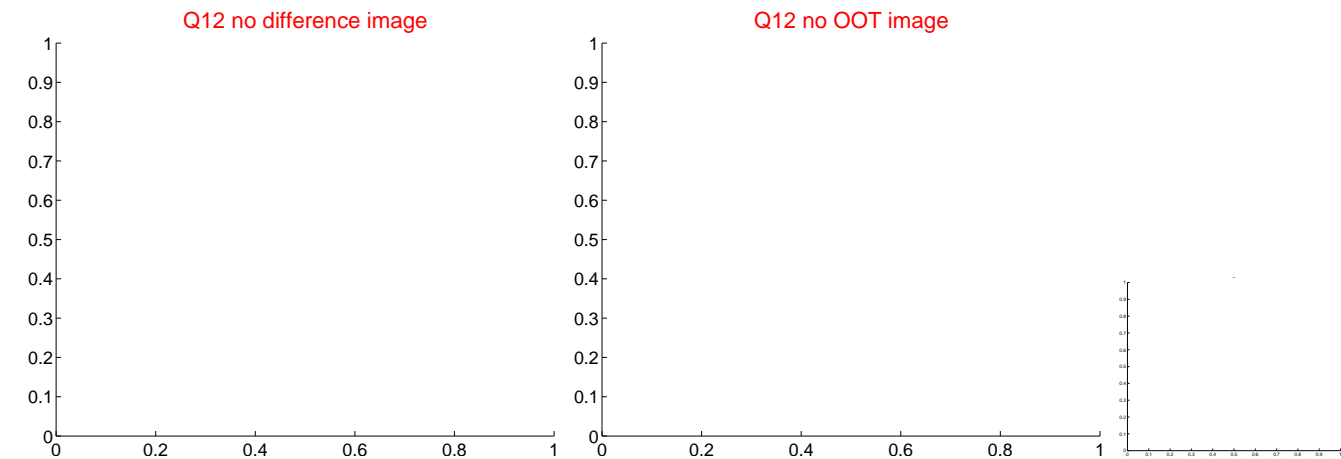
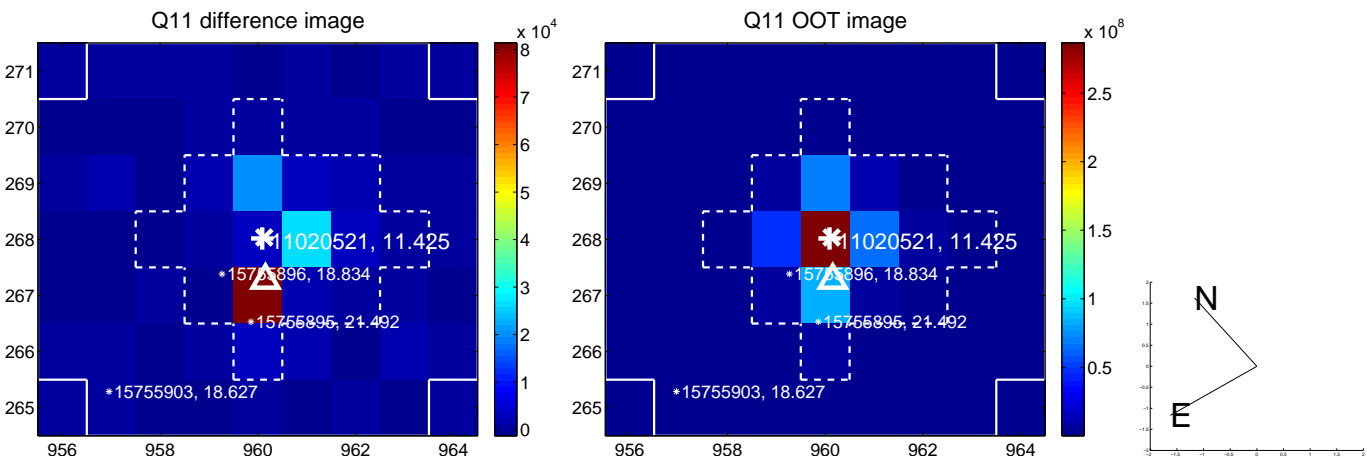
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



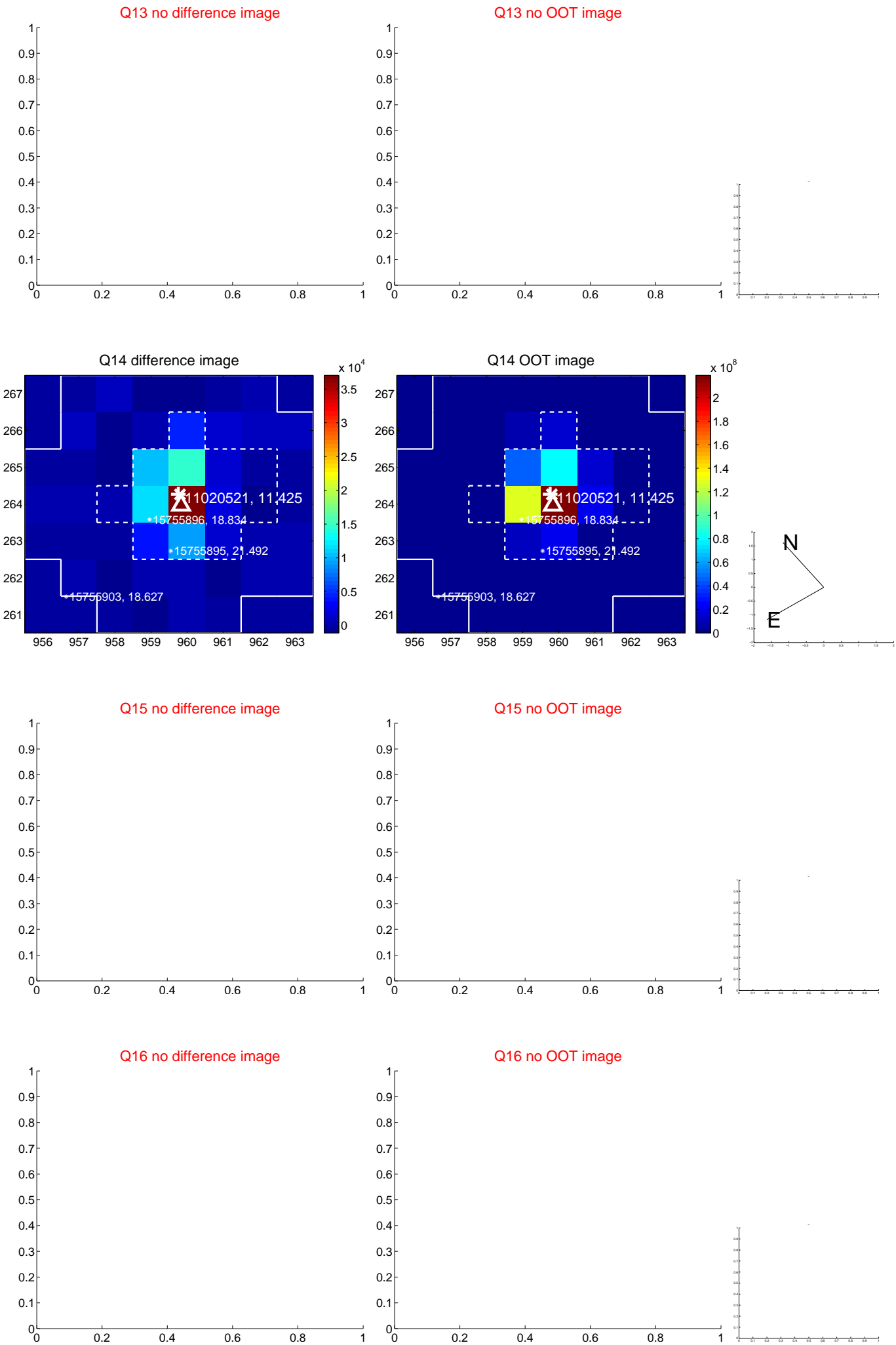
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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.





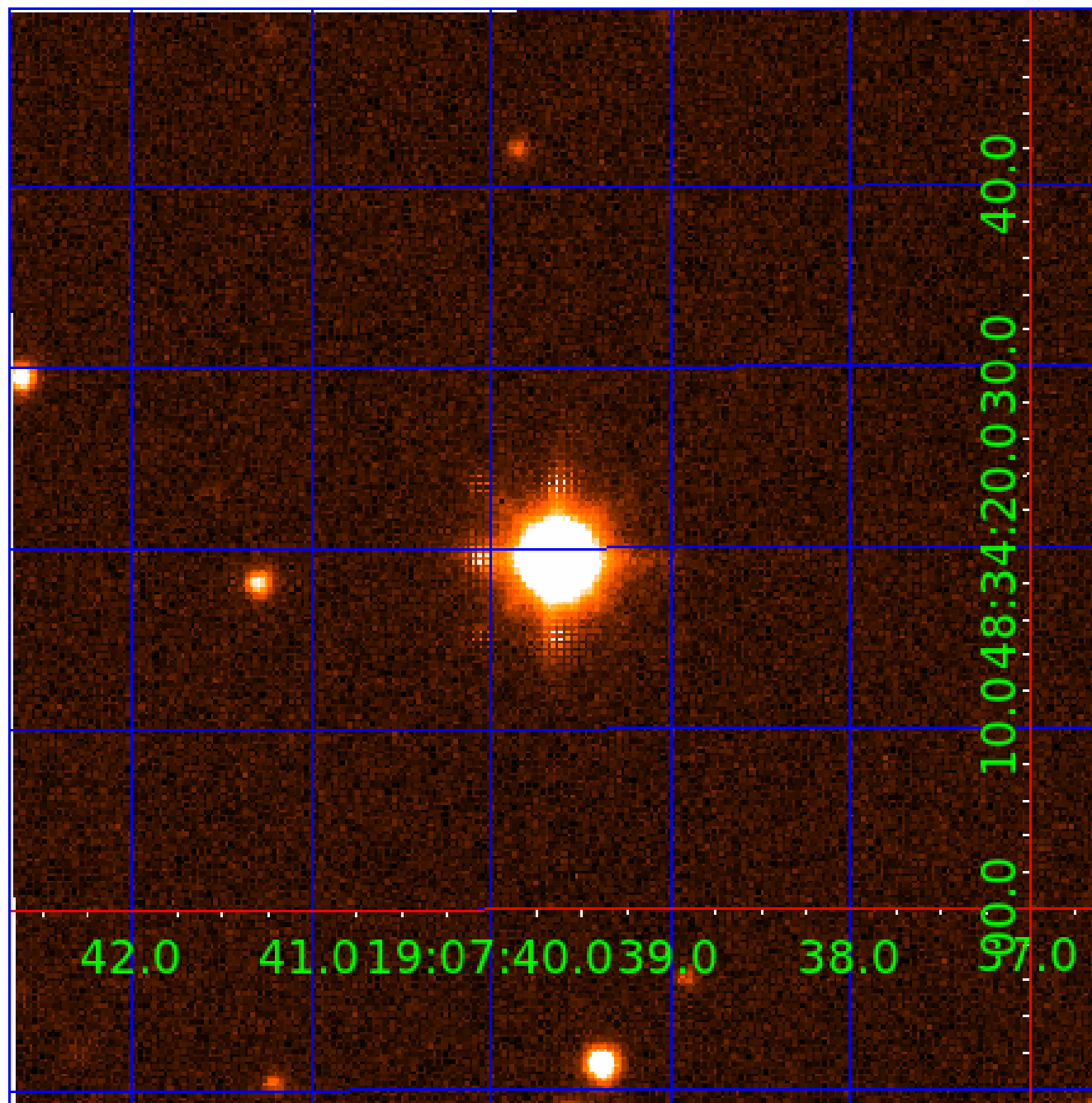
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



folded centroid time series figure for this object.

UKIRT Image

Declination



## KIC 011020521

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
011020521-01	OBS	No	2.929979	134.113706	0.1	0.514	8.2	0.0	3.22	6877	0.10	9371.70
011020521-02	OBS	No	2.930323	133.561397	22.1	5.264	8.1	6.6	3.22	6877	1.78	9370.24
011020521-03	OBS	No	2.930137	132.855754	16.9	12.993	9.2	7.9	3.22	6877	1.42	9371.03
011020521-04	OBS	No	11.171739	137.960832	85.1	3.597	8.7	9.1	3.22	6877	3.48	1573.30
011020521-05	OBS	No	293.095640	157.741380	193.4	6.042	8.2	8.1	3.22	6877	4.96	20.18
011020521-06	OBS	No	118.311612	211.553500	182.8	4.659	8.4	8.4	3.22	6877	5.08	67.65
011020521-07	OBS	No	131.858819	143.359611	66.9	9.614	8.3	5.6	3.22	6877	2.71	58.55
011020521-08	OBS	No	81.557176	178.687435	165.2	4.488	8.1	7.6	3.22	6877	4.58	111.09
011020521-09	OBS	No	36.435749	160.151233	162.1	3.382	8.0	9.4	3.22	6877	4.66	325.29
011020521-10	OBS	No	34.792680	149.579268	94.8	5.285	7.8	7.4	3.22	6877	3.67	345.93

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
011020521-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-04	OBS	FP	0.00	1	0	1	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
011020521-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-07	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-09	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_ALT—CENT_SATURATED
011020521-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—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.

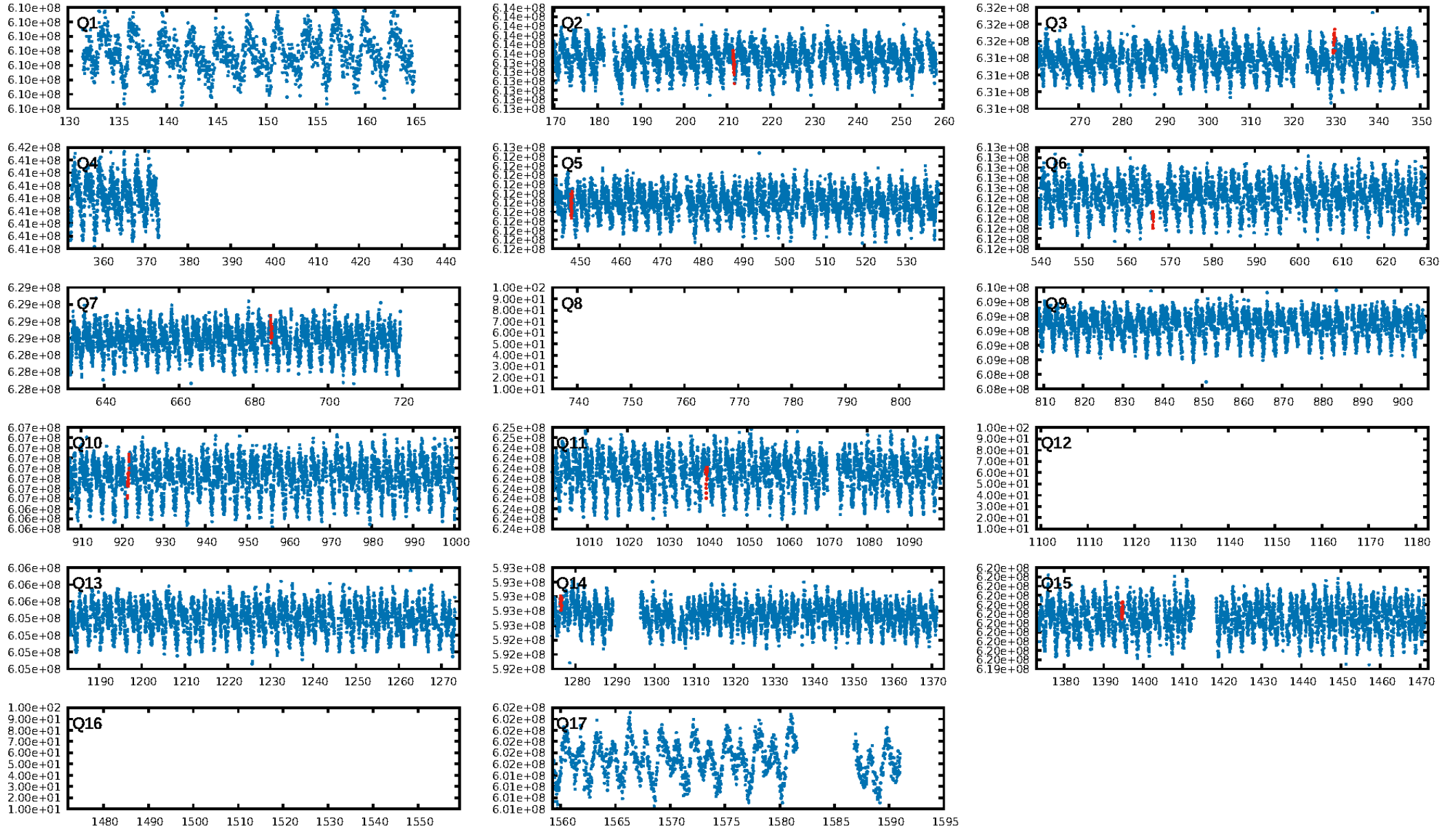
Ephemeris Match Information For 011020521-06

No Significant Match Found

KIC: 11020521    Candidate: 6 of 10    Period: 118.312 d

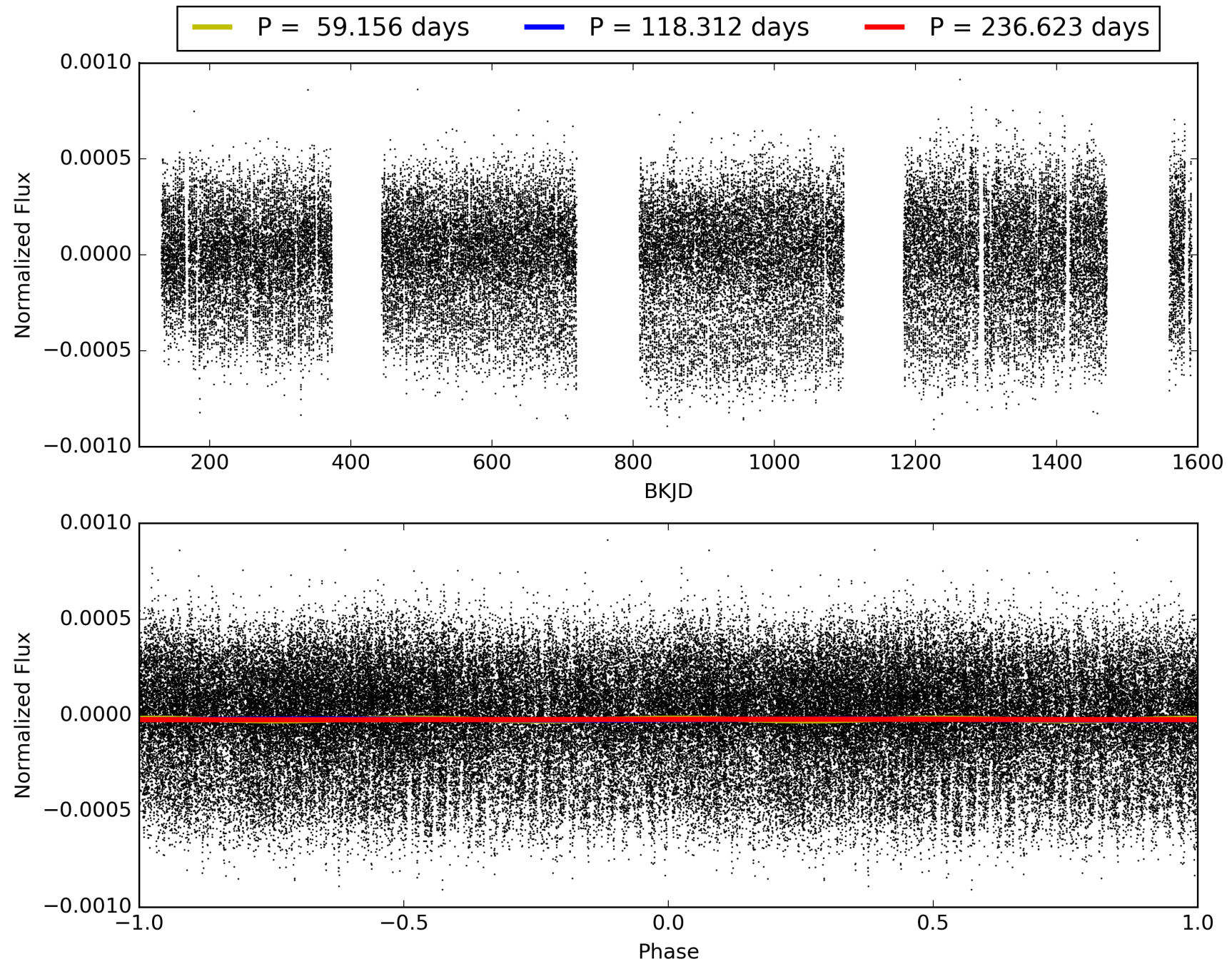


# TCE 011020521-06, PDC Light Curves



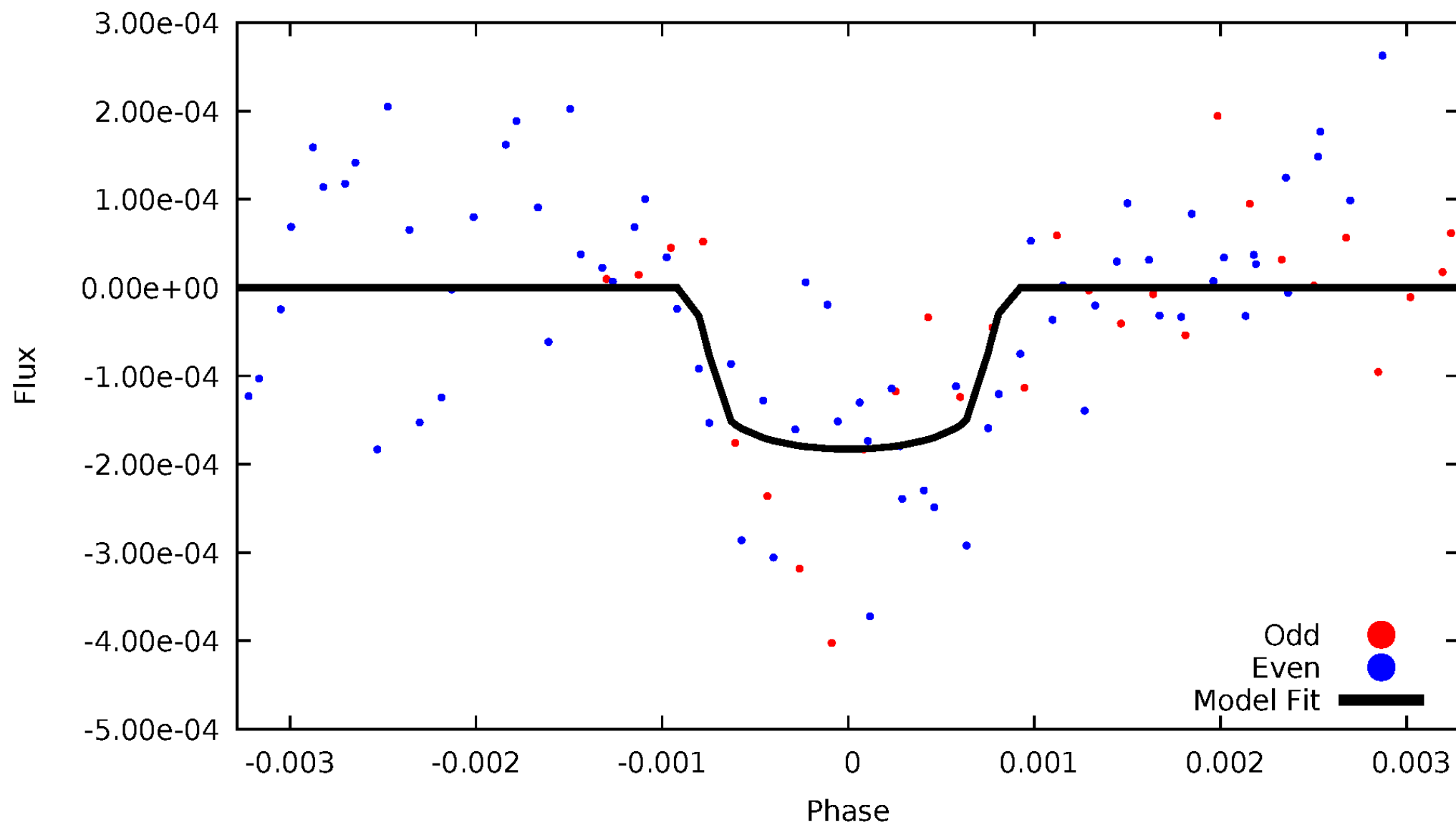


TCE 011020521-06



# DV Odd/Even

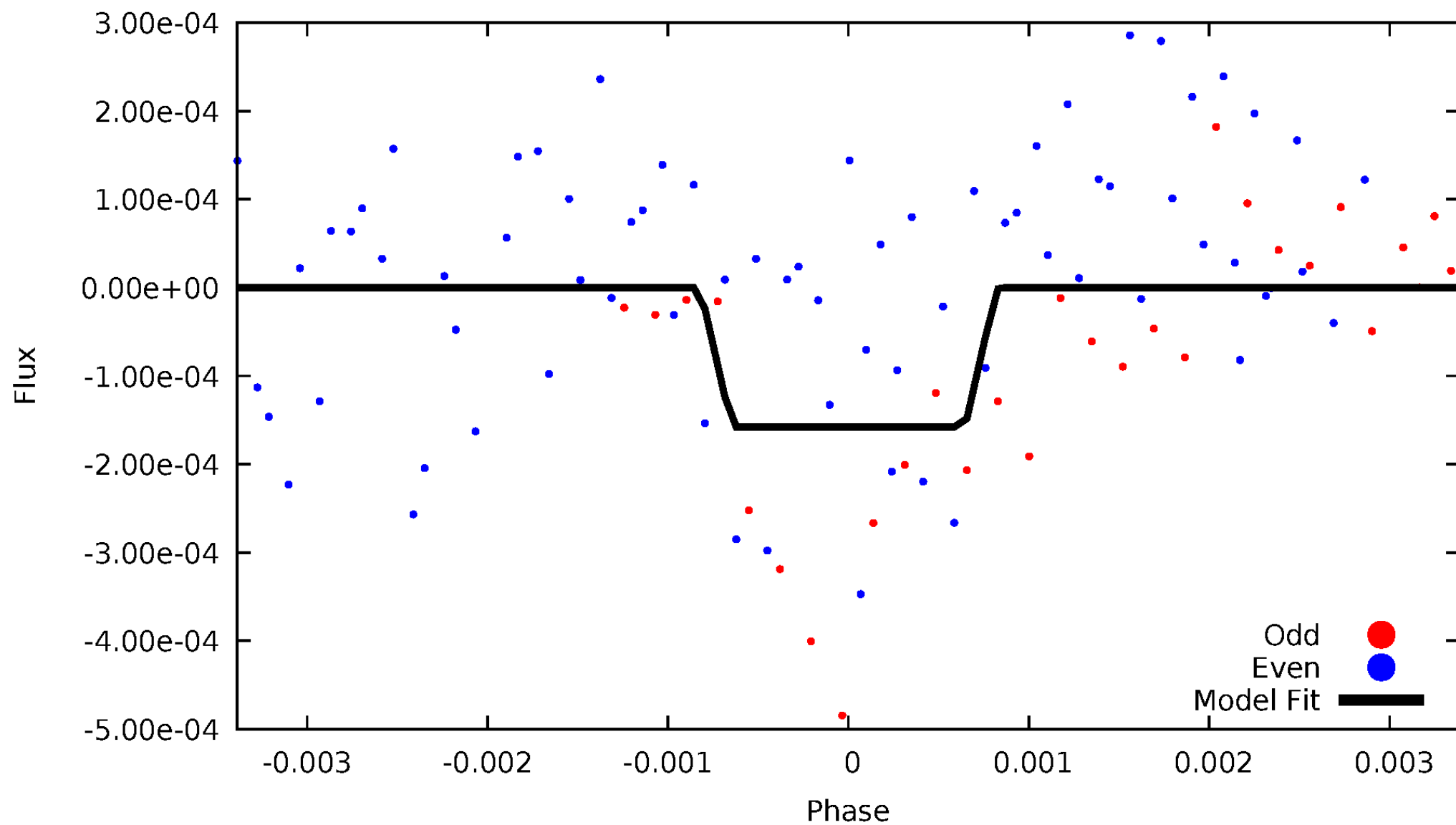
TCE 011020521-06





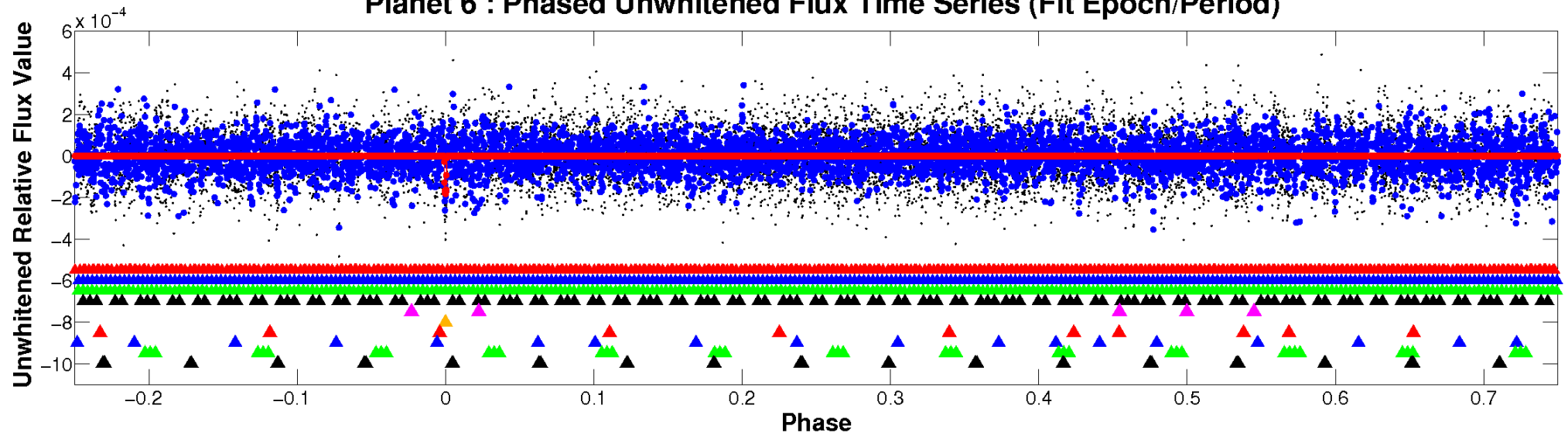
# ALT Odd/Even

TCE 011020521-06

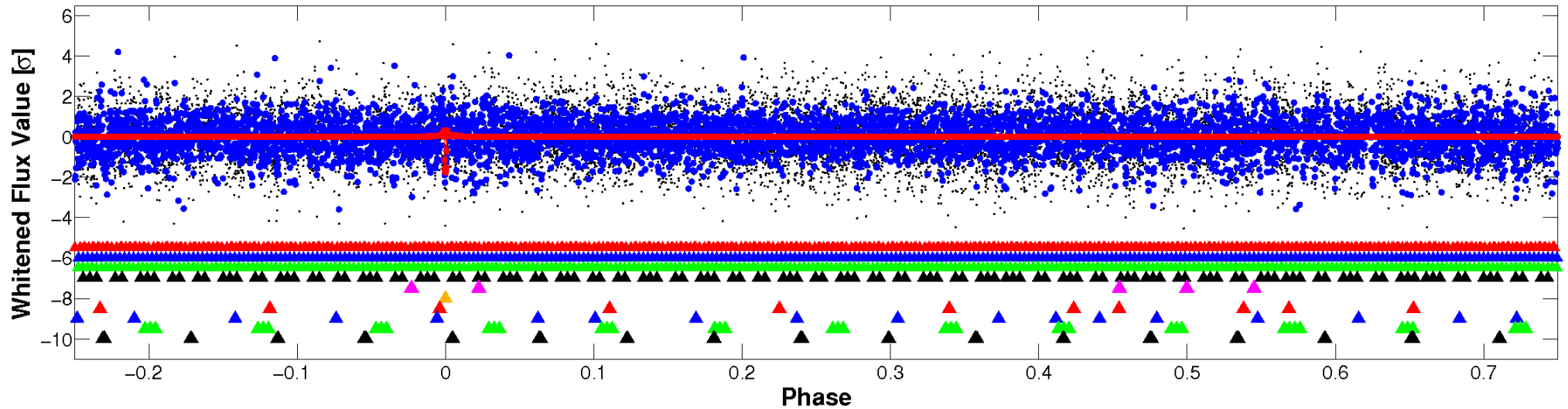


# Non-Whitened Vs. Whitened Light Curve

## Planet 6 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

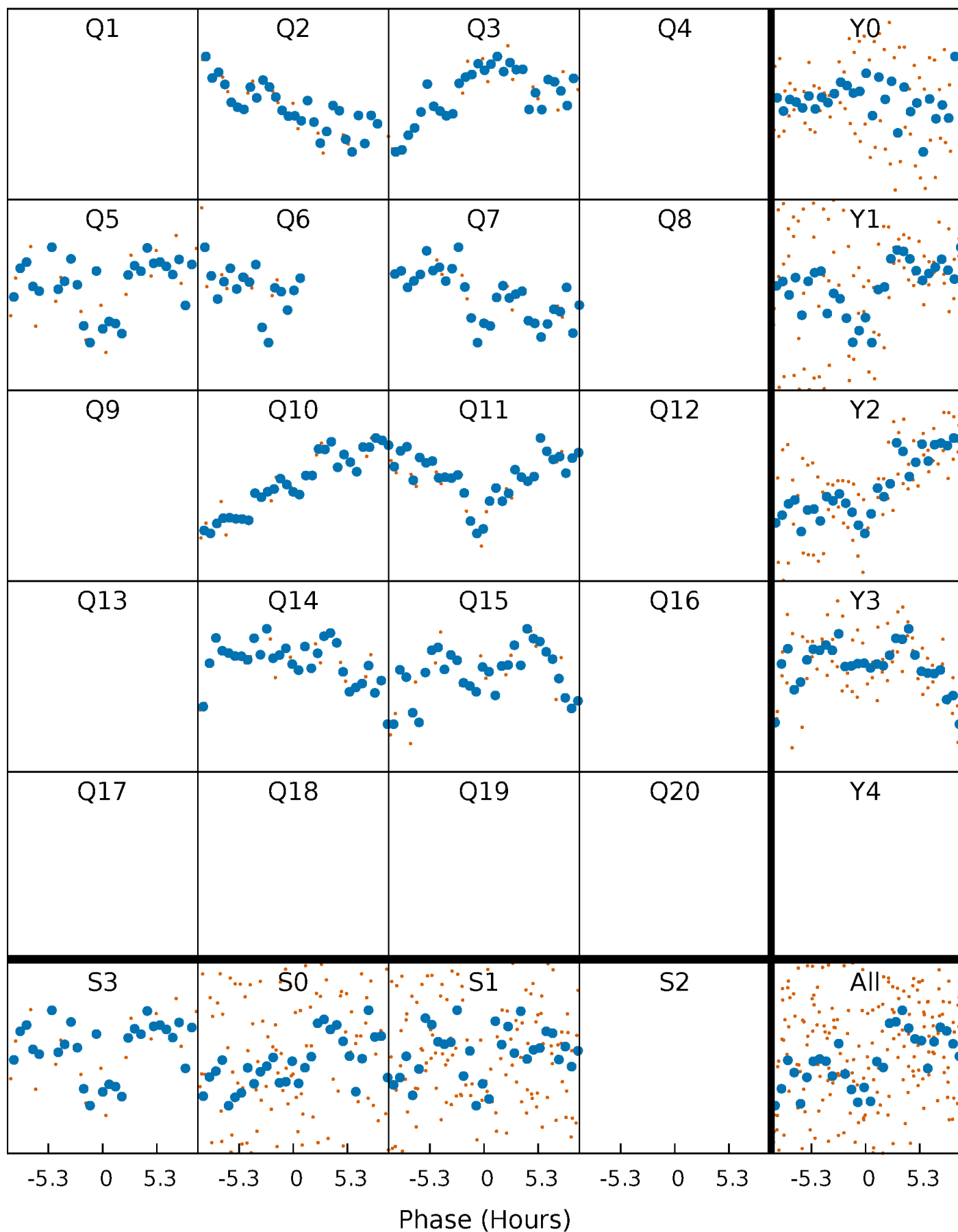


## Planet 6 : Phased Whitened Flux Time Series (Fit Epoch/Period)



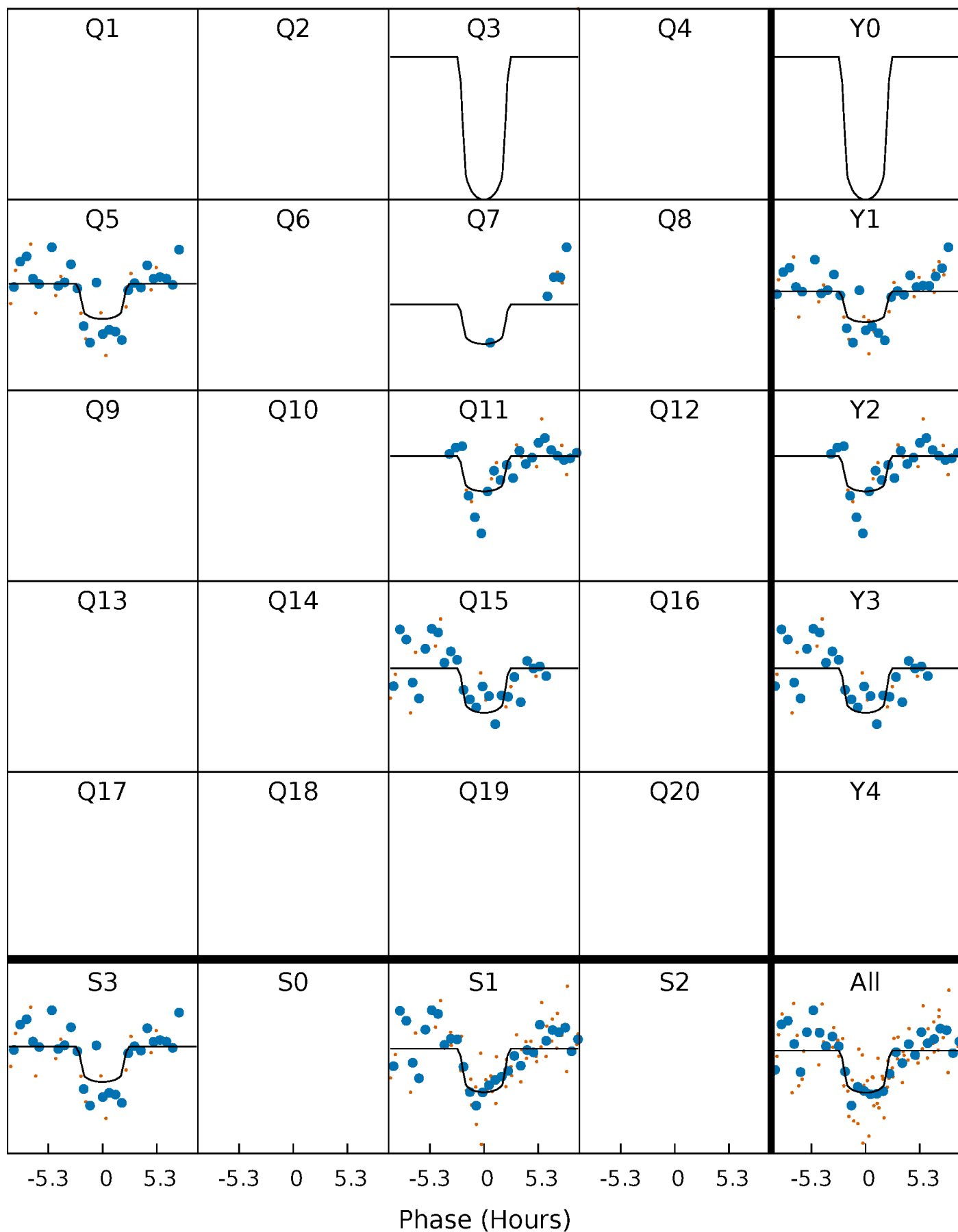
# PDC Quarter-Phased Transit Curves

TCE 011020521-06 P=118.311612 Days  $T_0=211.553500$  (BKJD)



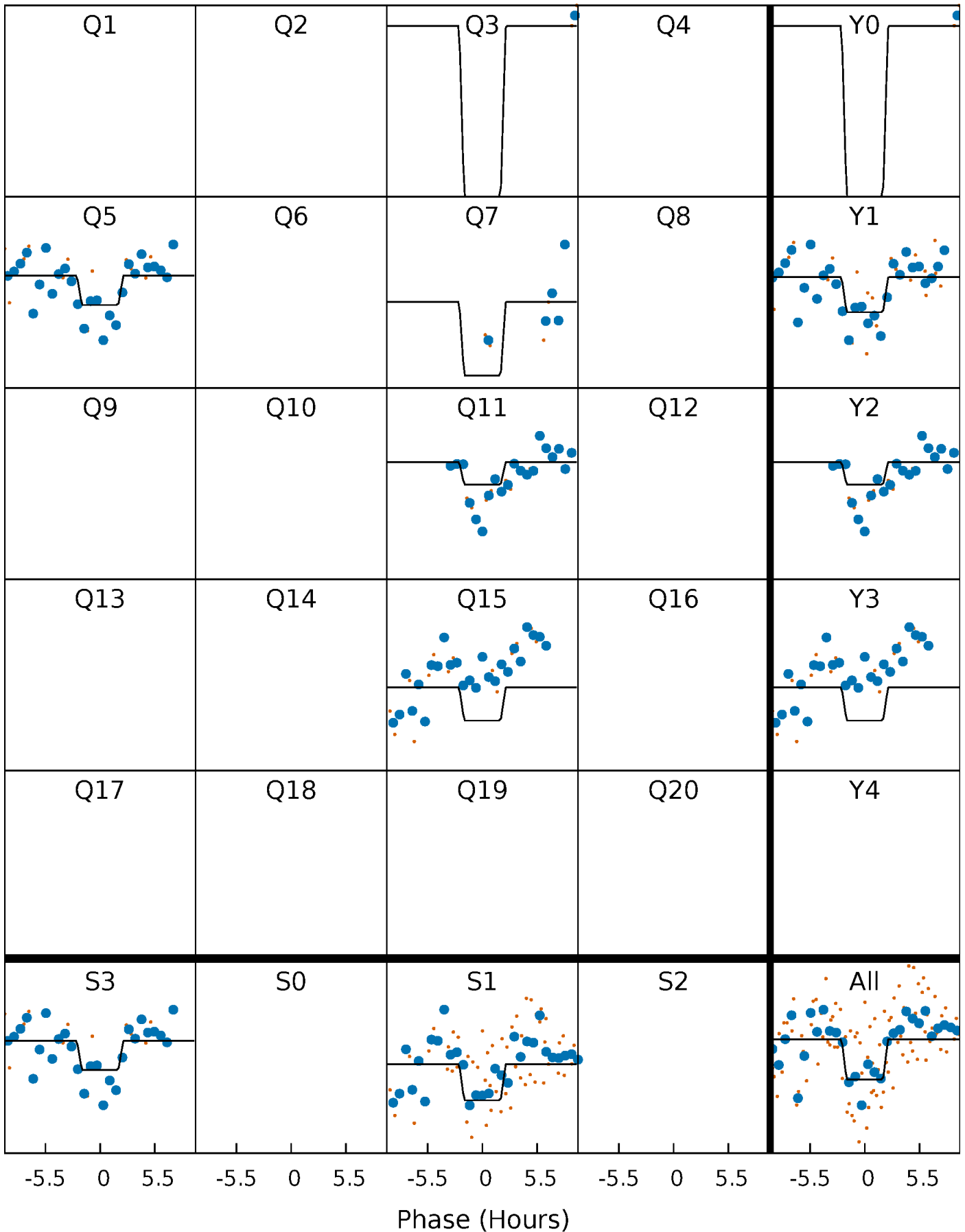
# DV Quarter-Phased Transit Curves

TCE 011020521-06 P=118.311612 Days  $T_0=211.553500$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

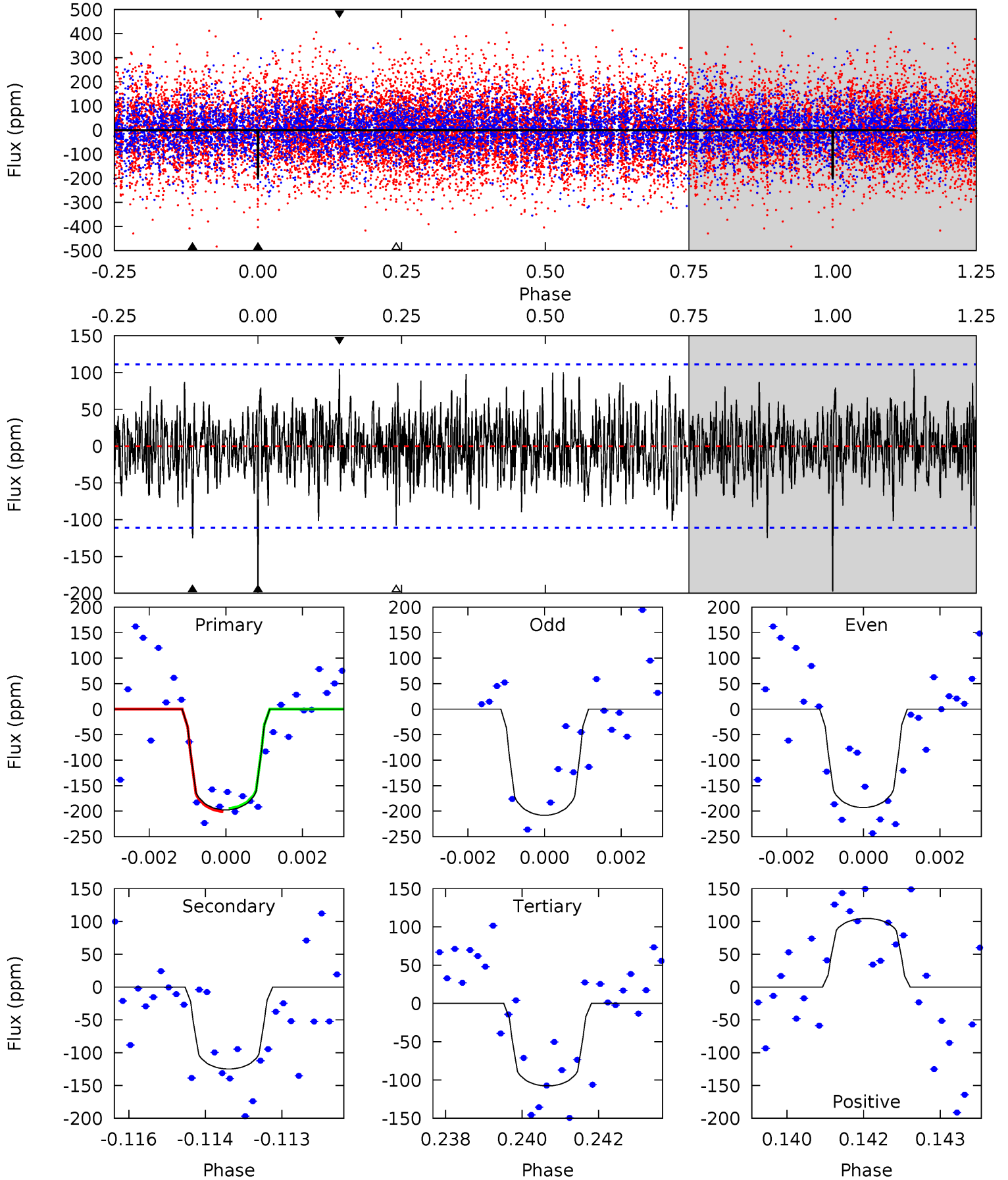
TCE 011020521-06 P=118.309155 Days  $T_0=211.564038$  (BKJD)



# DV Model-Shift Uniqueness Test

011020521-06, P = 118.311612 Days, E = 93.241888 Days

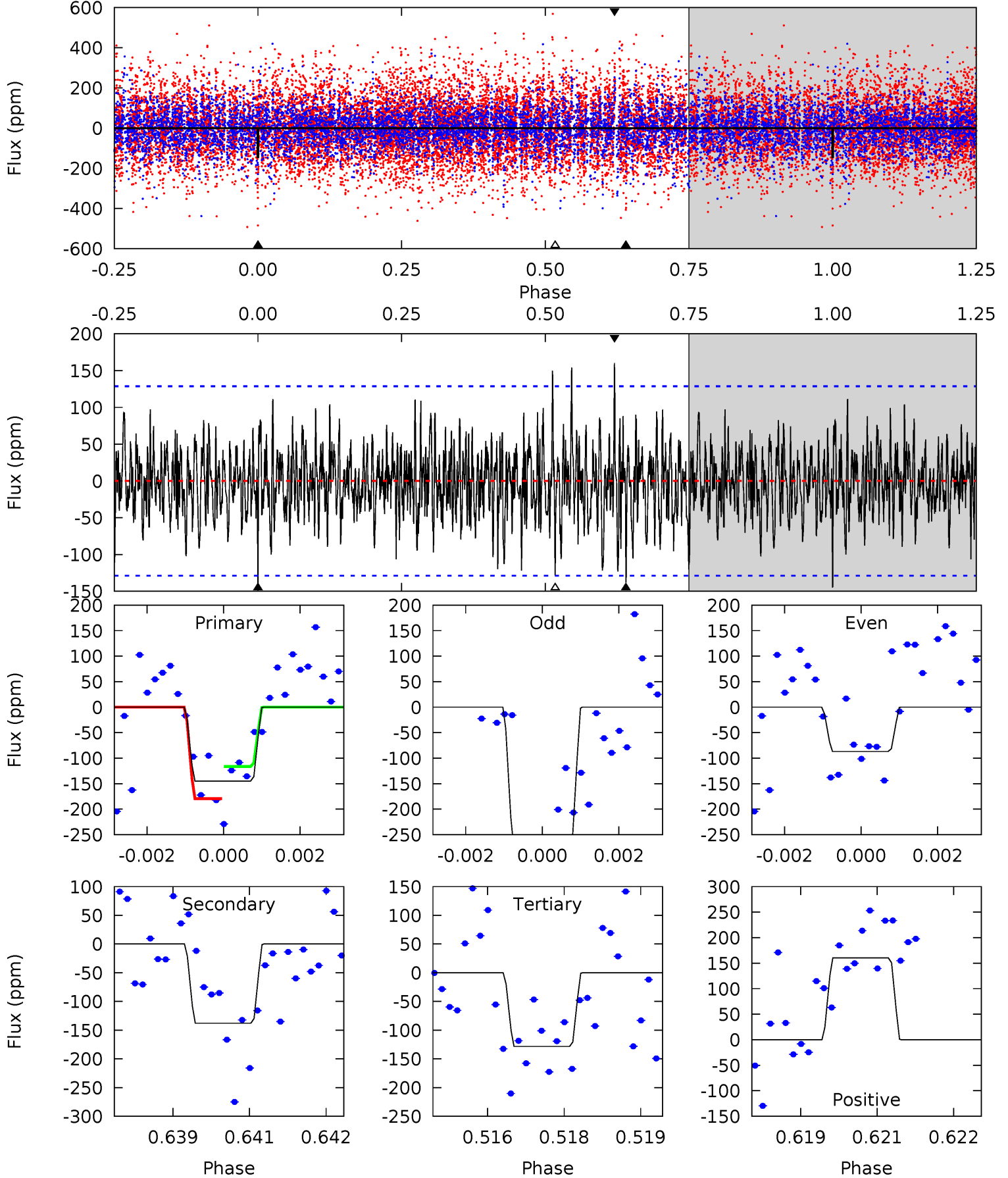
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
9.54	6.03	5.20	5.05	5.37	3.15	1.57	4.34	4.49	0.83	0.98	0.35	1.00	0.35	0.15



# Alt Model-Shift Uniqueness Test

011020521-06, P = 118.309155 Days, E = 93.254883 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
6.03	5.74	5.34	6.67	5.36	3.14	1.64	0.69	-0.64	0.40	-0.93	3.68	0.88	0.53	1.30





### Stellar Parameters For KIC 011020521

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6877^{+170}_{-204}$	$3.632^{+0.304}_{-0.076}$	$-0.320^{+0.300}_{-0.250}$	$3.219^{+0.406}_{-1.217}$	$1.619^{+0.227}_{-0.312}$	$0.068^{+0.149}_{-0.017}$
	+2%/-3%	+8%/-2%	+94%/-78%	+13%/-38%	+14%/-19%	+218%/-25%
Source	PHO1	FLK73	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 011020521-06 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-125 \pm 21$	$5.38^{+3.60}_{-3.15}$	$1003^{+53}_{-89}$	$5615^{+3719}_{-1053}$	$740^{+3366}_{-489}$
Alt.	$-138 \pm 24$	$4.79^{+3.38}_{-2.79}$	$1003^{+50}_{-89}$	$6066^{+4212}_{-1267}$	$974^{+4486}_{-624}$

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

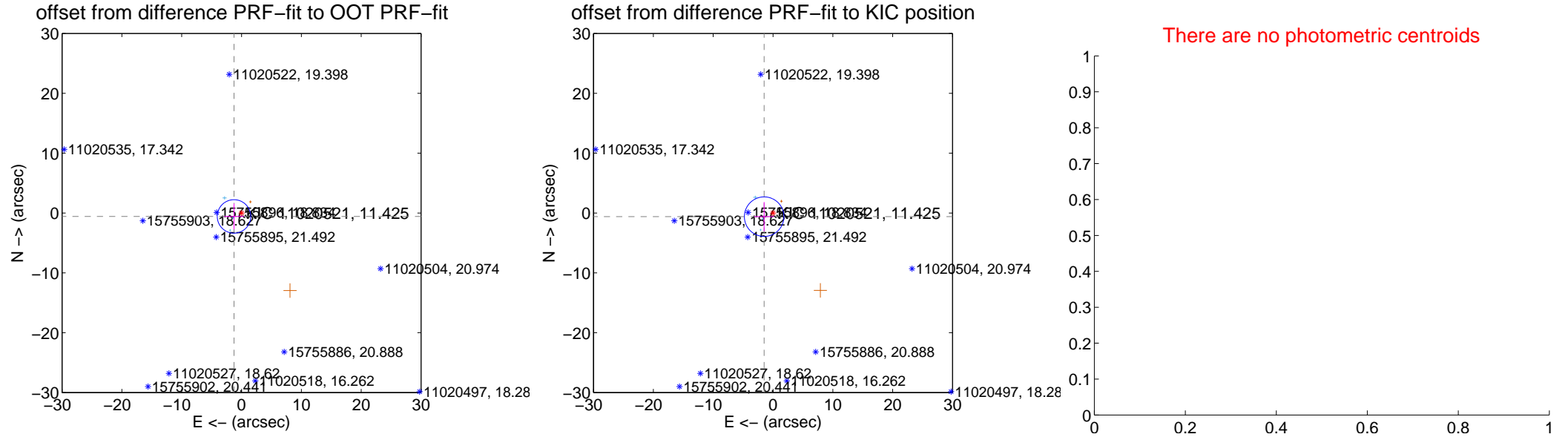
## DV Centroid Data

Supplemental centroid analysis for 011020521-06. **Kepler magnitude: 11.43.** Transit SNR 8.38

**There are 3 quarters with good PRF difference image offsets**

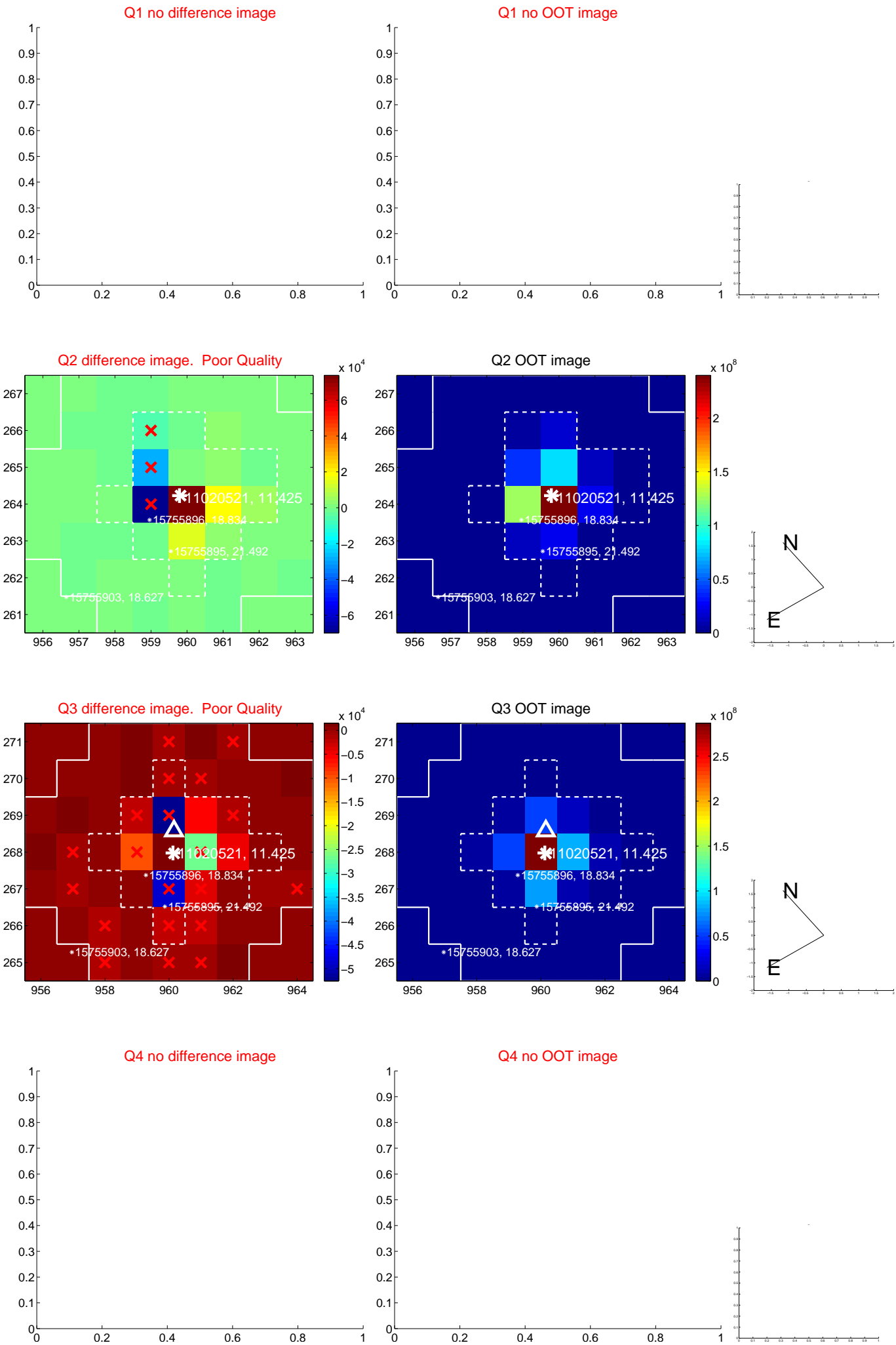
The direct PRF centroid is offset from the target star catalog position by about 0.19 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.382 \pm 0.932$	1.48	$1.259 \pm 1.642$	$-0.571 \pm 2.143$
PRF-fit source offset from KIC position	$1.601 \pm 1.101$	1.45	$1.481 \pm 1.665$	$-0.608 \pm 2.454$
photometric centroid source offset	—	—	—	—

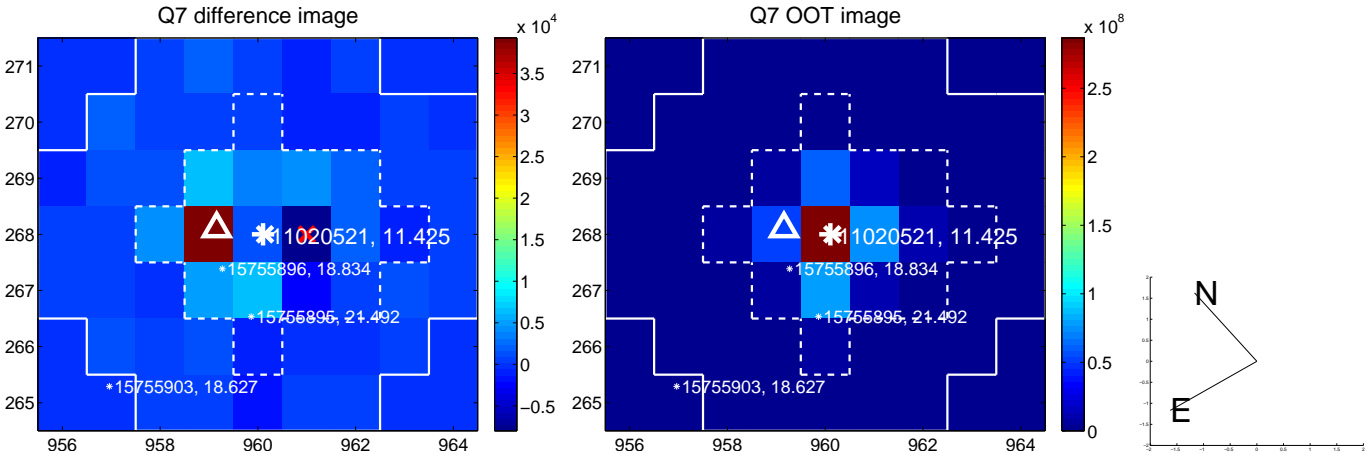
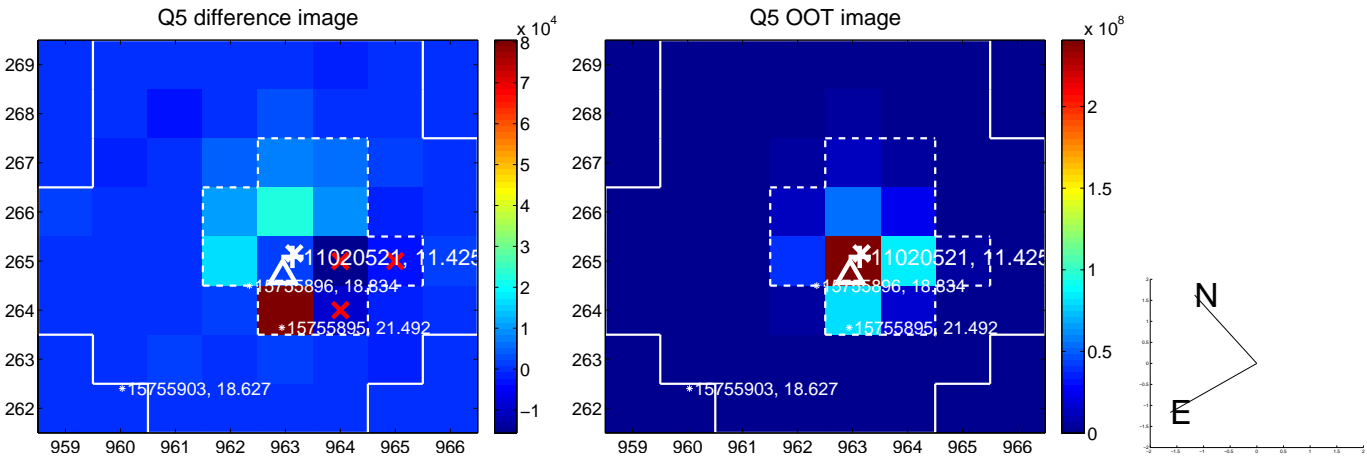


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

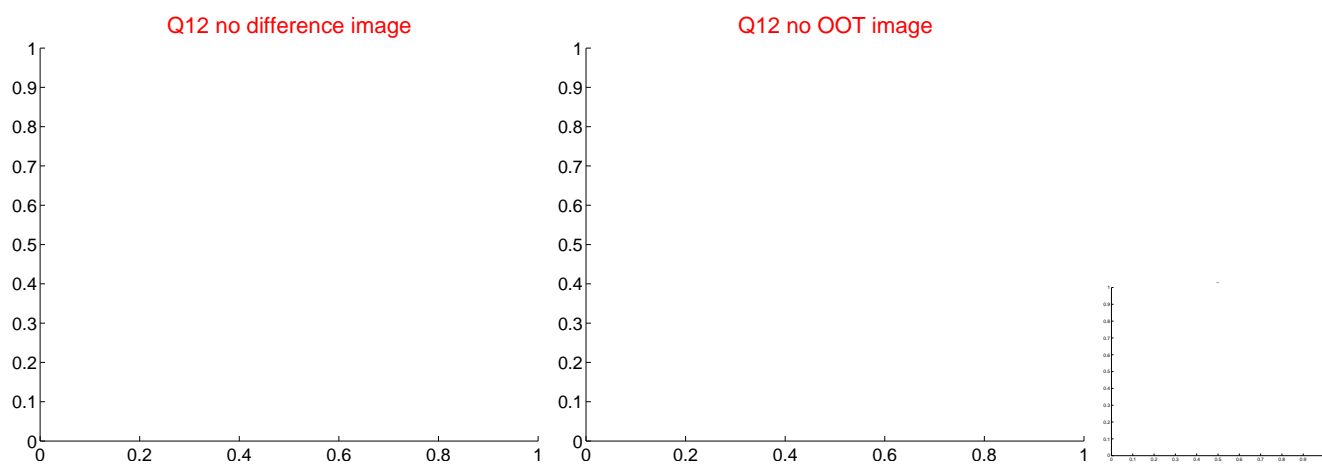
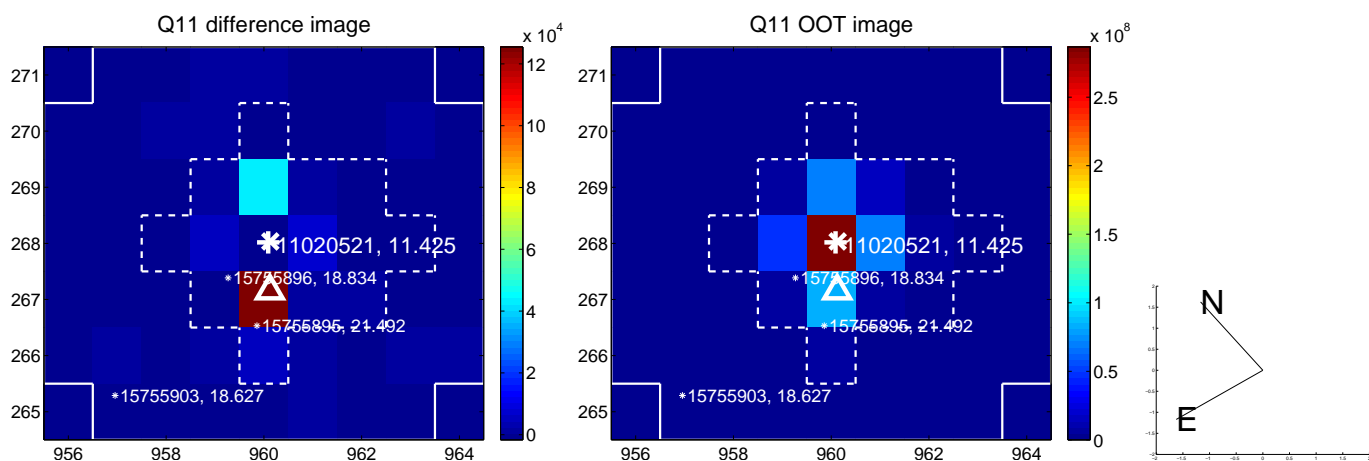
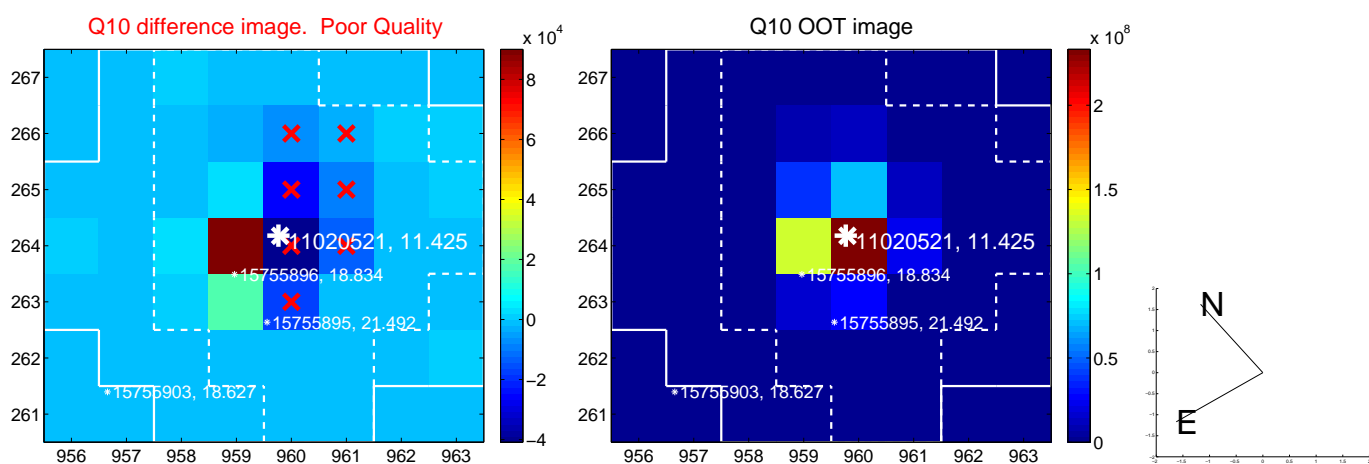
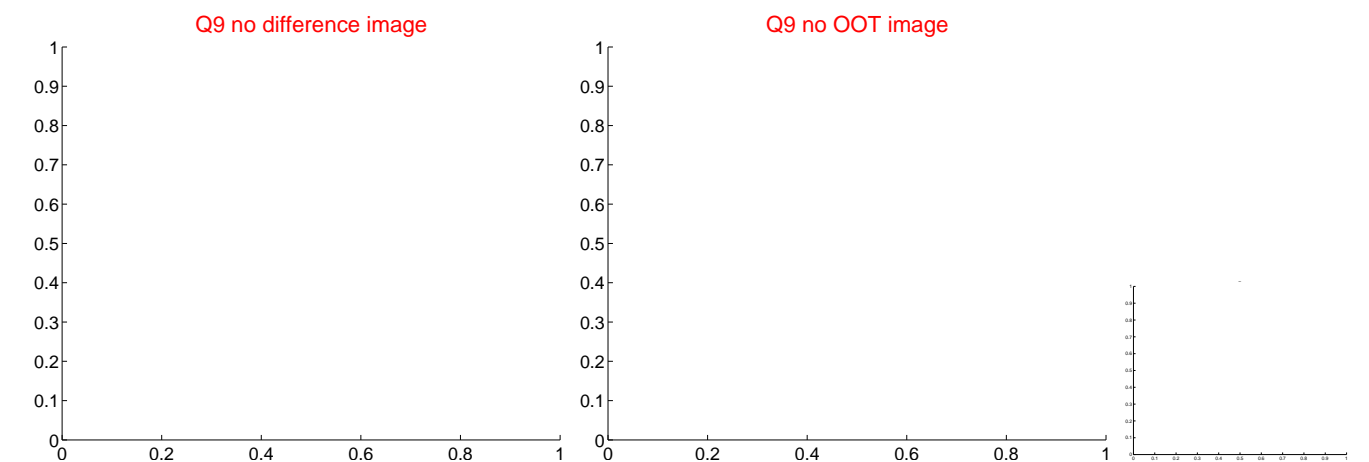
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



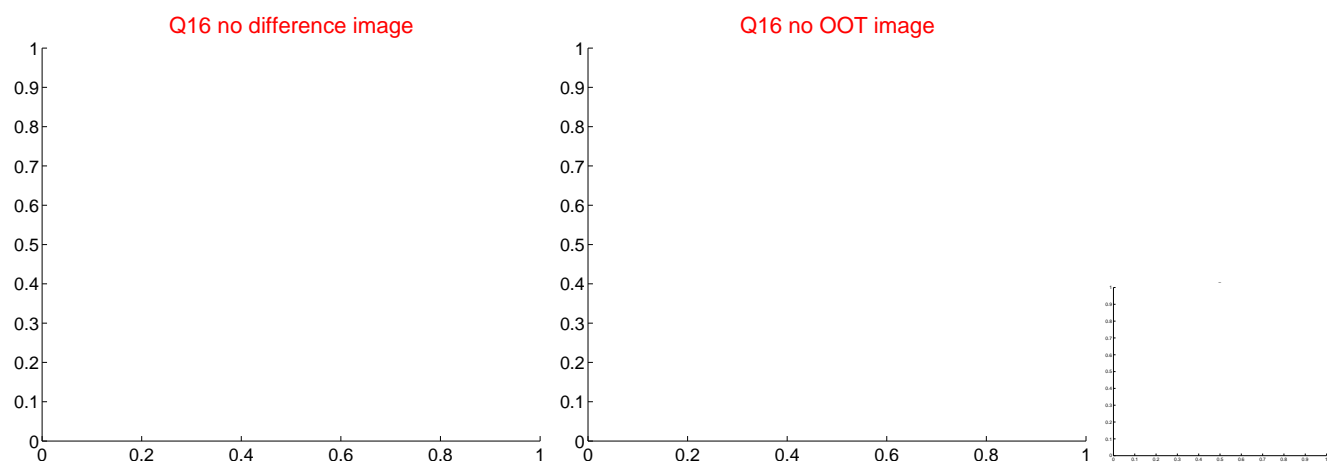
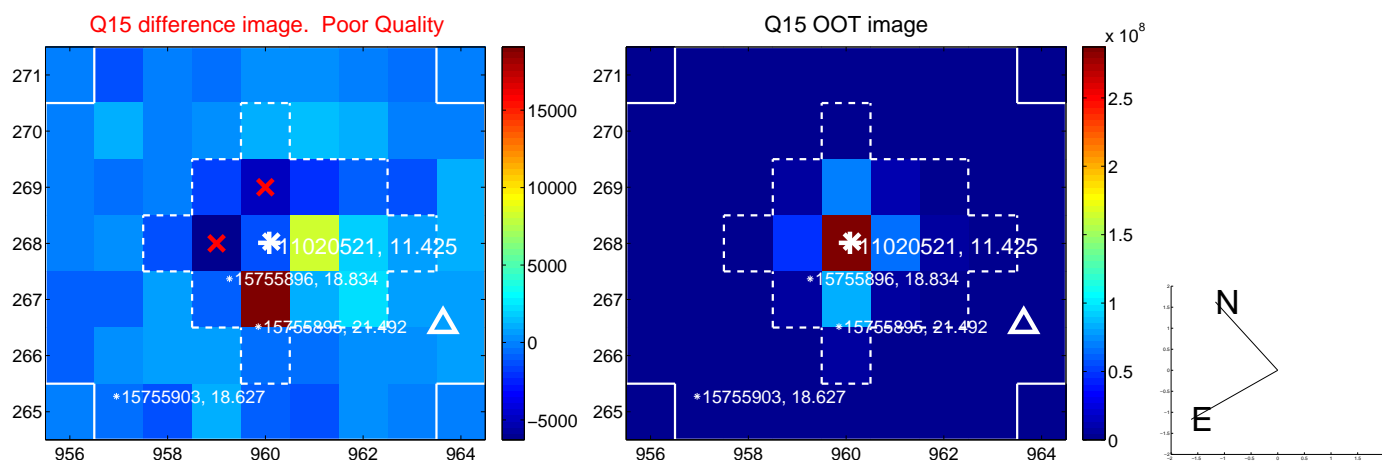
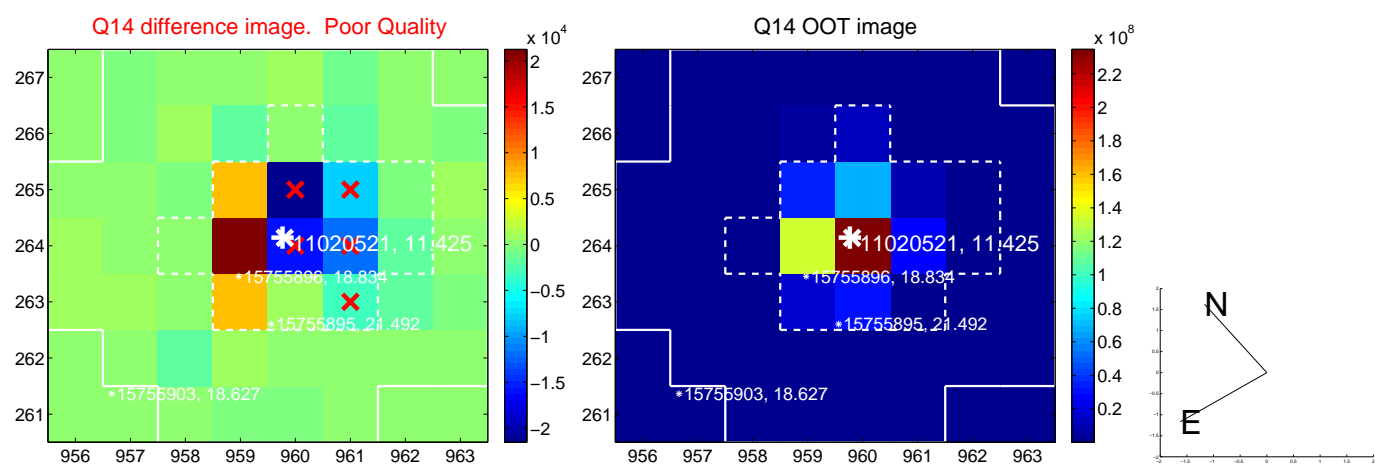
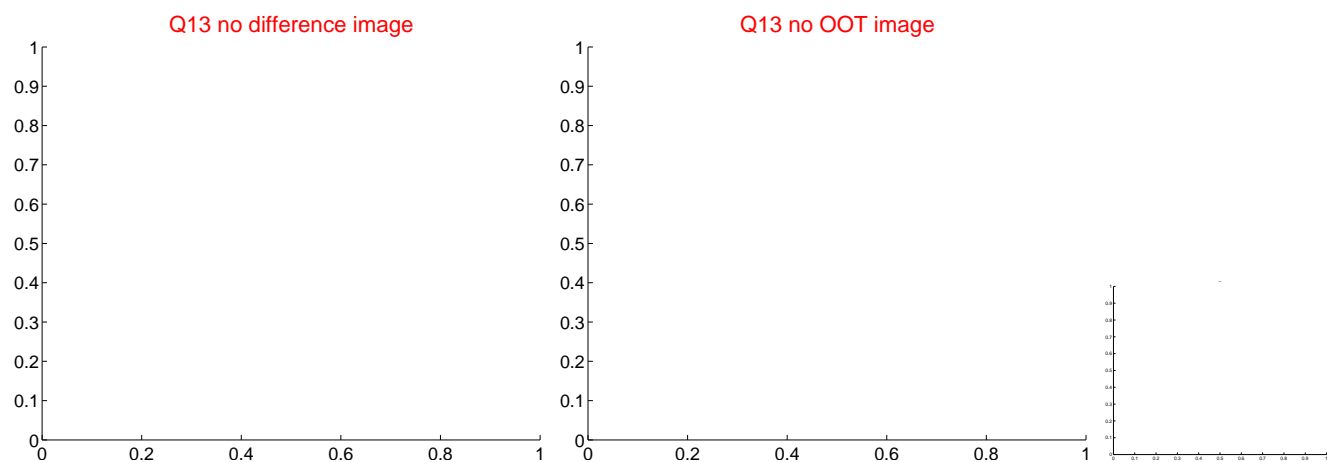
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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.

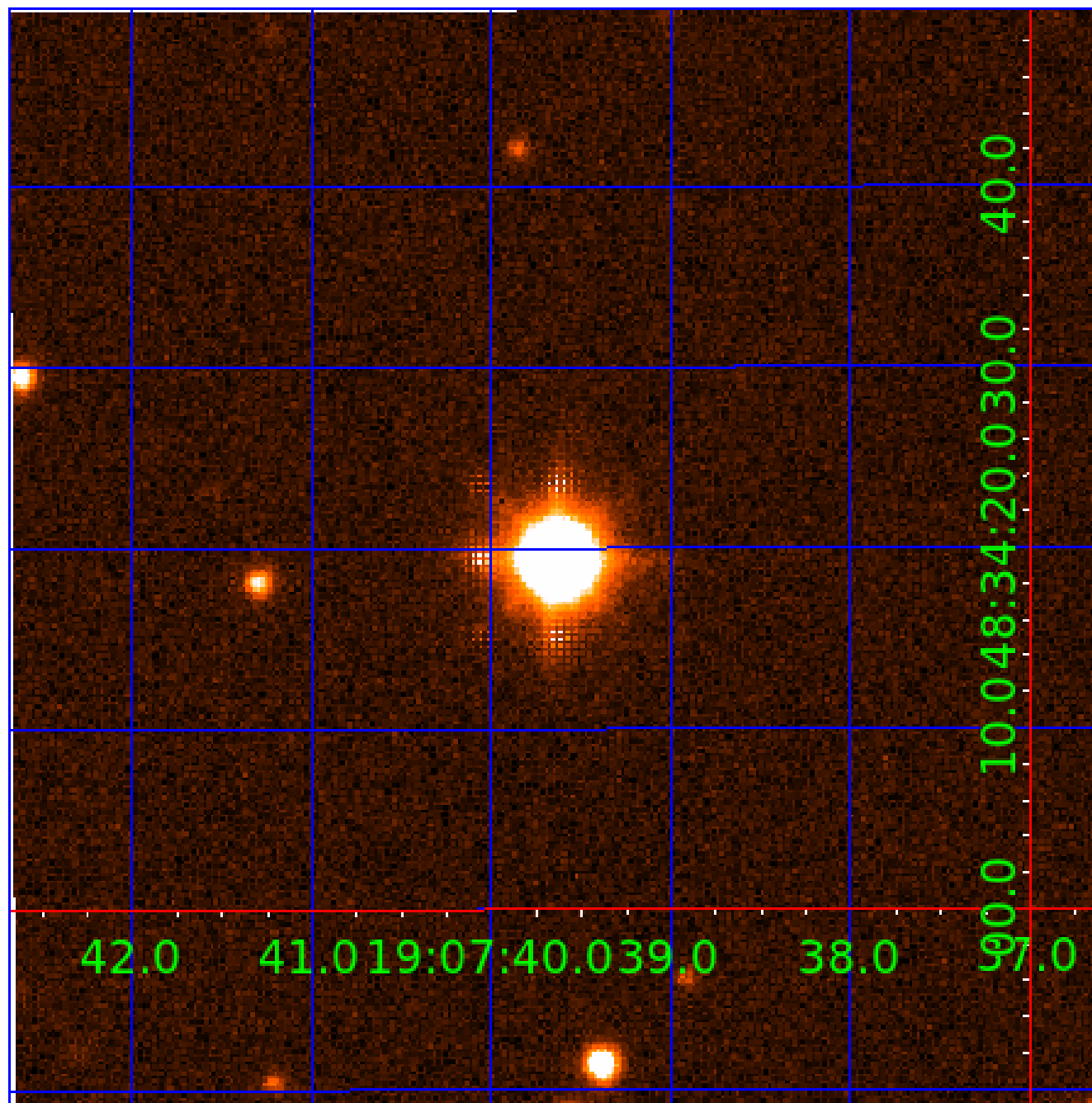


folded centroid time series figure for this object.



UKIRT Image

Declination



## KIC 011020521

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
011020521-01	OBS	No	2.929979	134.113706	0.1	0.514	8.2	0.0	3.22	6877	0.10	9371.70
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011020521-09	OBS	No	36.435749	160.151233	162.1	3.382	8.0	9.4	3.22	6877	4.66	325.29
011020521-10	OBS	No	34.792680	149.579268	94.8	5.285	7.8	7.4	3.22	6877	3.67	345.93

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
011020521-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-04	OBS	FP	0.00	1	0	1	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
011020521-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-07	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-09	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_ALT—CENT_SATURATED
011020521-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

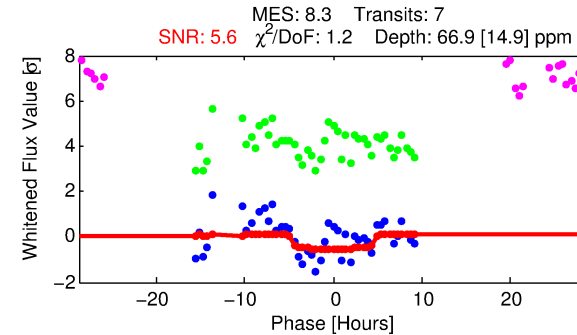
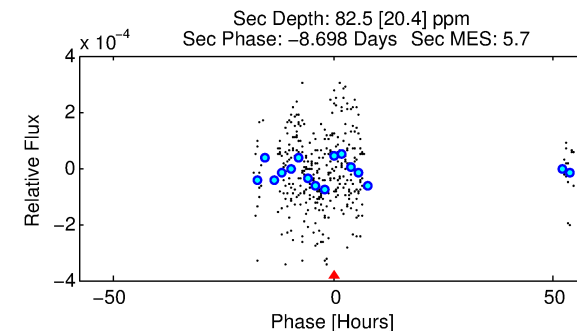
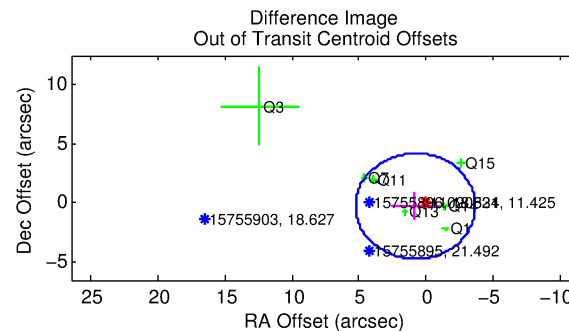
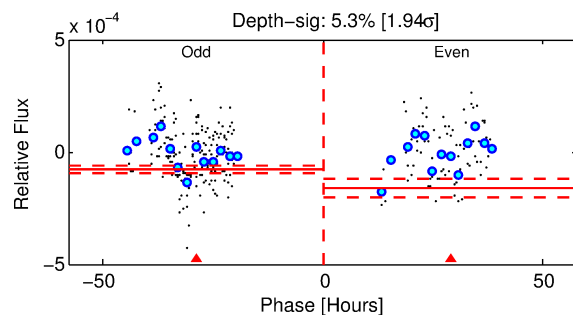
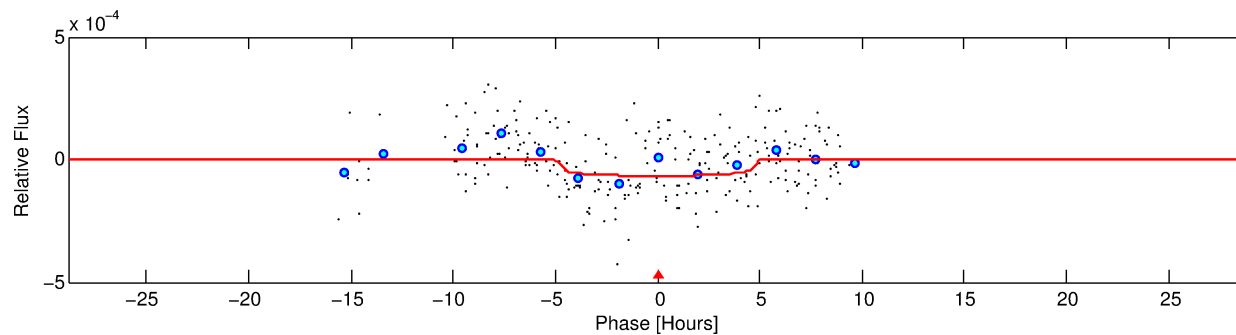
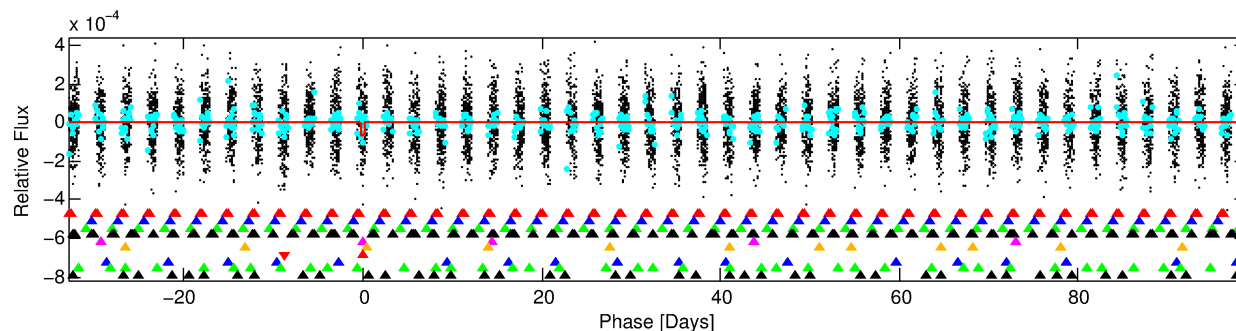
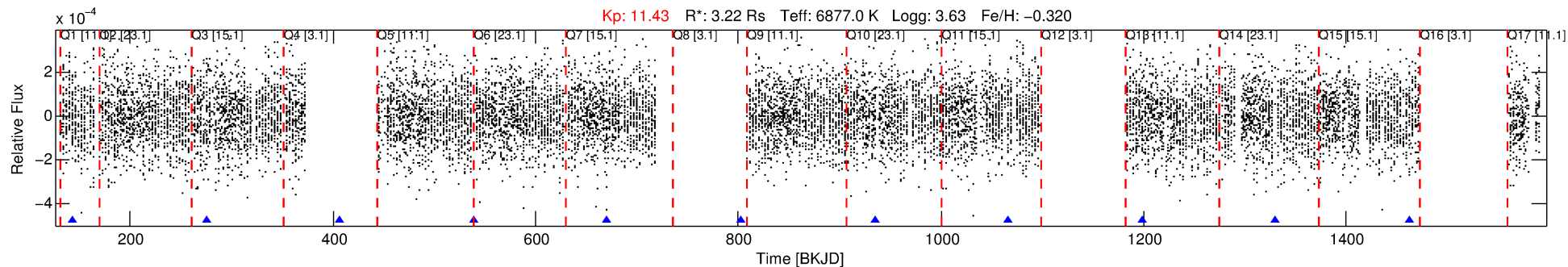
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 011020521-07

No Significant Match Found

# DV One-Page Summary

KIC: 11020521 Candidate: 7 of 10 Period: 131.859 d



## DV Fit Results:

Period = 131.85882 [0.00405] d  
Epoch = 143.3596 [0.0256] BKJD  
Rp/R\* = 0.0077 [0.0109]  
a/R\* = 95.59 [771.84]  
b = 0.43 [15.46]  
Seff = 58.55 [31.82]  
Teq = 705 [96] K  
Rp = 2.71 [3.96] Re  
a = 0.5955 [0.2046] AU  
Ag = 2200.50 [6348.81] [0.35 $\sigma$ ]  
Teffp = 7469 [5300] K [1.28 $\sigma$ ]

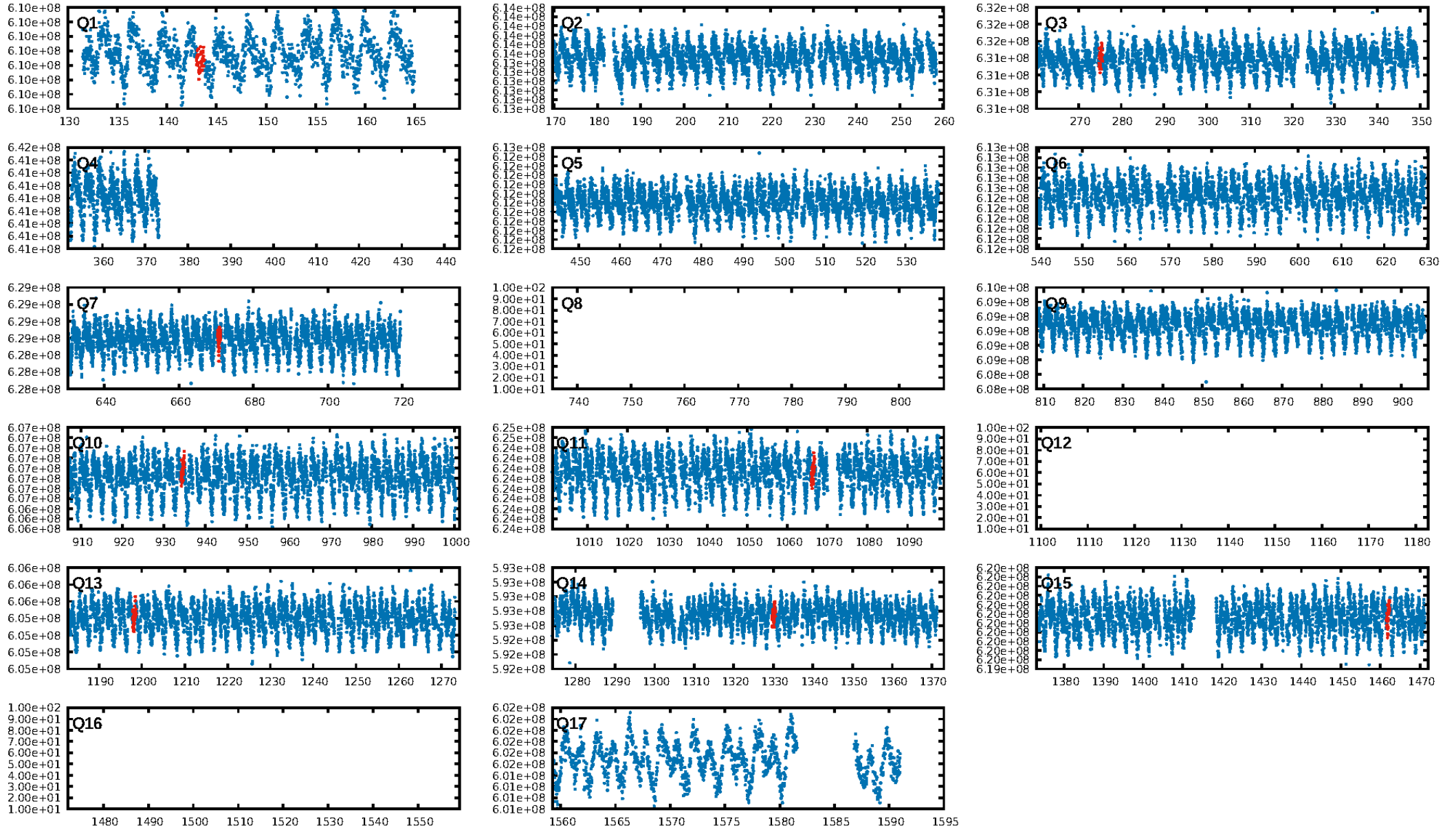
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [30.43 $\sigma$ ]  
LongPeriod-sig: 100.0% [340.80 $\sigma$ ]  
ModelChiSquare2-sig: 62.8%  
ModelChiSquareGof-sig: 61.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [6/6]  
GhostDiagnostic-chr: 1.93  
Centroid-sig: N/A  
Centroid-so: N/A  
OotOffset-rm: 0.834 arcsec [0.56 $\sigma$ ]  
KicOffset-rm: 1.005 arcsec [0.78 $\sigma$ ]  
OotOffset-st: 1/4/0/2 [7]  
KicOffset-st: 1/4/0/2 [7]  
DiffImageQuality-fgm: 0.57 [4/7]  
DiffImageOverlap-fno: 0.00 [0/8]

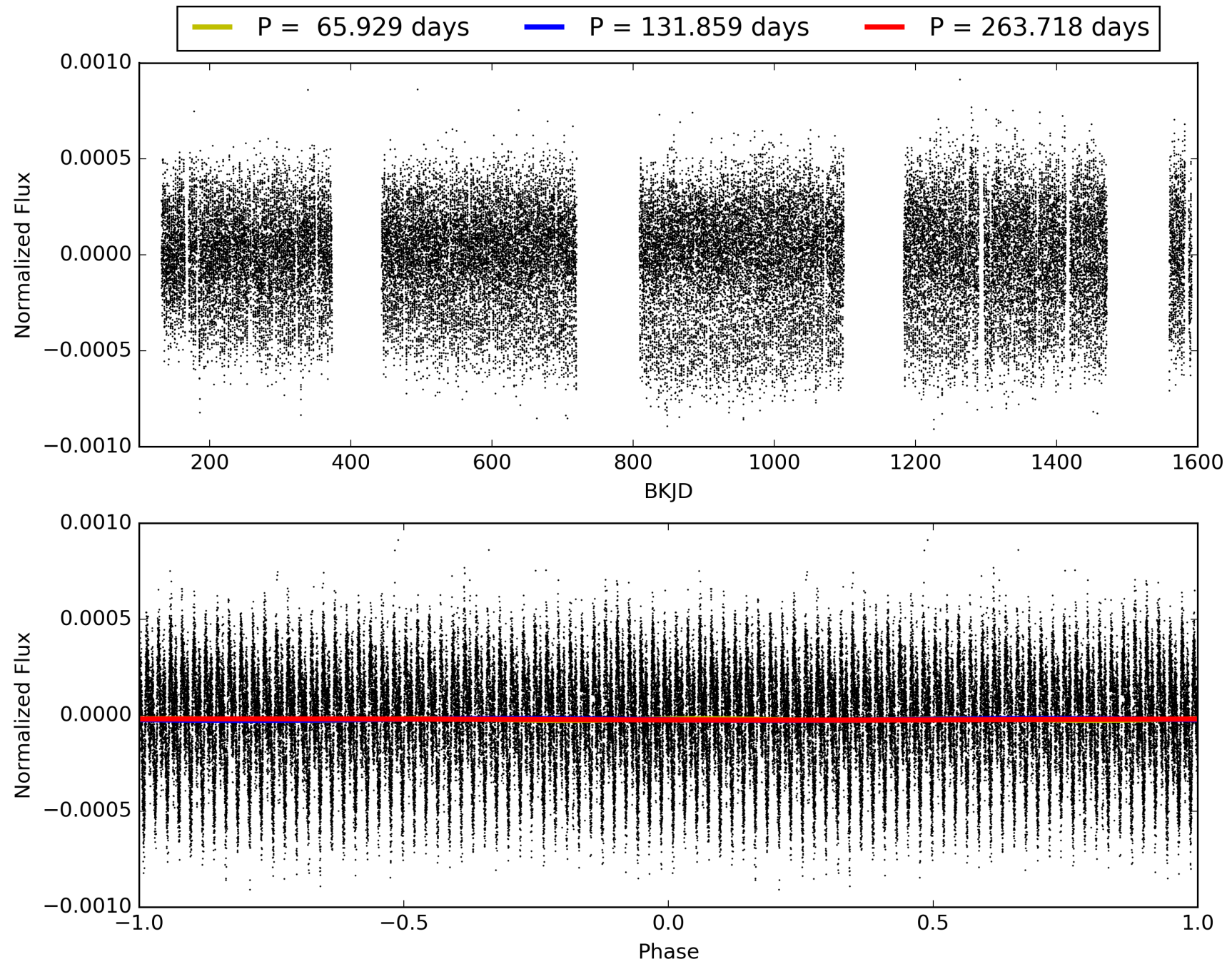
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 05:45:12 Z

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

# TCE 011020521-07, PDC Light Curves

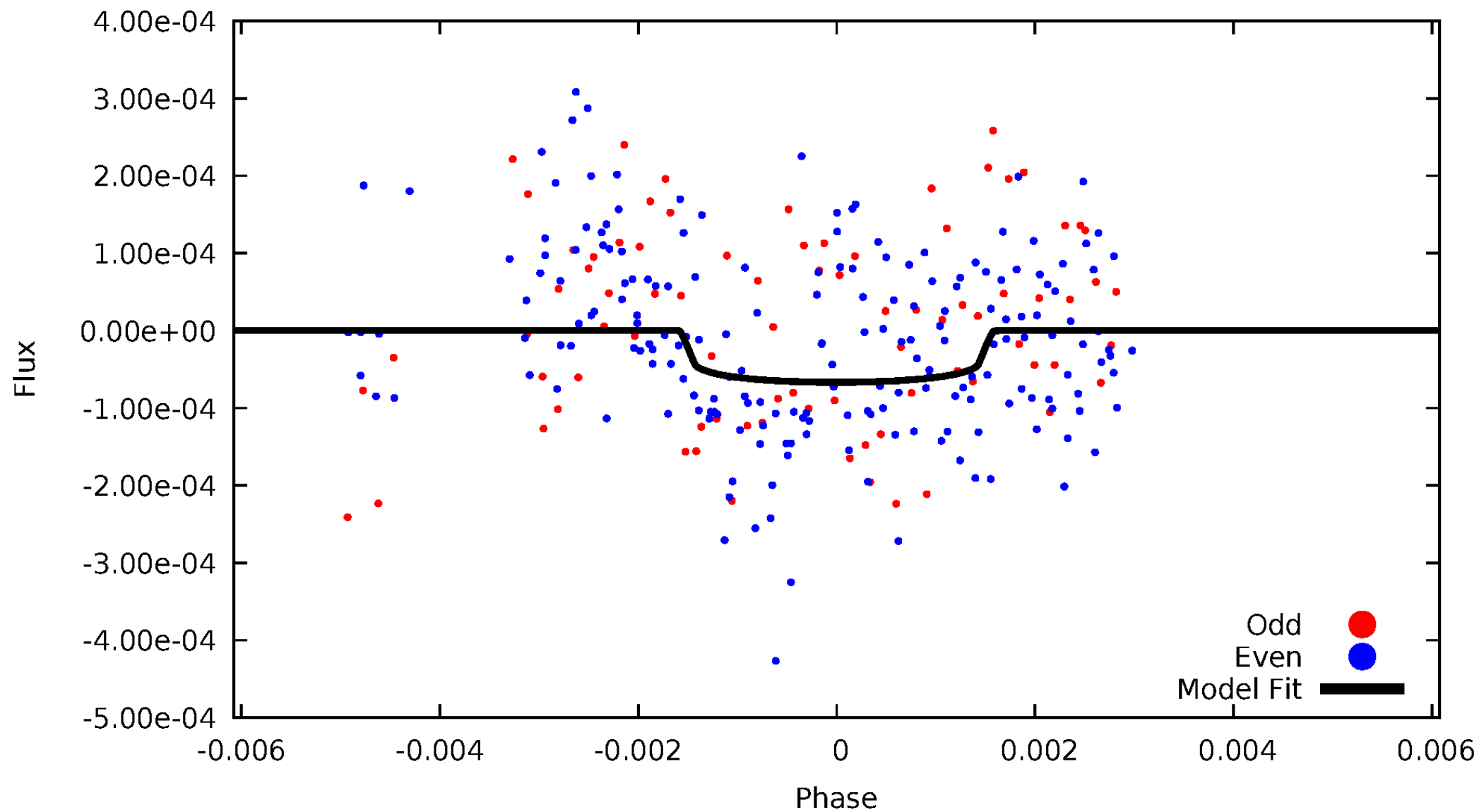


TCE 011020521-07



# DV Odd/Even

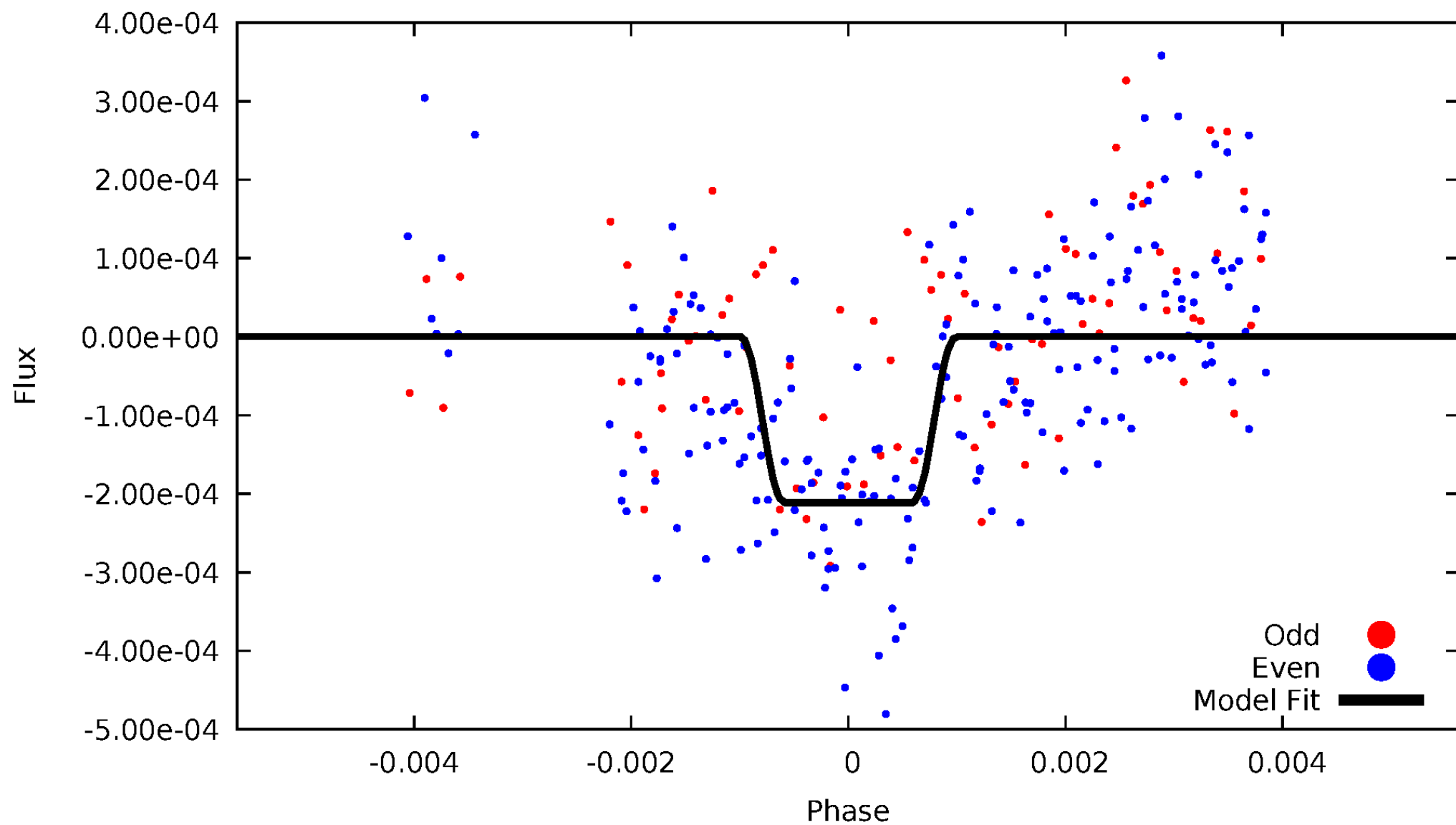
TCE 011020521-07





# ALT Odd/Even

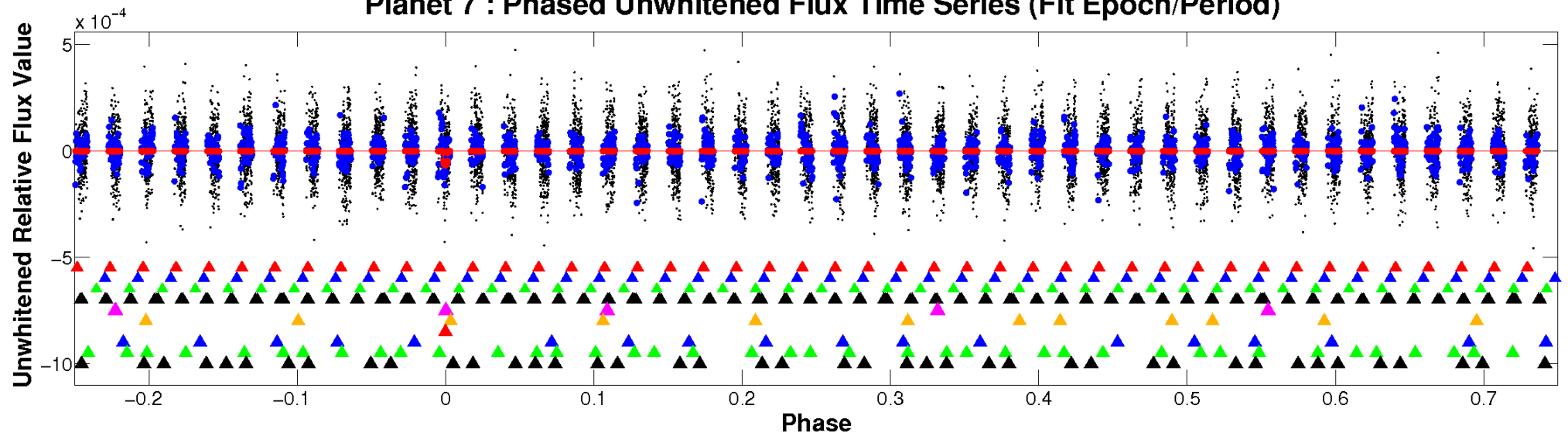
TCE 011020521-07



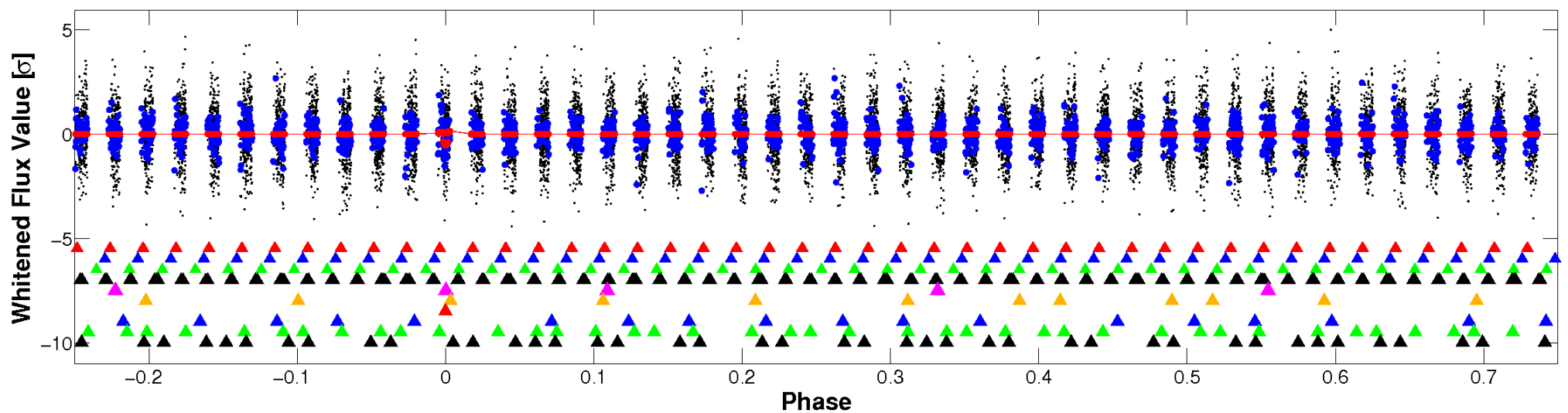


# Non-Whitened Vs. Whitened Light Curve

Planet 7 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

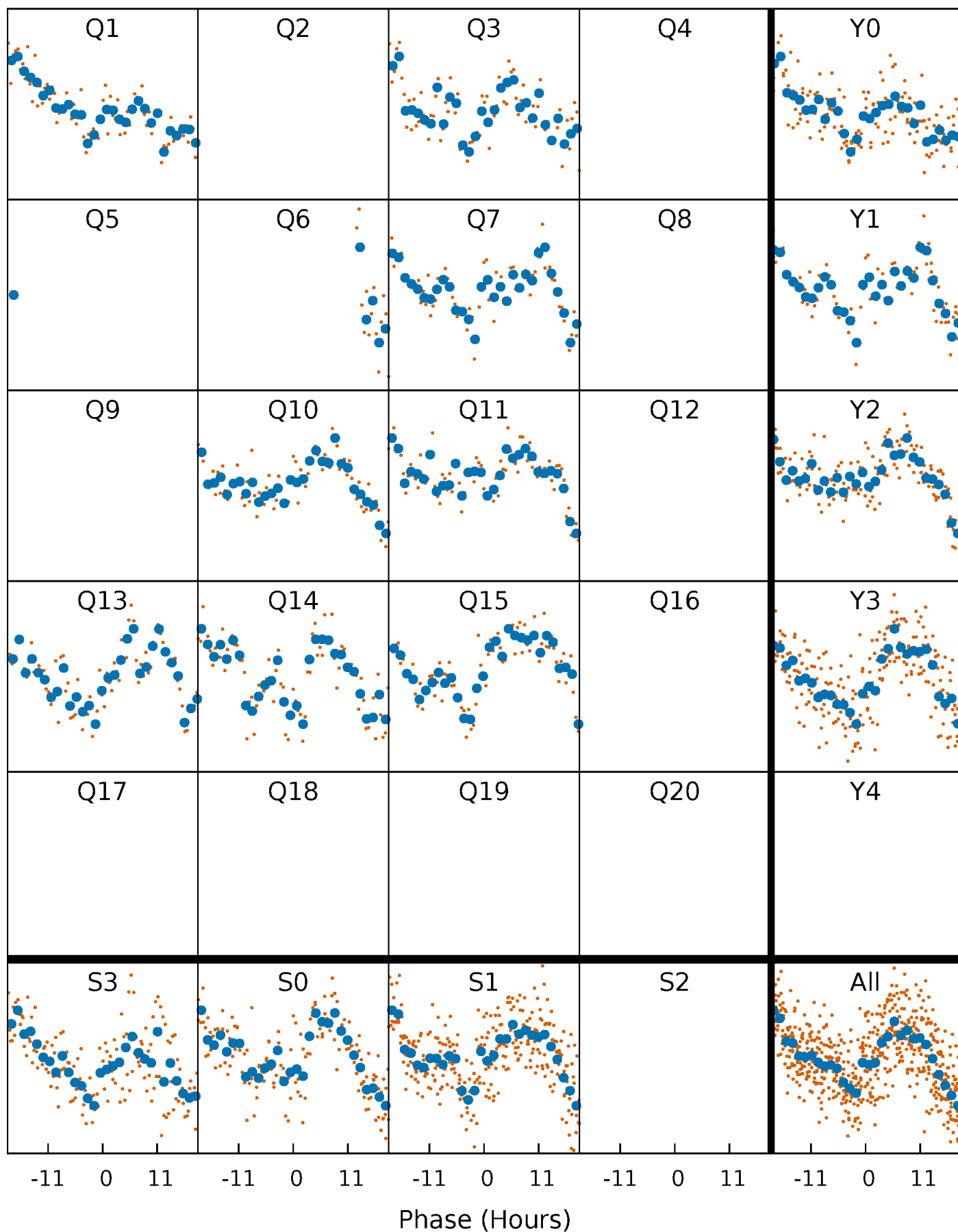


Planet 7 : Phased Whitened Flux Time Series (Fit Epoch/Period)



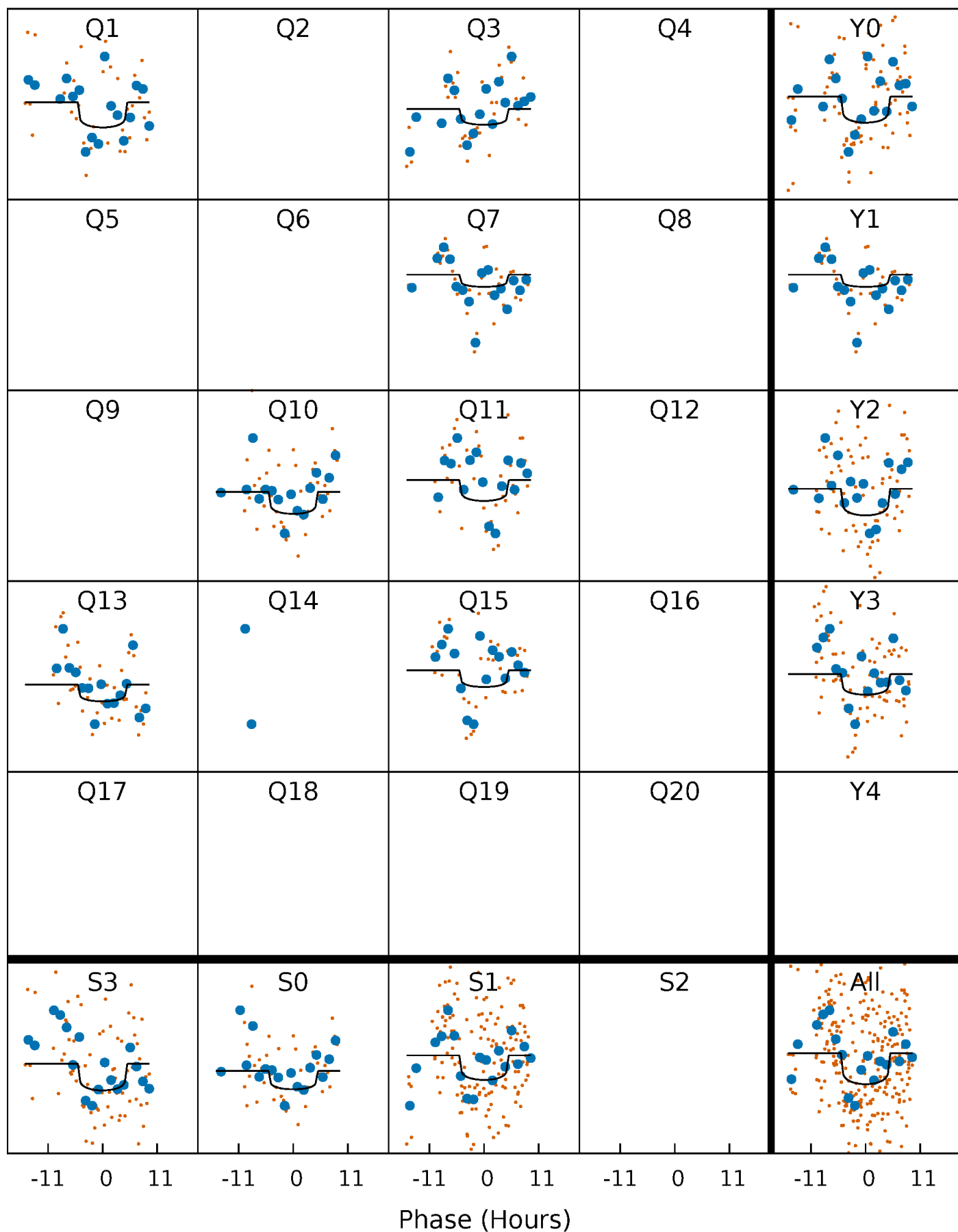
# PDC Quarter-Phased Transit Curves

TCE 011020521-07     $P=131.858819$  Days     $T_0=143.359611$  (BKJD)



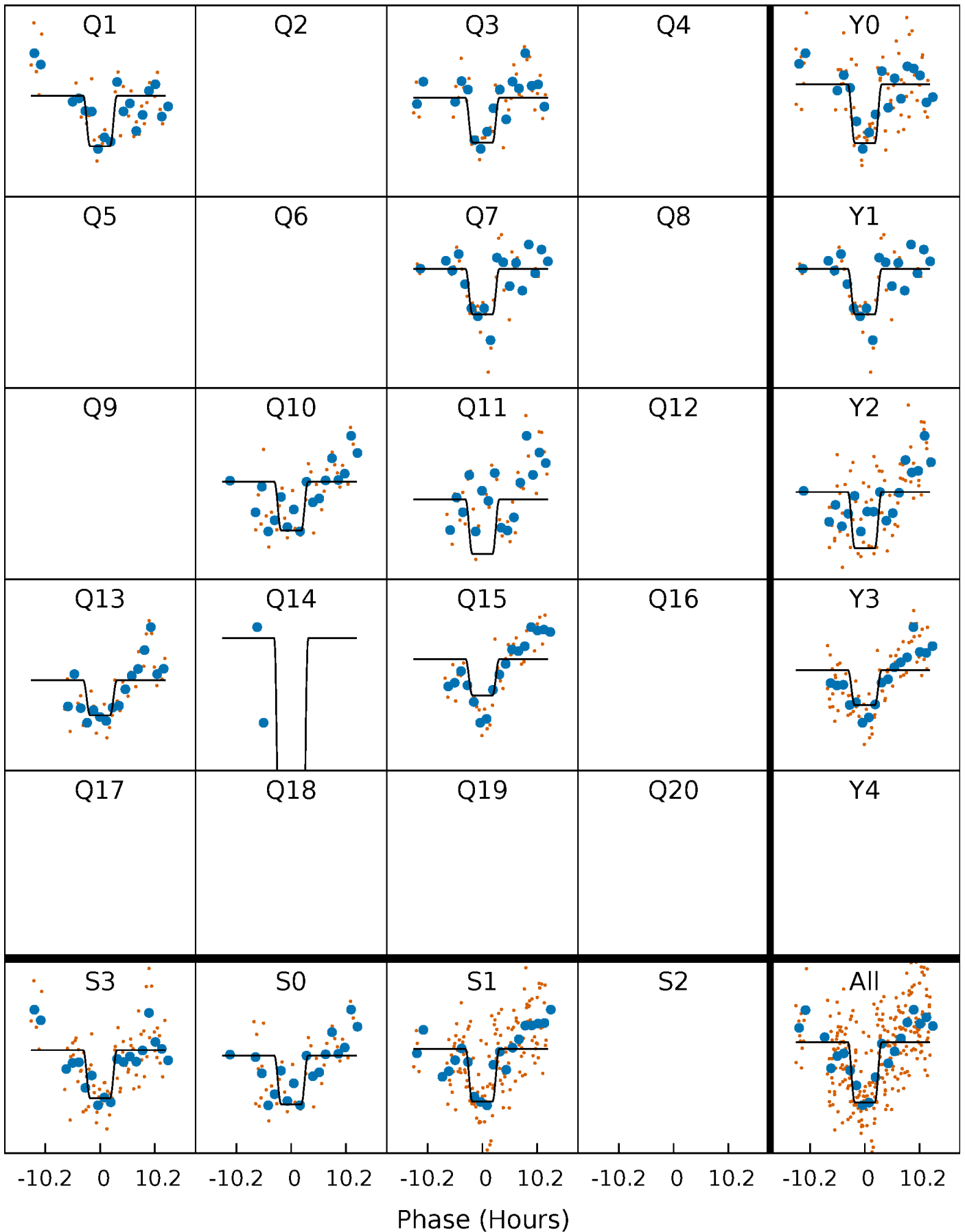
# DV Quarter-Phased Transit Curves

TCE 011020521-07 P=131.858819 Days  $T_0=143.359611$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

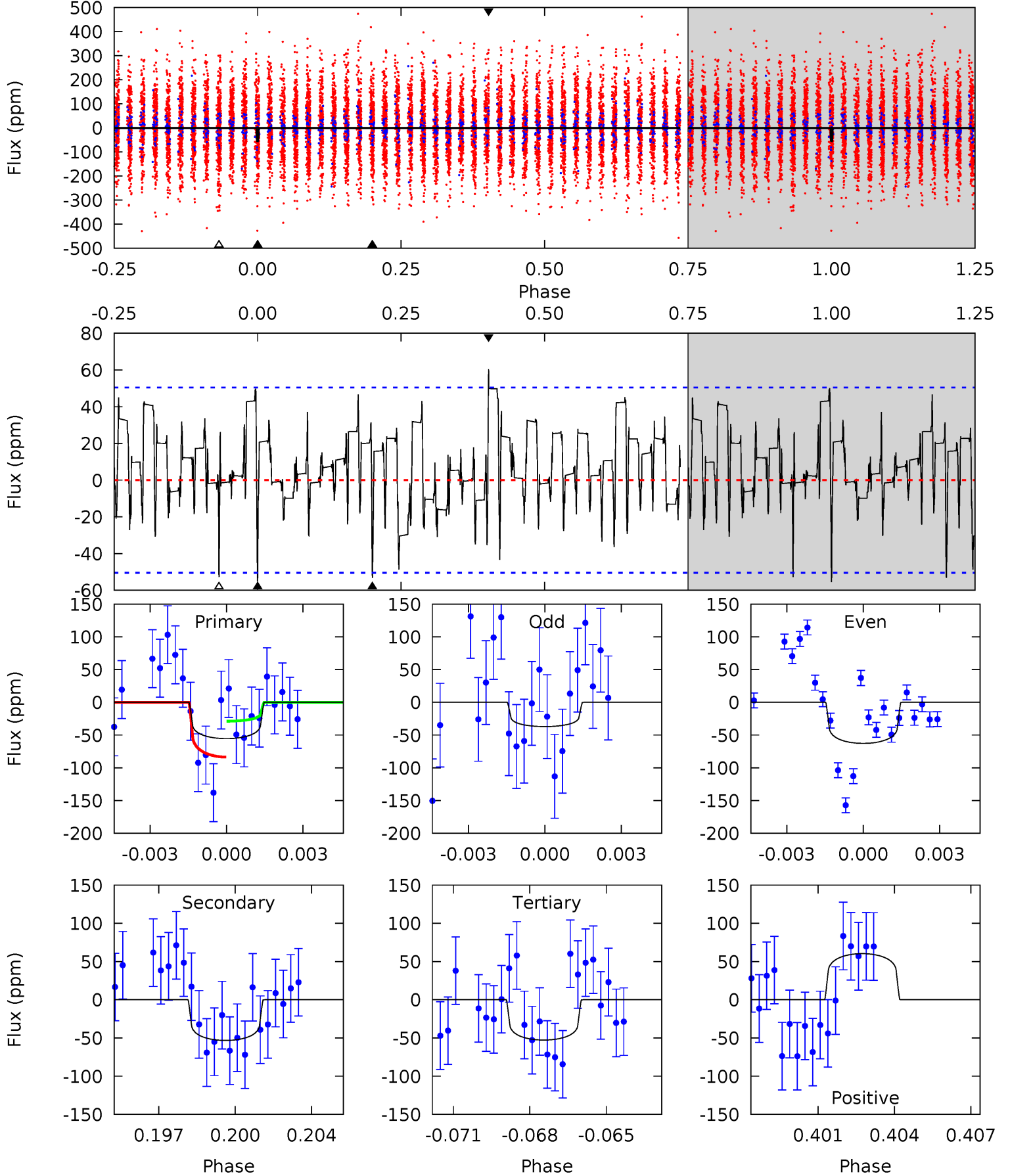
TCE 011020521-07 P=131.855749 Days  $T_0=143.245291$  (BKJD)



# DV Model-Shift Uniqueness Test

011020521-07,  $P = 131.858819$  Days,  $E = 11.500792$  Days

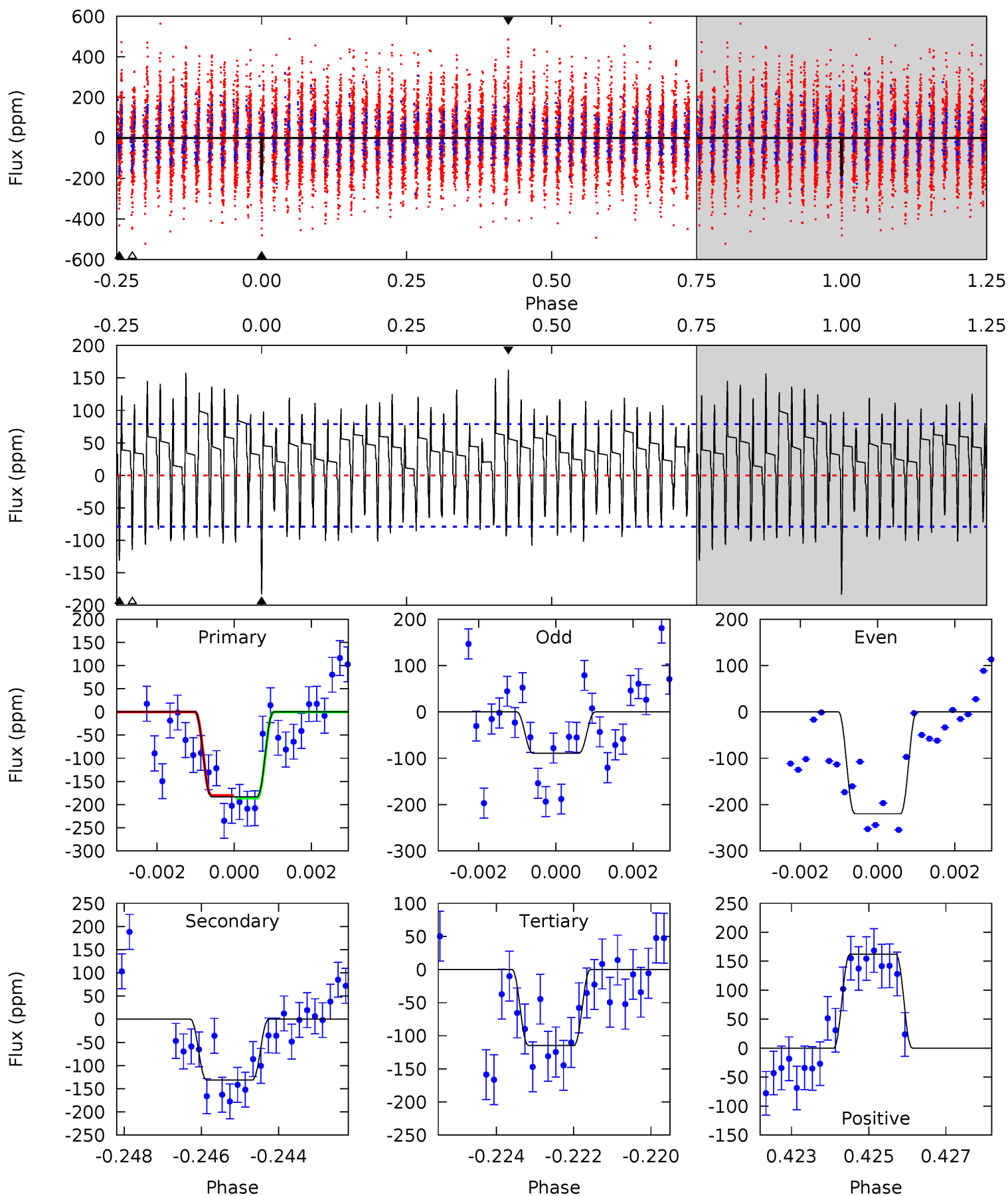
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
5.76	5.52	5.47	6.26	5.24	2.94	1.83	0.29	-0.50	0.05	-0.74	1.20	1.22	0.52	2.85



# Alt Model-Shift Uniqueness Test

011020521-07, P = 131.855749 Days, E = 11.389542 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.4	8.86	7.74	11.0	5.33	3.09	4.46	4.63	1.41	1.12	-2.10	4.01	1.06	0.47	0.18



### Stellar Parameters For KIC 011020521

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6877^{+170}_{-204}$	$3.632^{+0.304}_{-0.076}$	$-0.320^{+0.300}_{-0.250}$	$3.219^{+0.406}_{-1.217}$	$1.619^{+0.227}_{-0.312}$	$0.068^{+0.149}_{-0.017}$
	+2%/-3%	+8%/-2%	+94%/-78%	+13%/-38%	+14%/-19%	+218%/-25%
Source	PHO1	FLK73	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 011020521-07 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-53 \pm 10$	$3.61^{+3.31}_{-2.24}$	$965^{+53}_{-94}$	$5596^{+4135}_{-1273}$	$818^{+4755}_{-599}$
Alt.	$-131 \pm 15$	$5.09^{+3.74}_{-2.87}$	$965^{+50}_{-88}$	$5883^{+3328}_{-1235}$	$1017^{+3876}_{-680}$

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



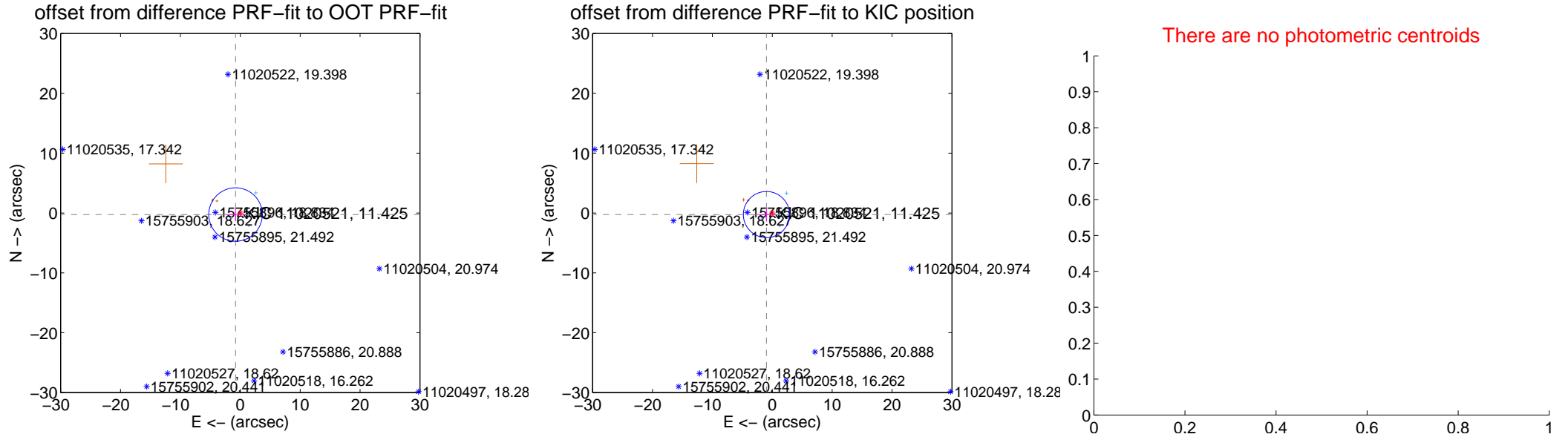
## DV Centroid Data

Supplemental centroid analysis for 011020521-07. **Kepler magnitude: 11.43.** Transit SNR 5.65

There are 4 quarters with good PRF difference image offsets

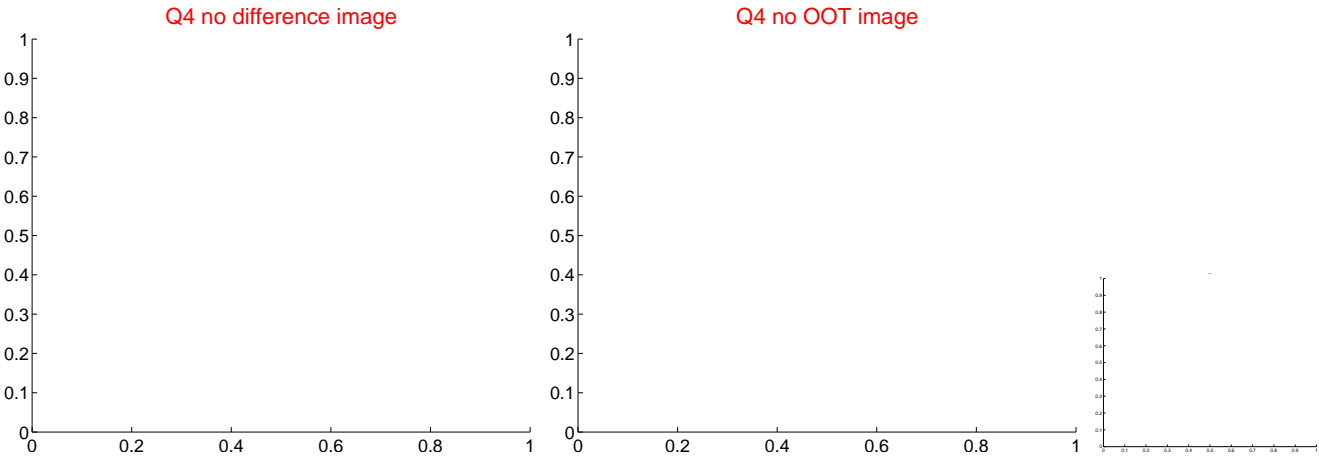
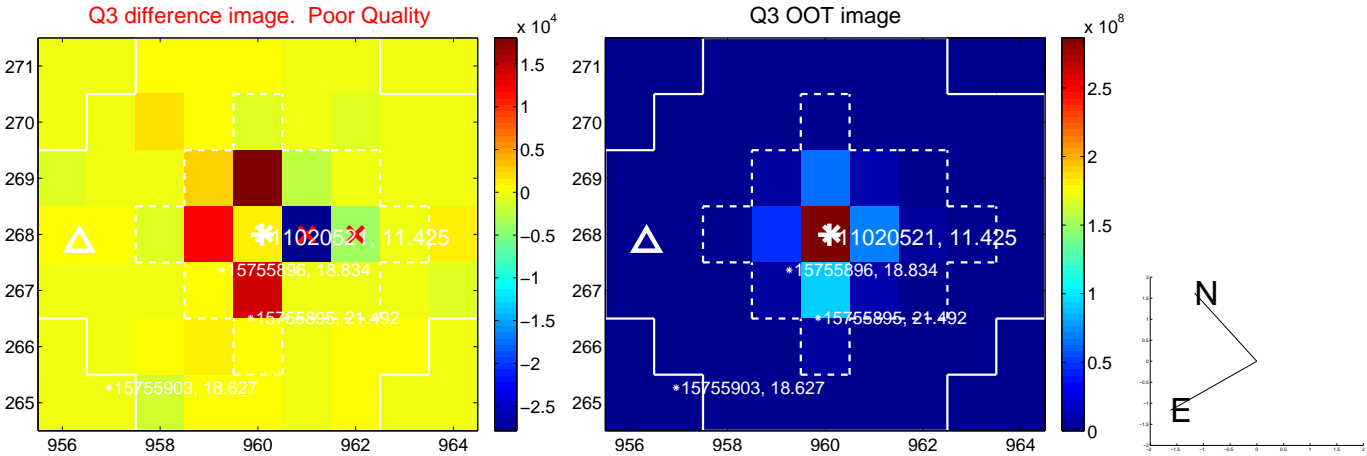
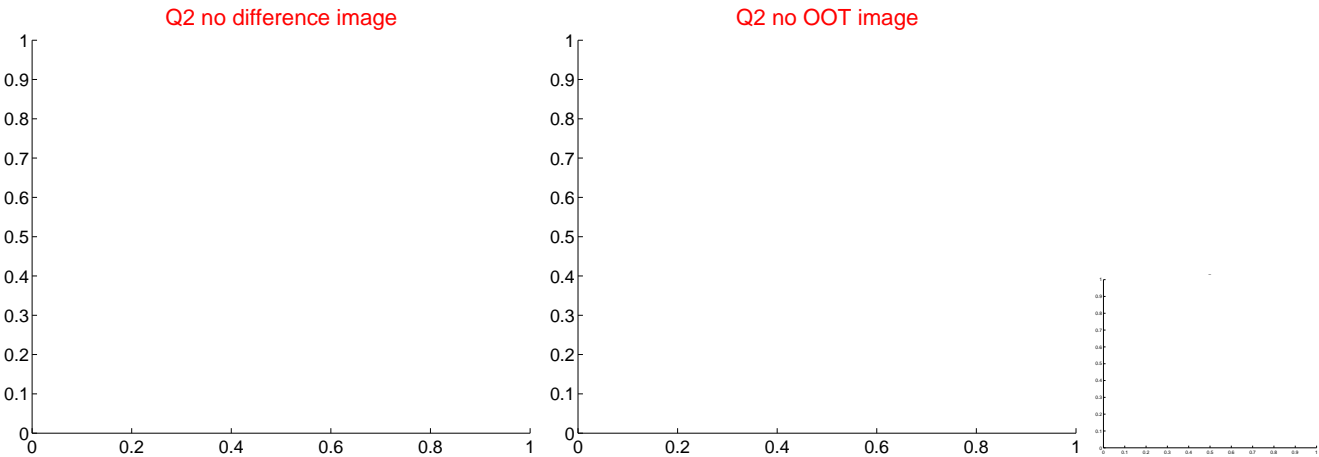
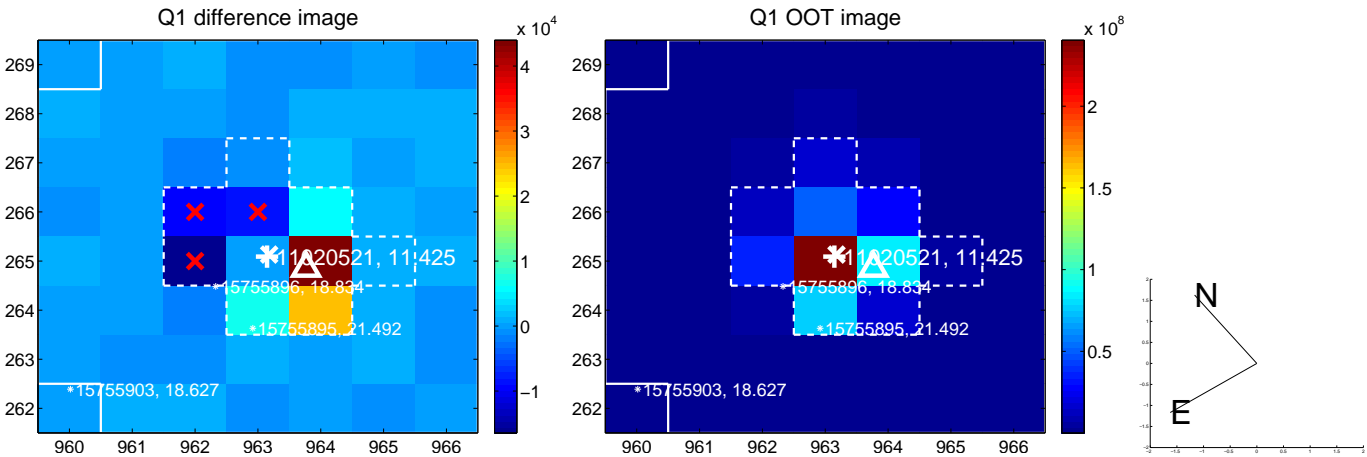
The direct PRF centroid is offset from the target star catalog position by about 0.21 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.834 \pm 1.489$	0.56	$0.794 \pm 1.806$	$-0.256 \pm 1.071$
PRF-fit source offset from KIC position	$1.005 \pm 1.285$	0.78	$0.971 \pm 1.550$	$-0.260 \pm 1.153$
photometric centroid source offset	—	—	—	—

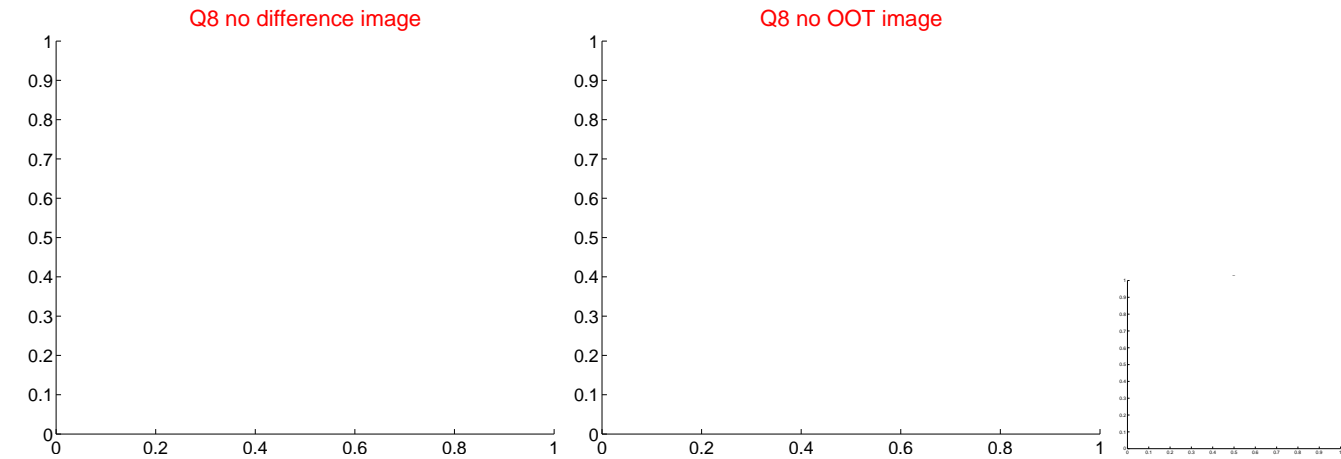
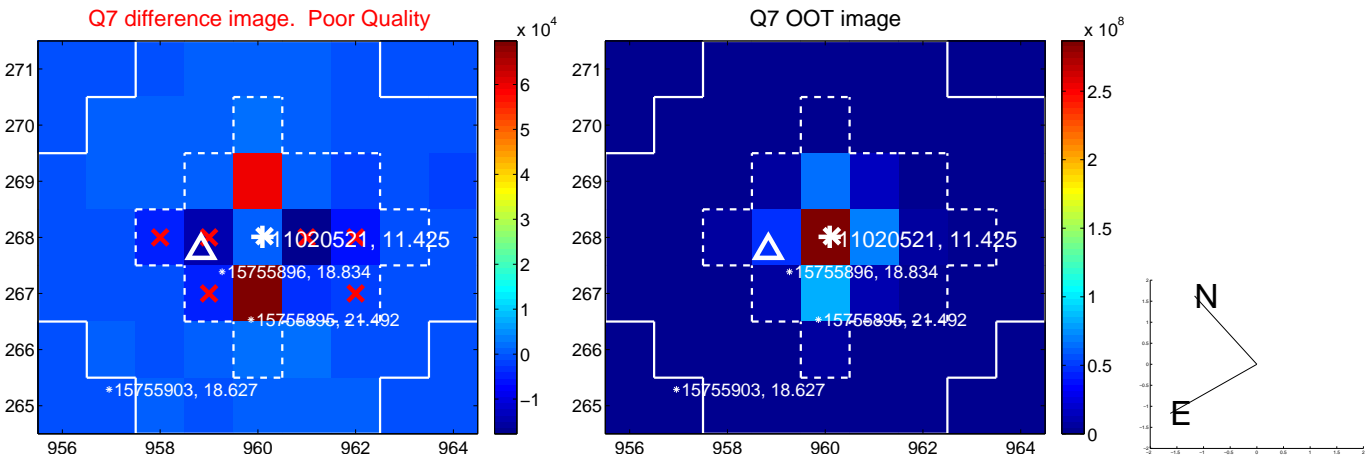
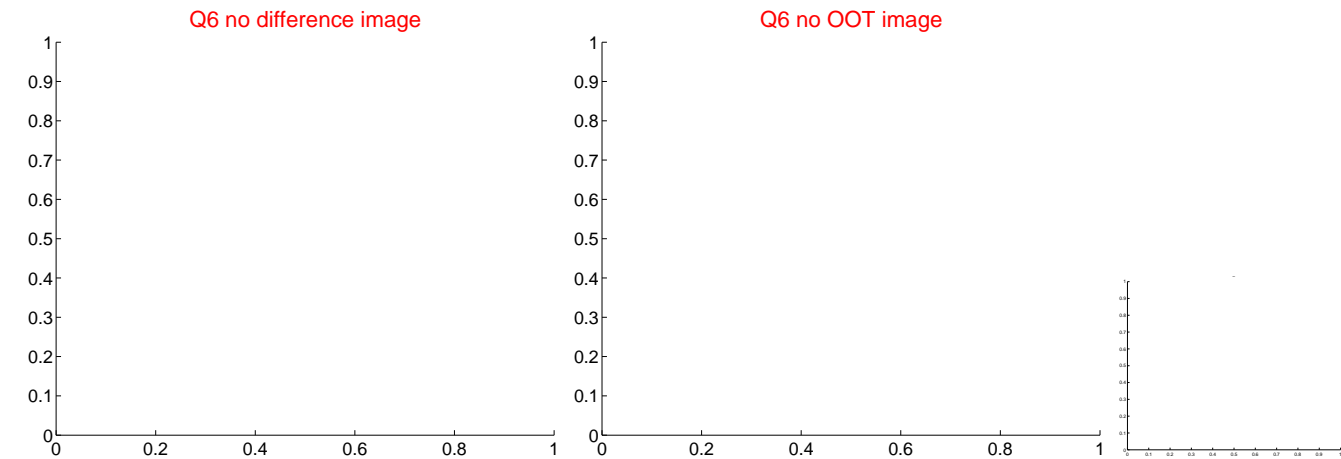
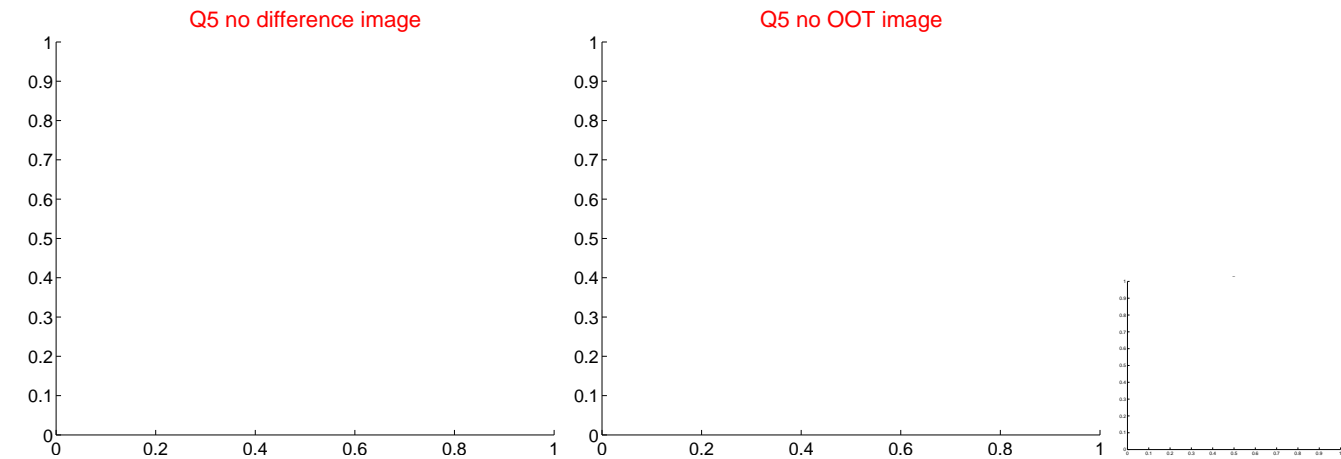


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

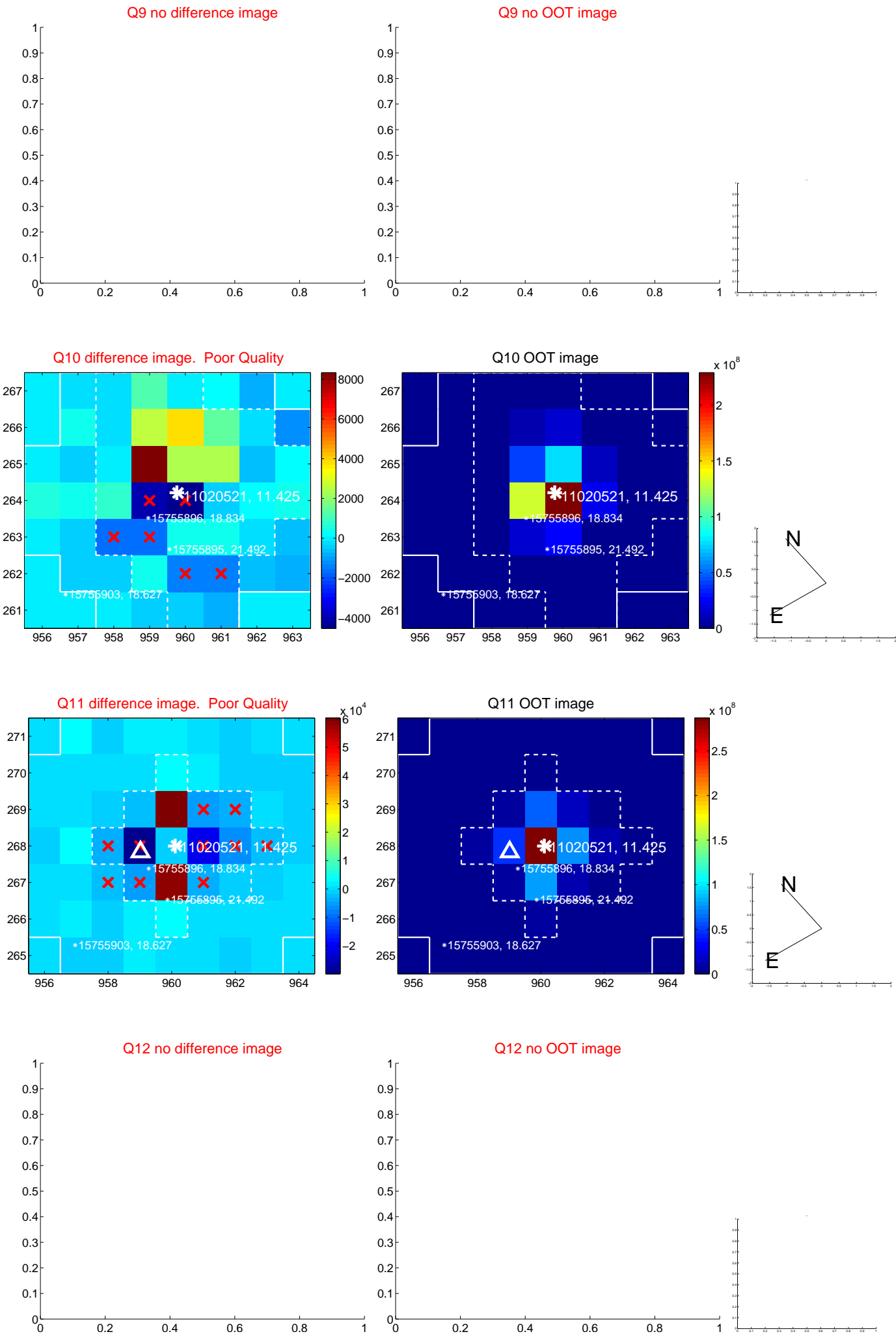
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



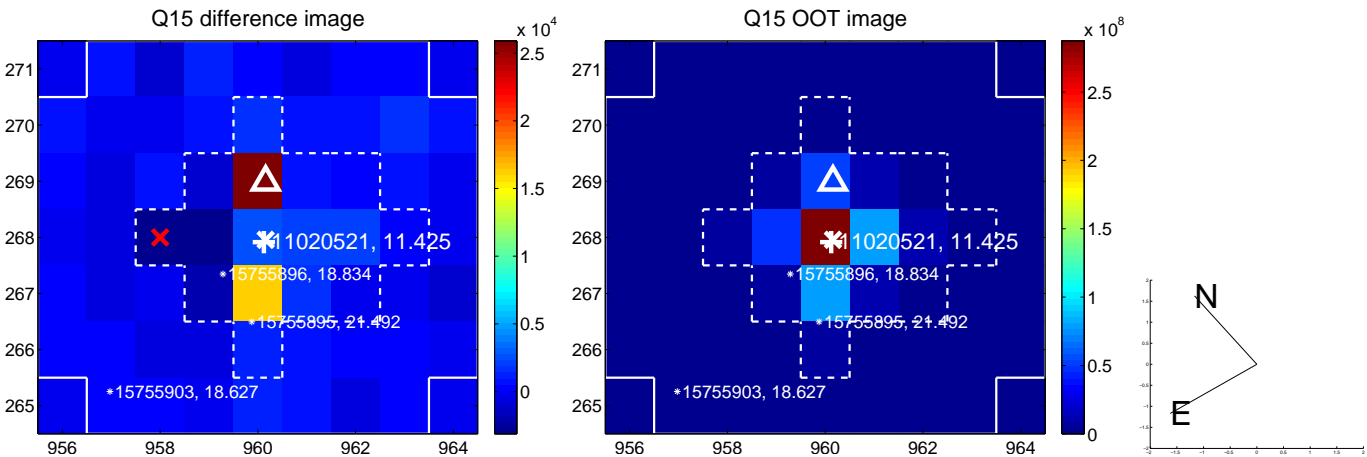
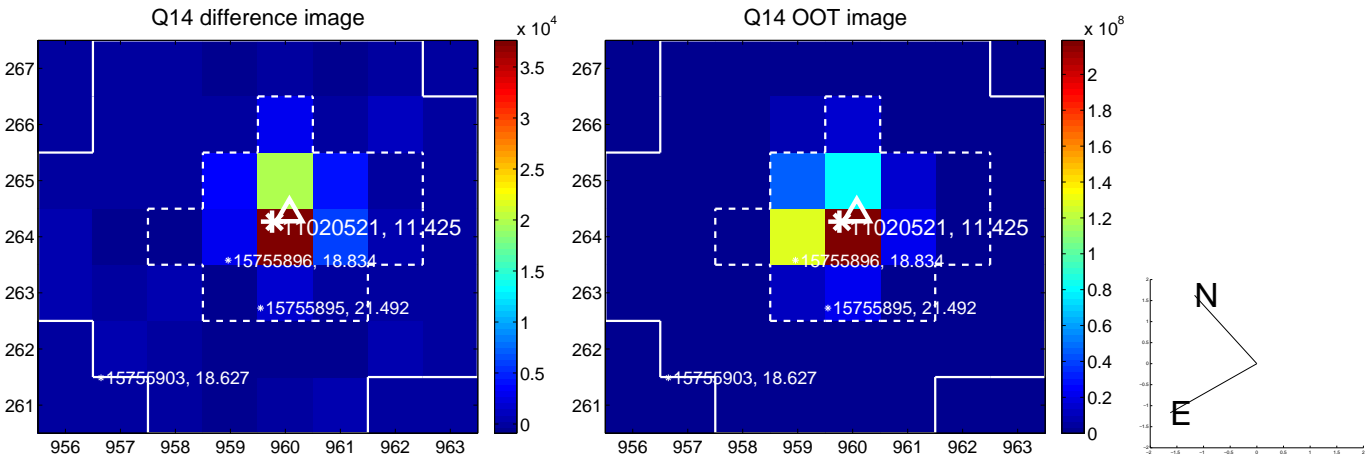
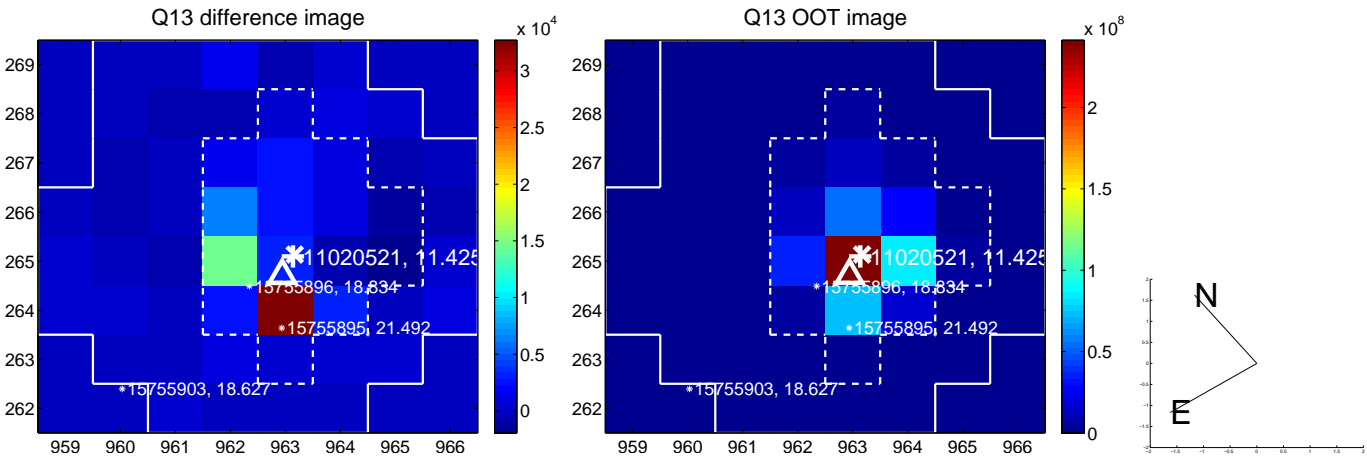
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



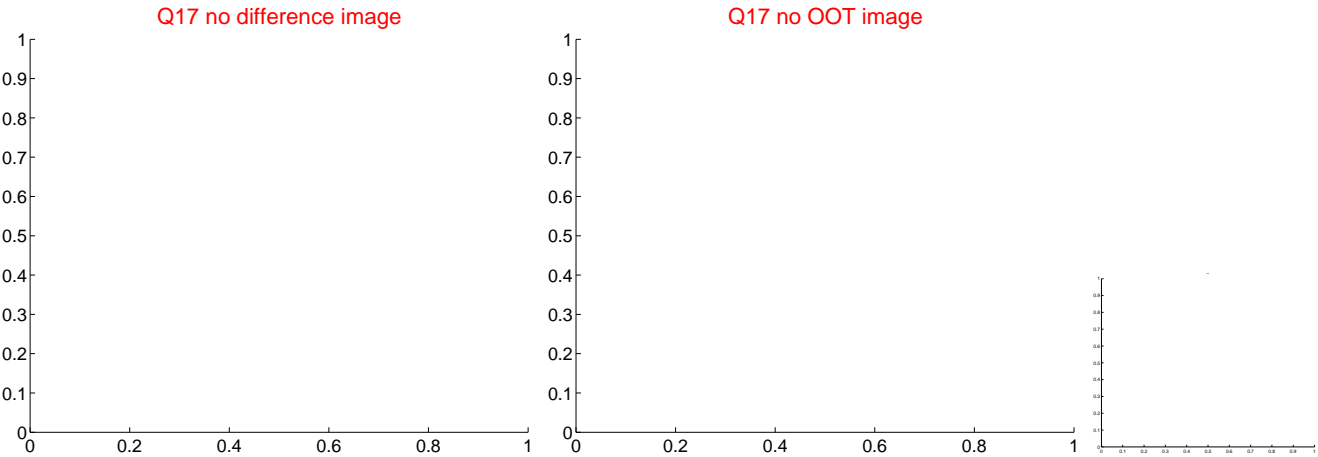
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



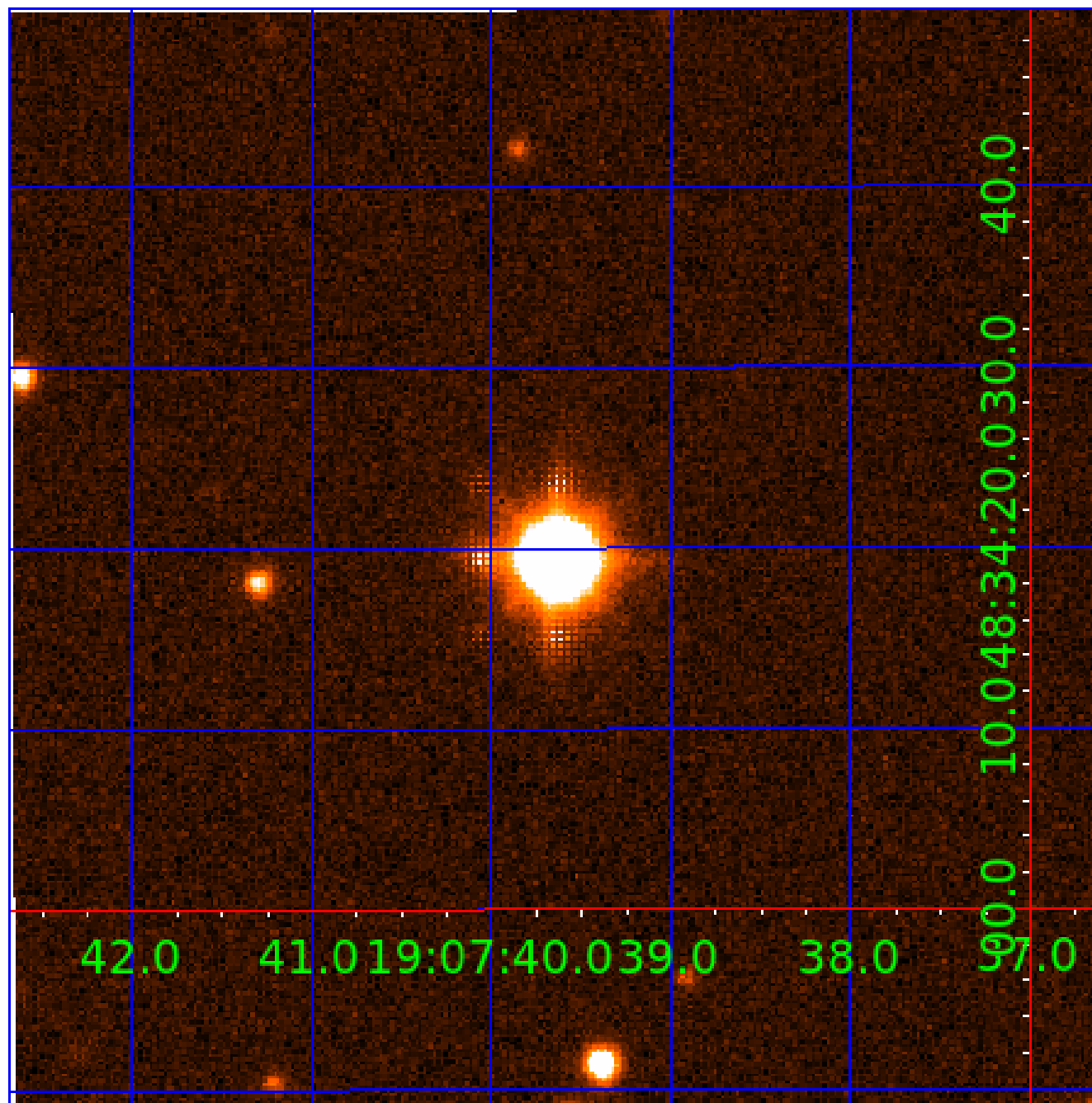
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



folded centroid time series figure for this object.

UKIRT Image

Declination





## KIC 011020521

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
011020521-01	OBS	No	2.929979	134.113706	0.1	0.514	8.2	0.0	3.22	6877	0.10	9371.70
011020521-02	OBS	No	2.930323	133.561397	22.1	5.264	8.1	6.6	3.22	6877	1.78	9370.24
011020521-03	OBS	No	2.930137	132.855754	16.9	12.993	9.2	7.9	3.22	6877	1.42	9371.03
011020521-04	OBS	No	11.171739	137.960832	85.1	3.597	8.7	9.1	3.22	6877	3.48	1573.30
011020521-05	OBS	No	293.095640	157.741380	193.4	6.042	8.2	8.1	3.22	6877	4.96	20.18
011020521-06	OBS	No	118.311612	211.553500	182.8	4.659	8.4	8.4	3.22	6877	5.08	67.65
011020521-07	OBS	No	131.858819	143.359611	66.9	9.614	8.3	5.6	3.22	6877	2.71	58.55
011020521-08	OBS	No	81.557176	178.687435	165.2	4.488	8.1	7.6	3.22	6877	4.58	111.09
011020521-09	OBS	No	36.435749	160.151233	162.1	3.382	8.0	9.4	3.22	6877	4.66	325.29
011020521-10	OBS	No	34.792680	149.579268	94.8	5.285	7.8	7.4	3.22	6877	3.67	345.93

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
011020521-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-04	OBS	FP	0.00	1	0	1	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
011020521-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-07	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-09	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_ALT—CENT_SATURATED
011020521-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

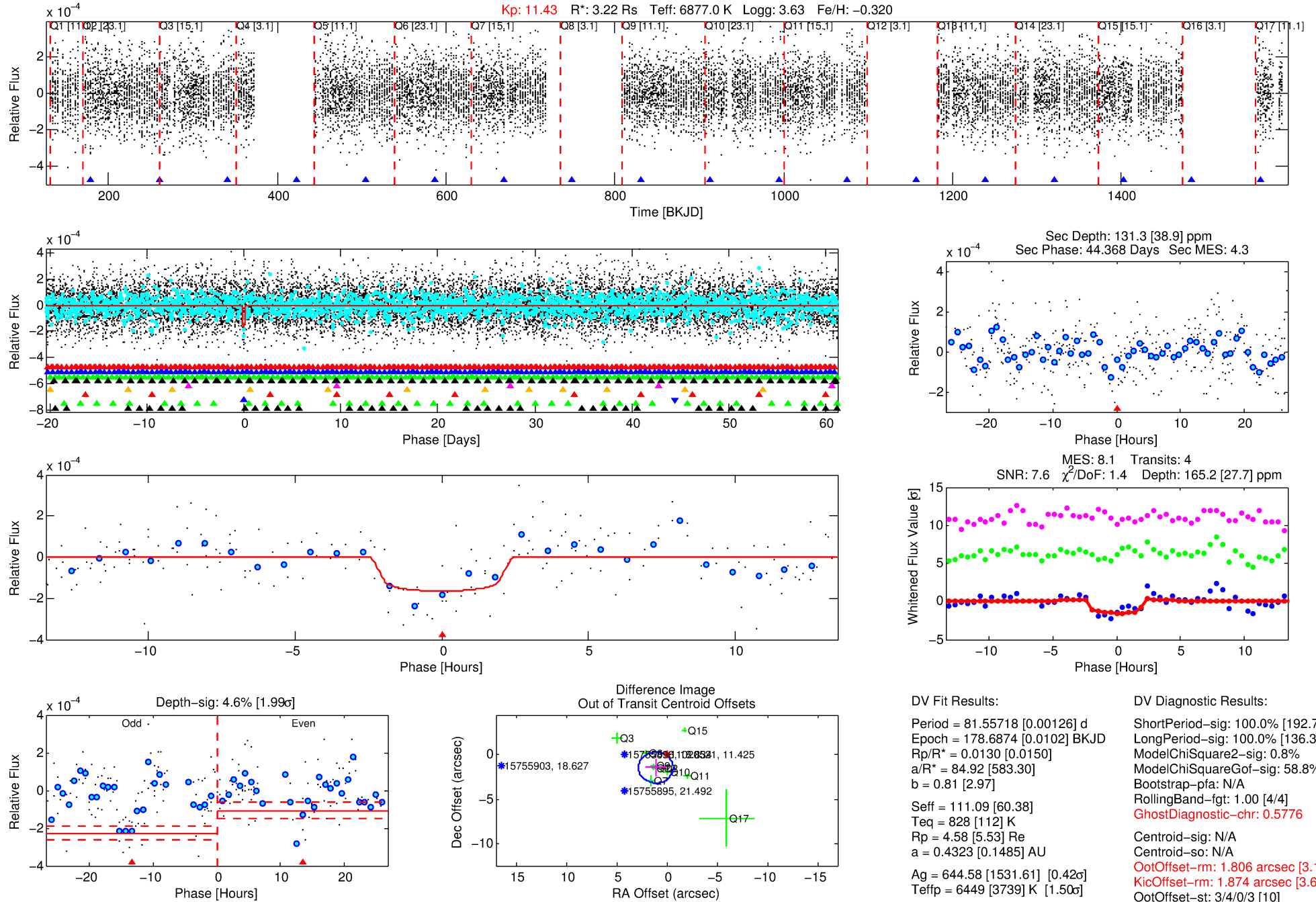
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 011020521-08

No Significant Match Found

# DV One-Page Summary

KIC: 11020521 Candidate: 8 of 10 Period: 81.557 d



## DV Fit Results:

Period = 81.55718 [0.00126] d  
 Epoch = 178.6874 [0.0102] BKJD  
 Rp/R\* = 0.0130 [0.0150]  
 a/R\* = 84.92 [583.30]  
 b = 0.81 [2.97]  
 Seff = 111.09 [60.38]  
 Teq = 828 [112] K  
 Rp = 4.58 [5.53] Re  
 a = 0.4323 [0.1485] AU  
 Ag = 644.58 [1531.61] [0.42 $\sigma$ ]  
 Teffp = 6449 [3739] K [1.50 $\sigma$ ]

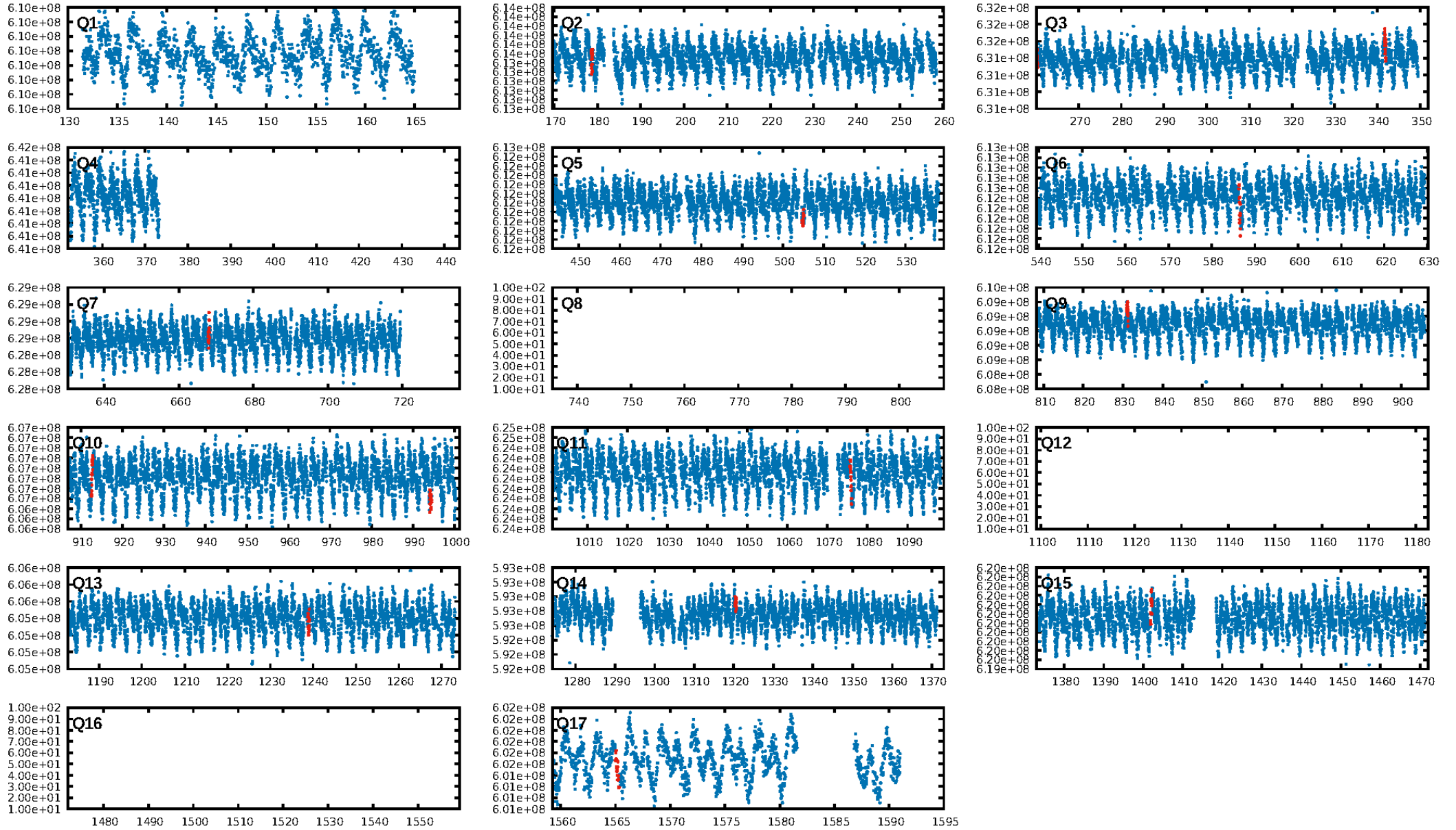
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [192.72 $\sigma$ ]  
 LongPeriod-sig: 100.0% [136.36 $\sigma$ ]  
 ModelChiSquare2-sig: 0.8%  
 ModelChiSquareGof-sig: 58.8%  
 Bootstrap-pfa: N/A  
 RollingBand-fgt: 1.00 [4/4]  
 GhostDiagnostic-chr: 0.5776  
 Centroid-sig: N/A  
 Centroid-so: N/A  
 OotOffset-rm: 1.806 arcsec [3.12 $\sigma$ ]  
 KicOffset-rm: 1.874 arcsec [3.63 $\sigma$ ]  
 OotOffset-st: 3/4/0/3 [10]  
 KicOffset-st: 3/4/0/3 [10]  
 DiffImageQuality-fgm: 0.40 [4/10]  
 DiffImageOverlap-fno: 0.18 [2/11]

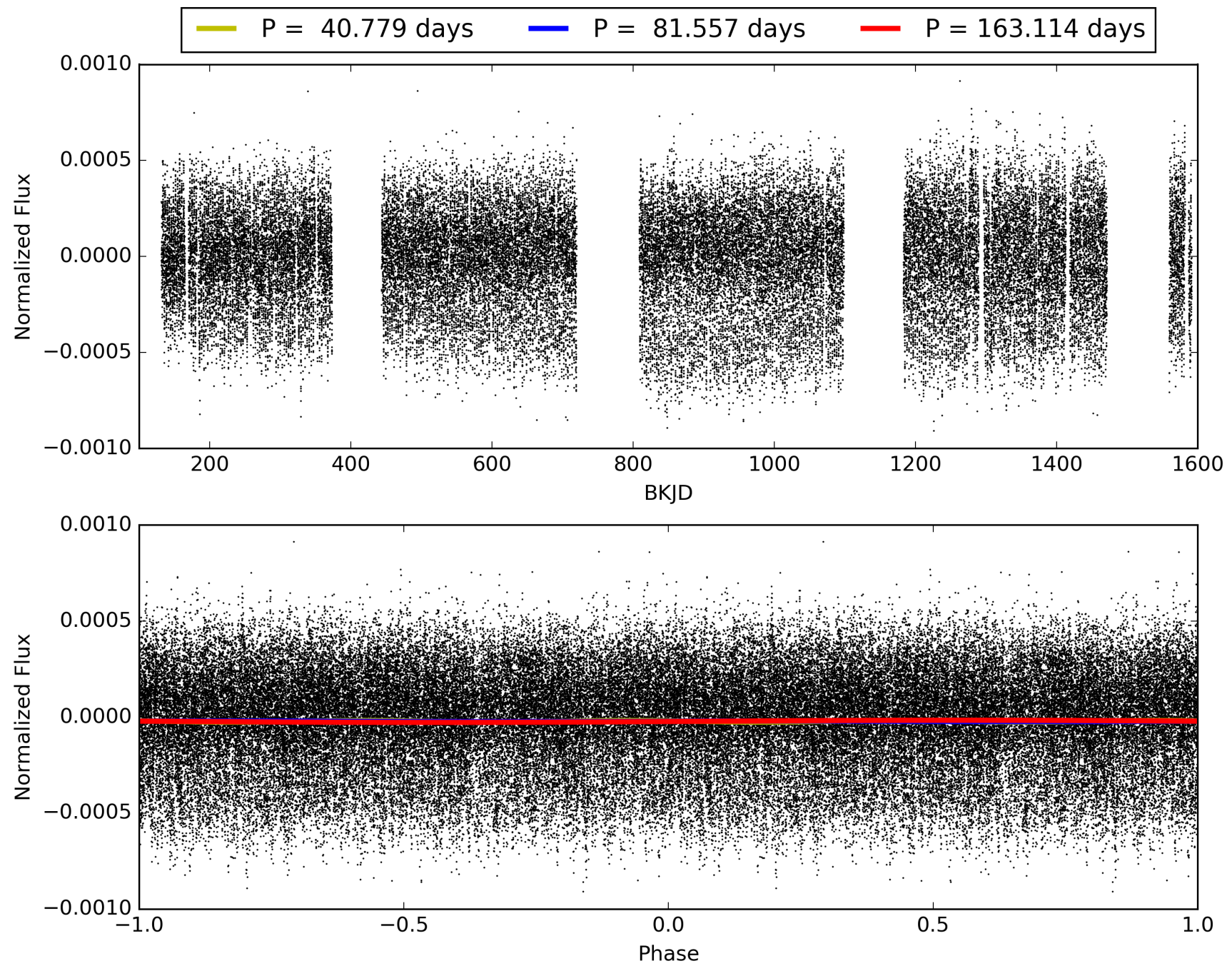
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 05:45:16 Z

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

# TCE 011020521-08, PDC Light Curves

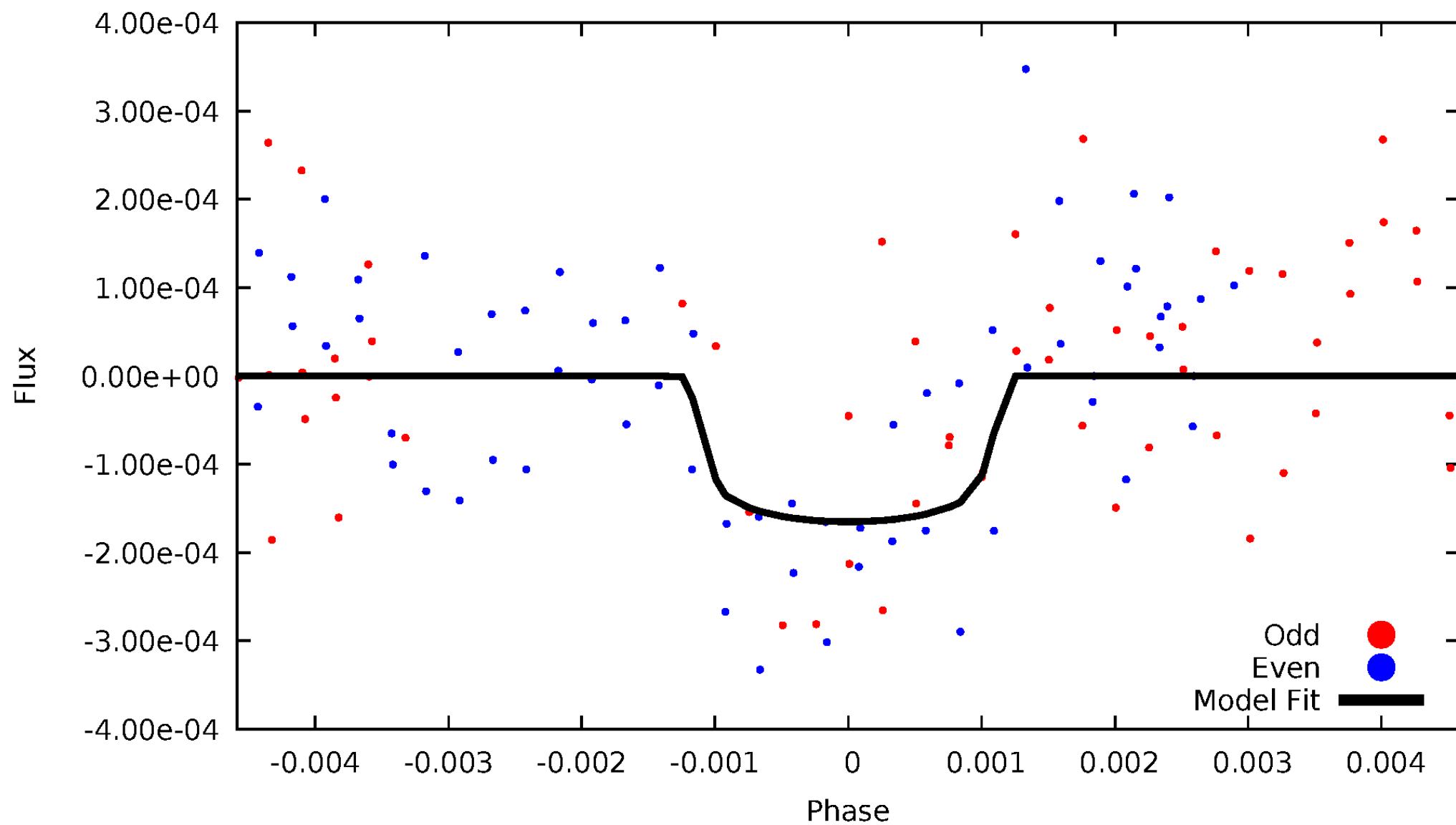


# TCE 011020521-08



# DV Odd/Even

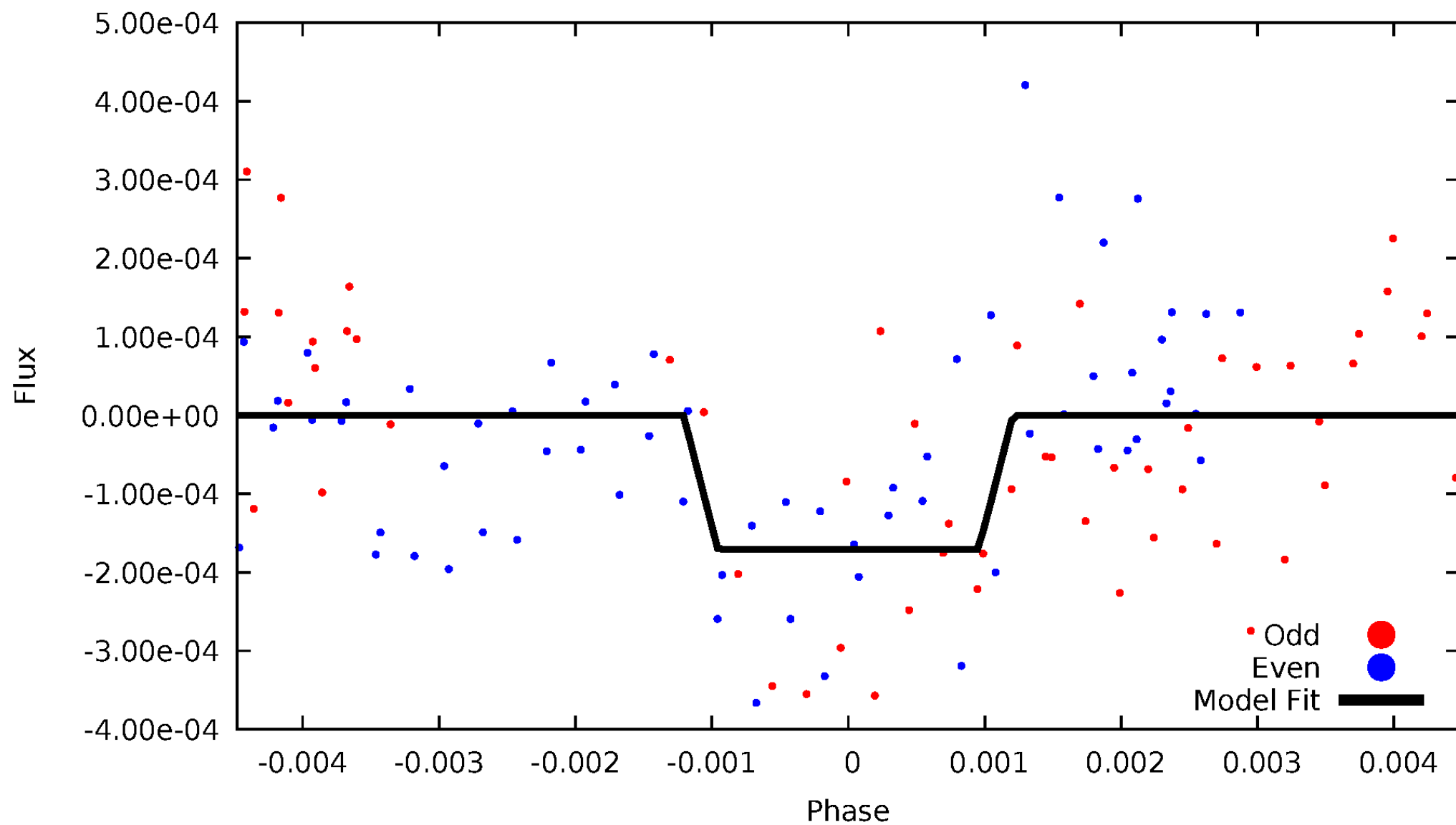
TCE 011020521-08





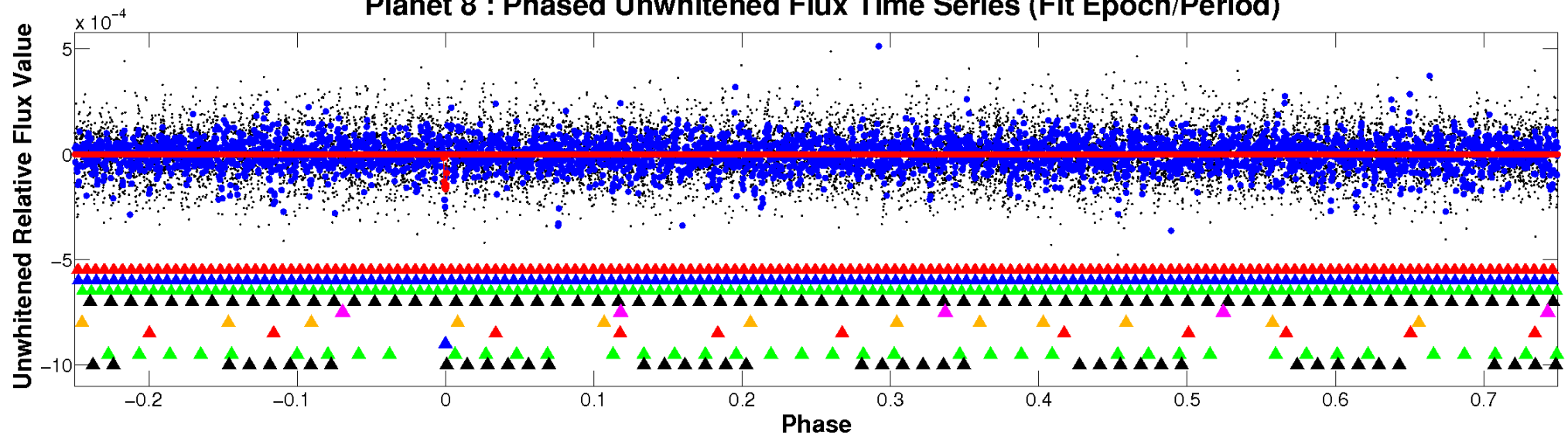
# ALT Odd/Even

TCE 011020521-08

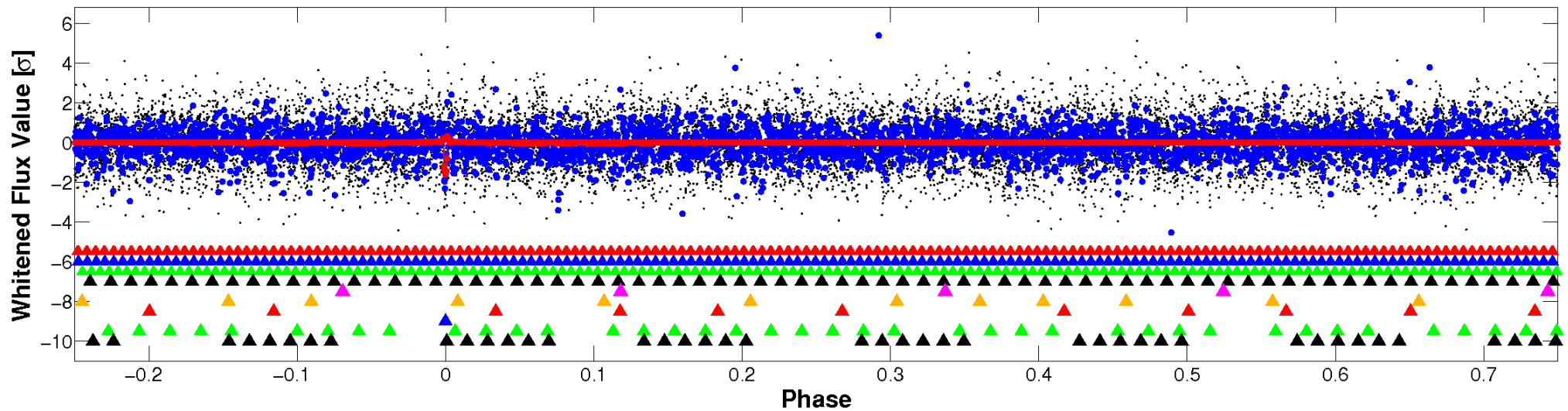


# Non-Whitened Vs. Whitened Light Curve

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



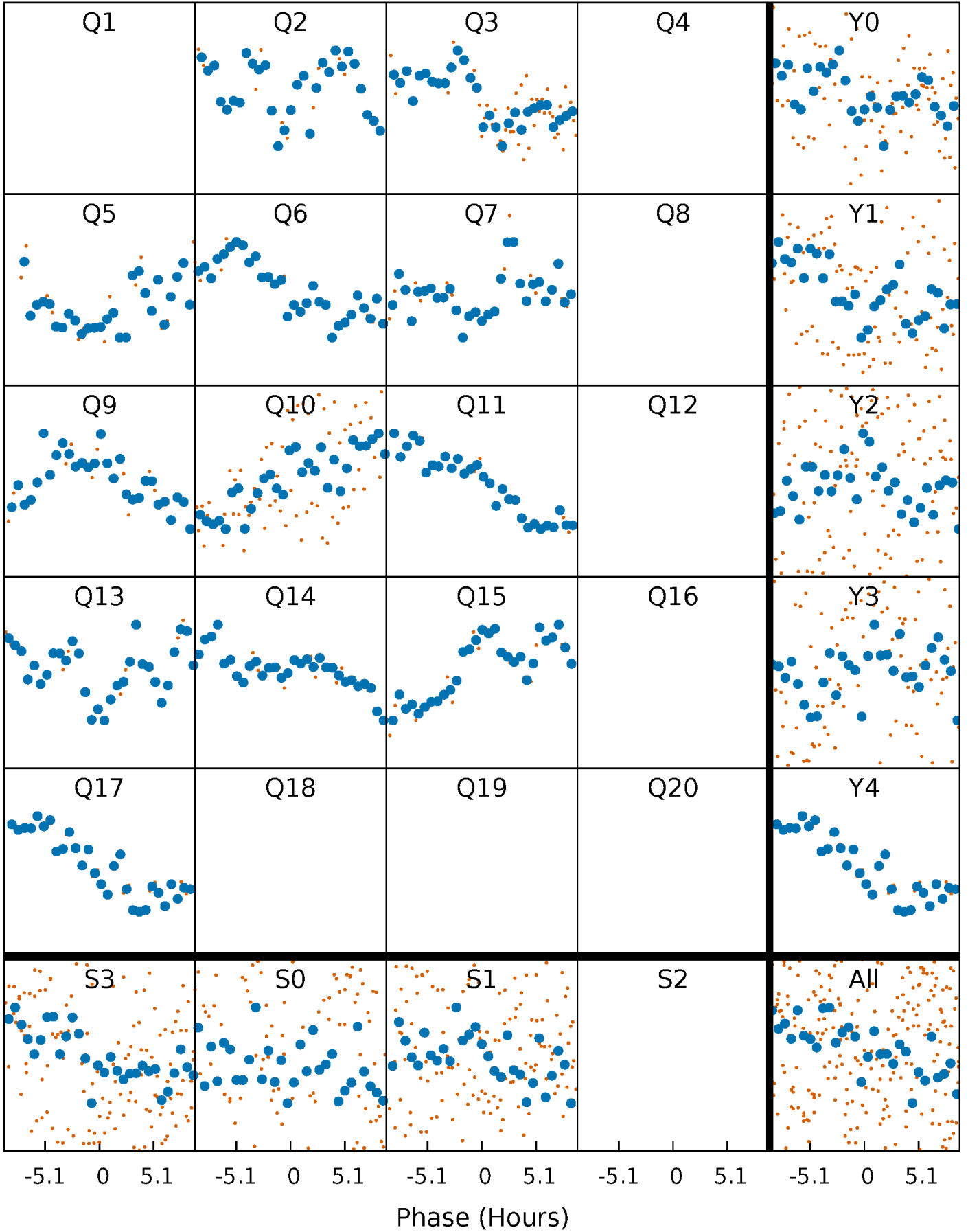
## Planet 8 : Phased Whitened Flux Time Series (Fit Epoch/Period)





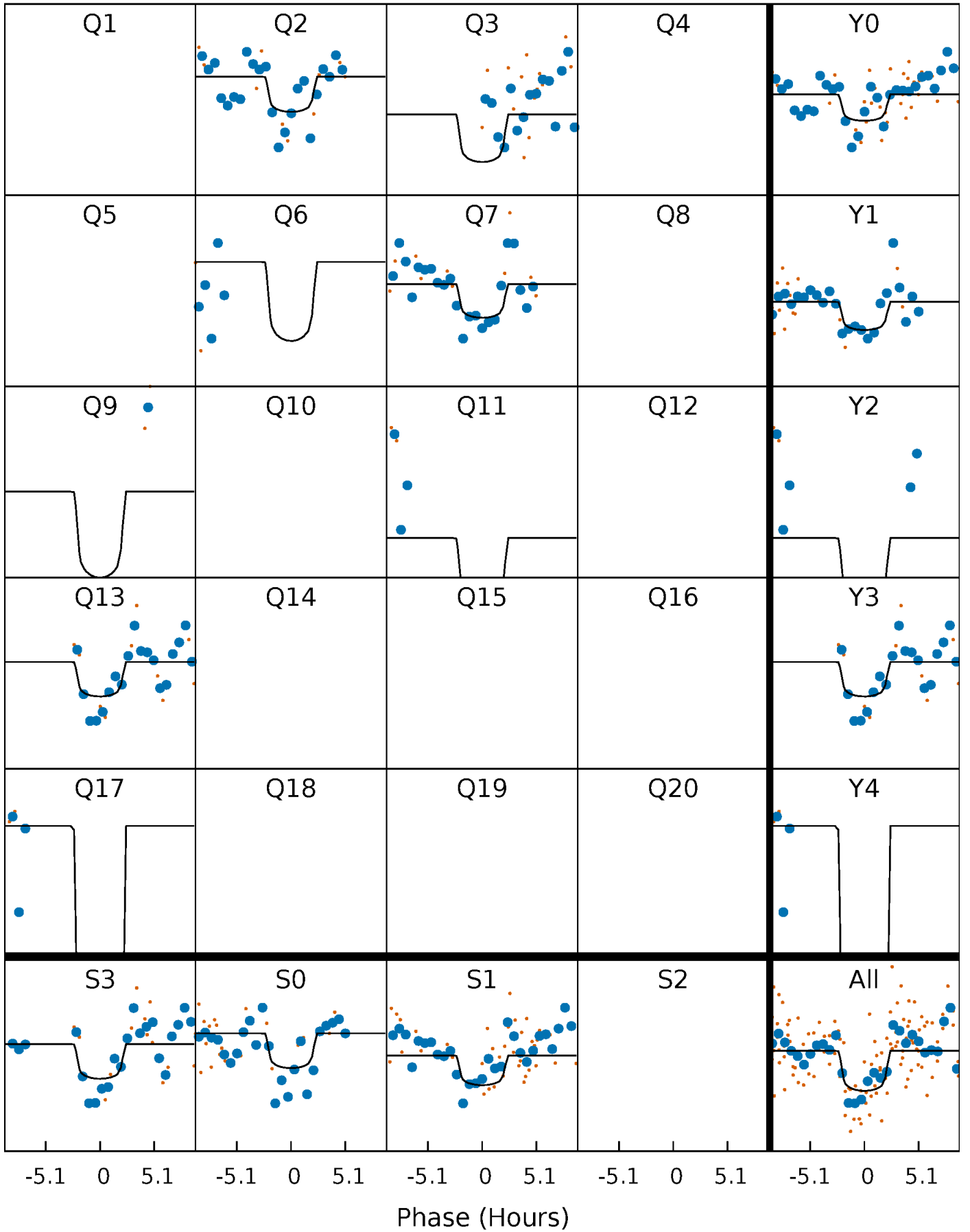
# PDC Quarter-Phased Transit Curves

TCE 011020521-08   P= 81.557176 Days    $T_0=178.687435$  (BKJD)



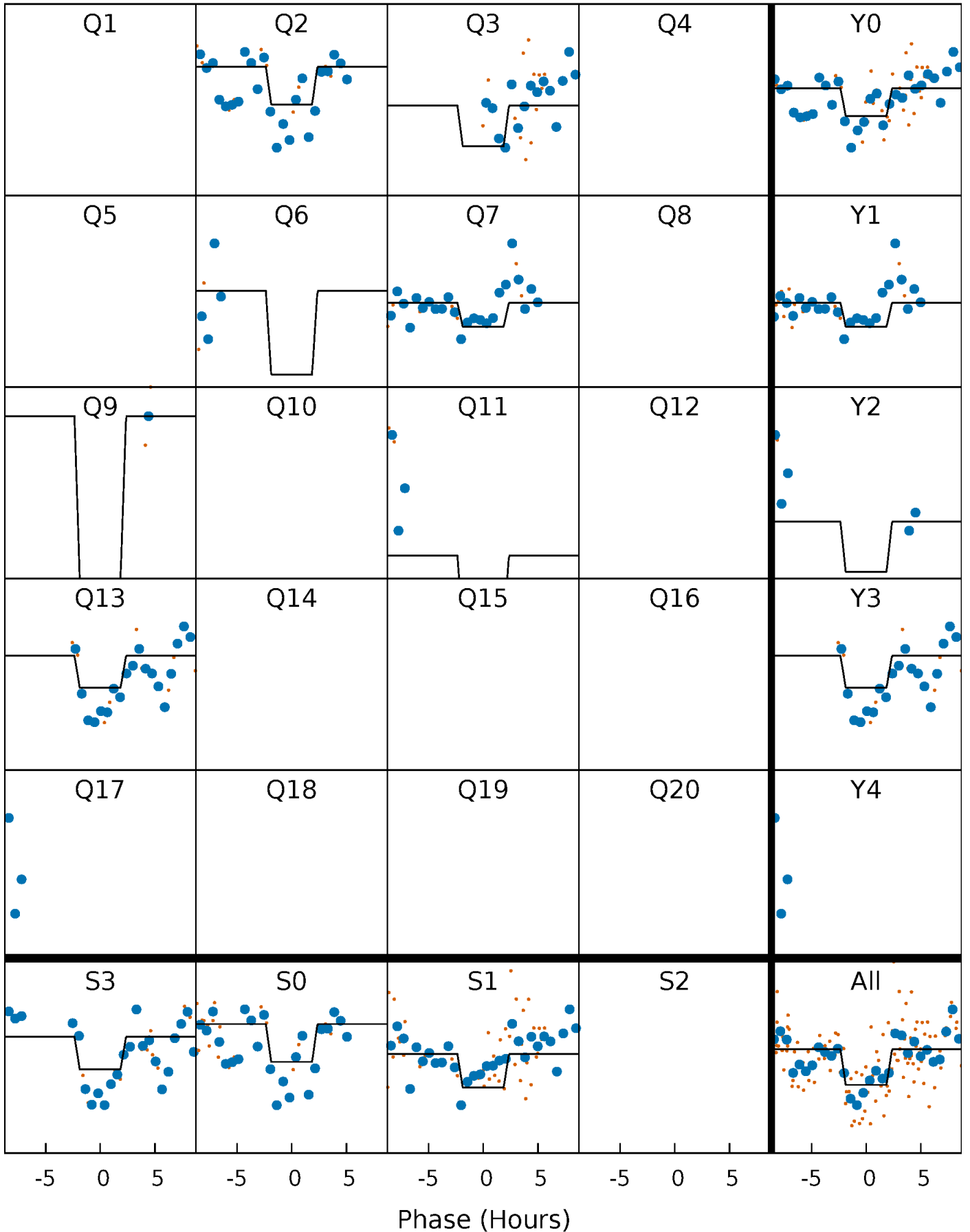
# DV Quarter-Phased Transit Curves

TCE 011020521-08 P= 81.557176 Days  $T_0=178.687435$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

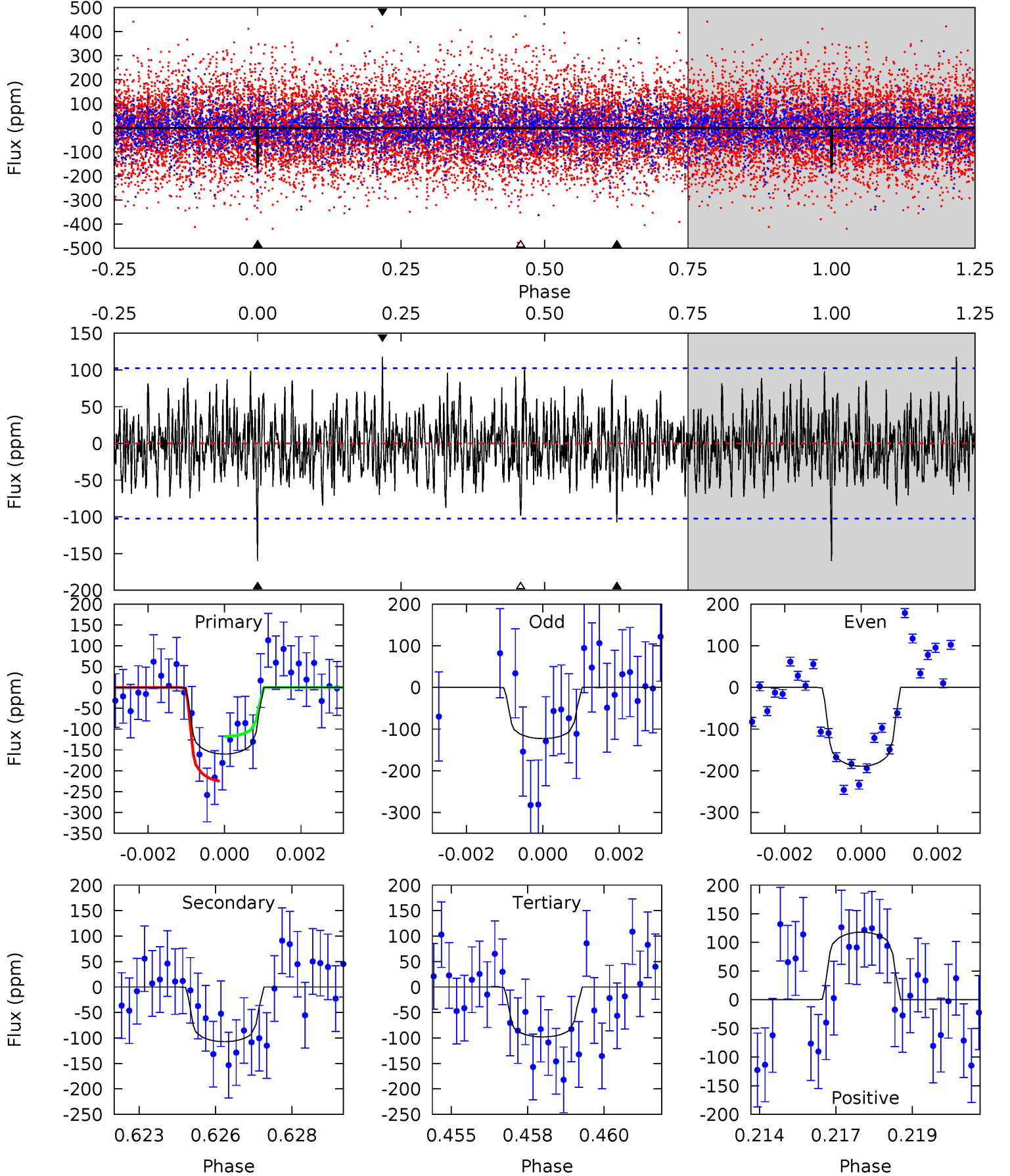
TCE 011020521-08     $P = 81.557506$  Days     $T_0 = 178.688427$  (BKJD)



# DV Model-Shift Uniqueness Test

011020521-08, P = 81.557176 Days, E = 97.130259 Days

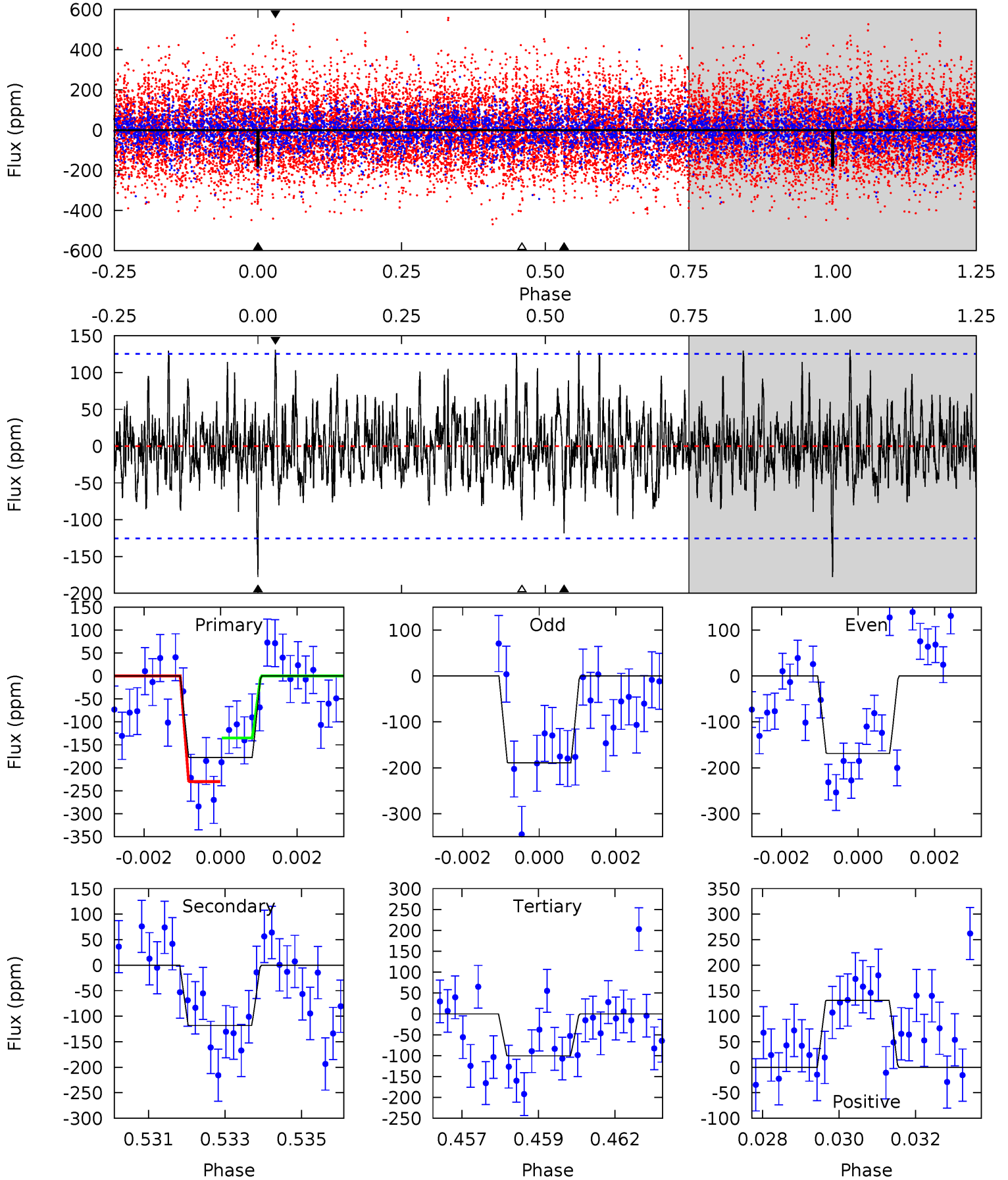
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.27	5.55	5.07	6.10	5.29	3.03	1.65	3.20	2.17	0.48	-0.55	1.71	0.79	0.42	2.70



# Alt Model-Shift Uniqueness Test

011020521-08, P = 81.557506 Days, E = 97.130921 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
7.52	5.00	4.25	5.54	5.30	3.05	1.56	3.27	1.98	0.75	-0.54	0.43	0.98	0.42	1.97



### Stellar Parameters For KIC 011020521

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6877^{+170}_{-204}$	$3.632^{+0.304}_{-0.076}$	$-0.320^{+0.300}_{-0.250}$	$3.219^{+0.406}_{-1.217}$	$1.619^{+0.227}_{-0.312}$	$0.068^{+0.149}_{-0.017}$
	+2%/-3%	+8%/-2%	+94%/-78%	+13%/-38%	+14%/-19%	+218%/-25%
Source	PHO1	FLK73	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 011020521-08 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-107 \pm 19$	$5.87^{+5.02}_{-3.76}$	$1137^{+57}_{-100}$	$5244^{+3806}_{-1107}$	$324^{+2159}_{-228}$
Alt.	$-118 \pm 24$	$5.53^{+4.64}_{-3.72}$	$1134^{+62}_{-99}$	$5550^{+4761}_{-1258}$	$411^{+3189}_{-300}$

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

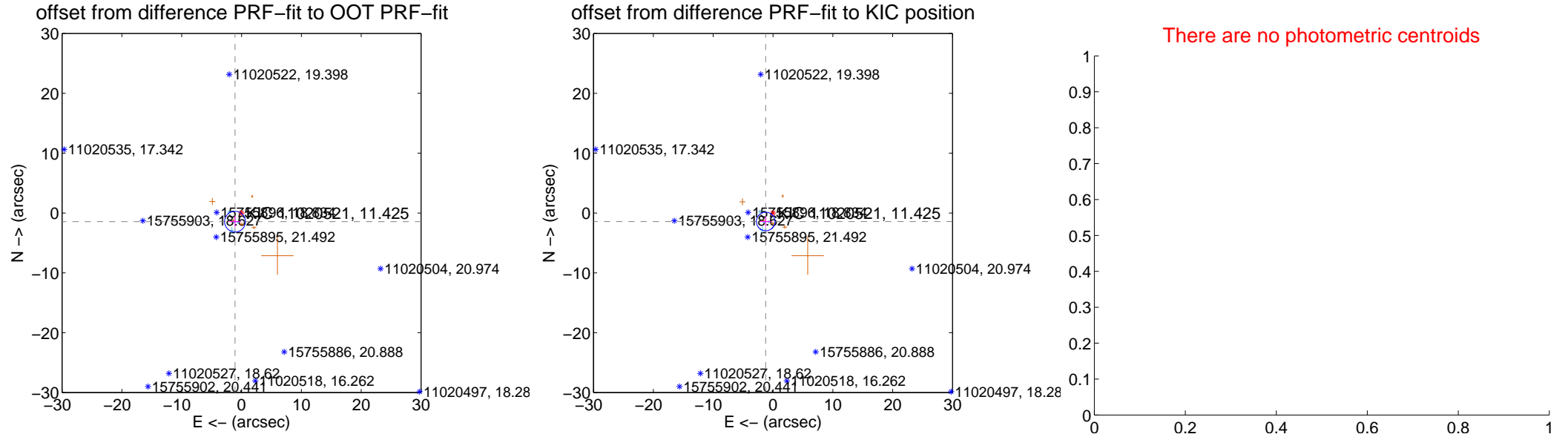
## DV Centroid Data

Supplemental centroid analysis for 011020521-08. **Kepler magnitude: 11.43.** Transit SNR 7.61

There are 4 quarters with good PRF difference image offsets

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

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	<b><math>1.806 \pm 0.579</math></b>	<b>3.12</b>	$1.093 \pm 0.985$	$-1.438 \pm 0.926$
PRF-fit source offset from KIC position	<b><math>1.874 \pm 0.516</math></b>	<b>3.63</b>	$1.221 \pm 0.956$	$-1.422 \pm 0.866$
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.

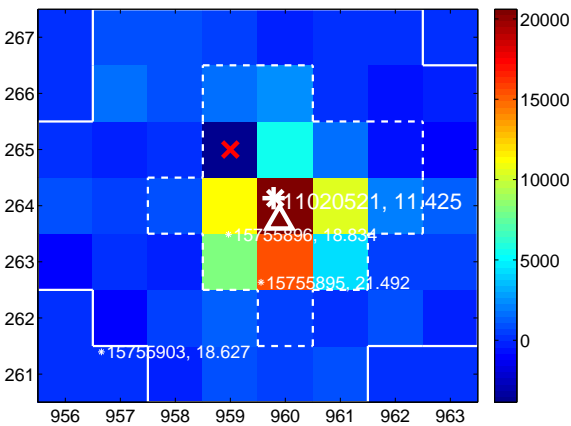
Q1 no difference image



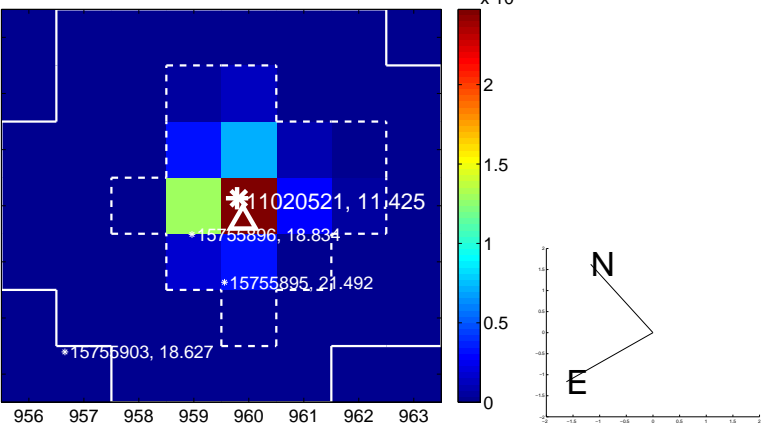
Q1 no OOT image



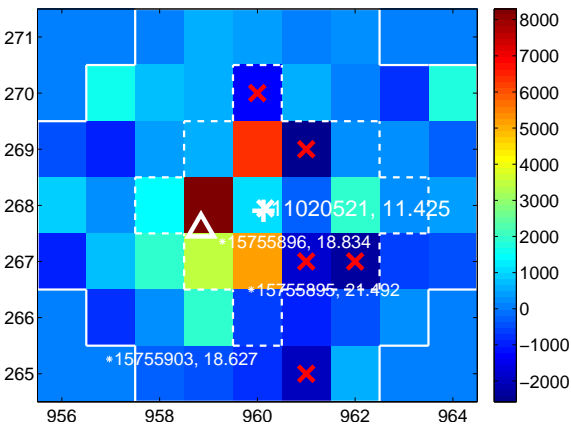
Q2 difference image



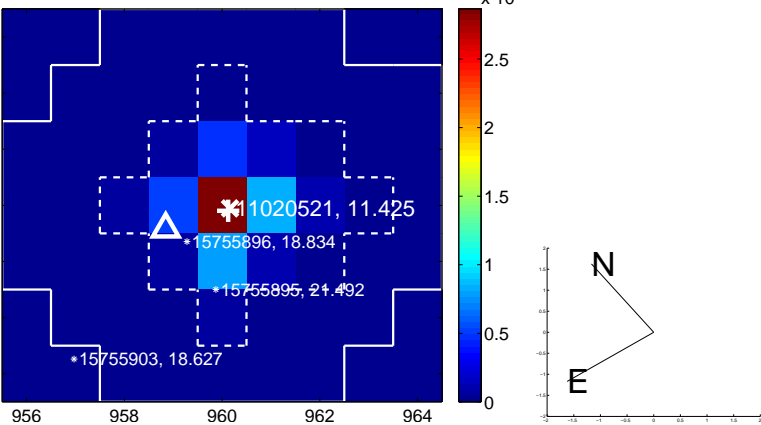
Q2 OOT image



Q3 difference image. Poor Quality



Q3 OOT image



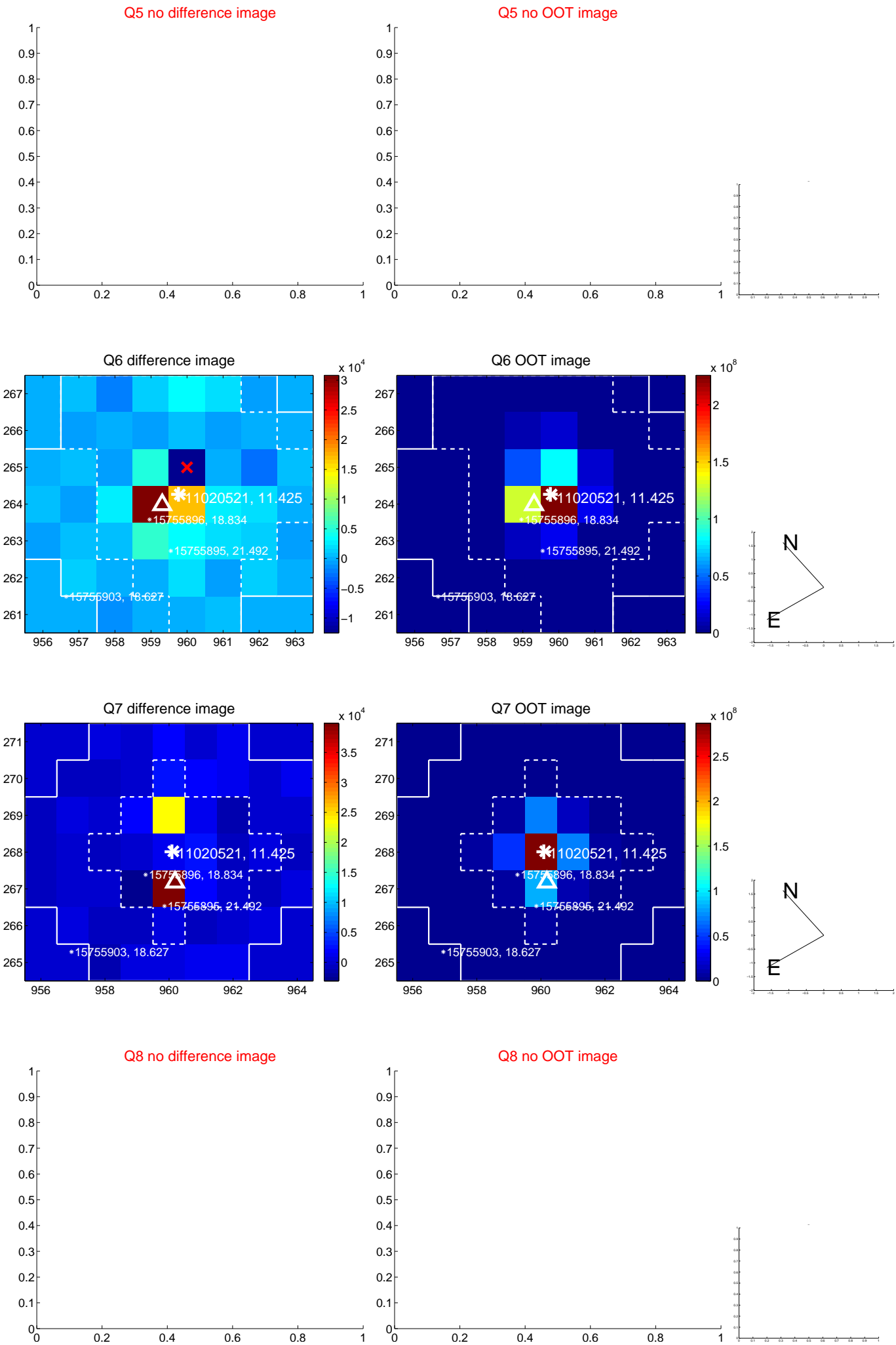
Q4 no difference image



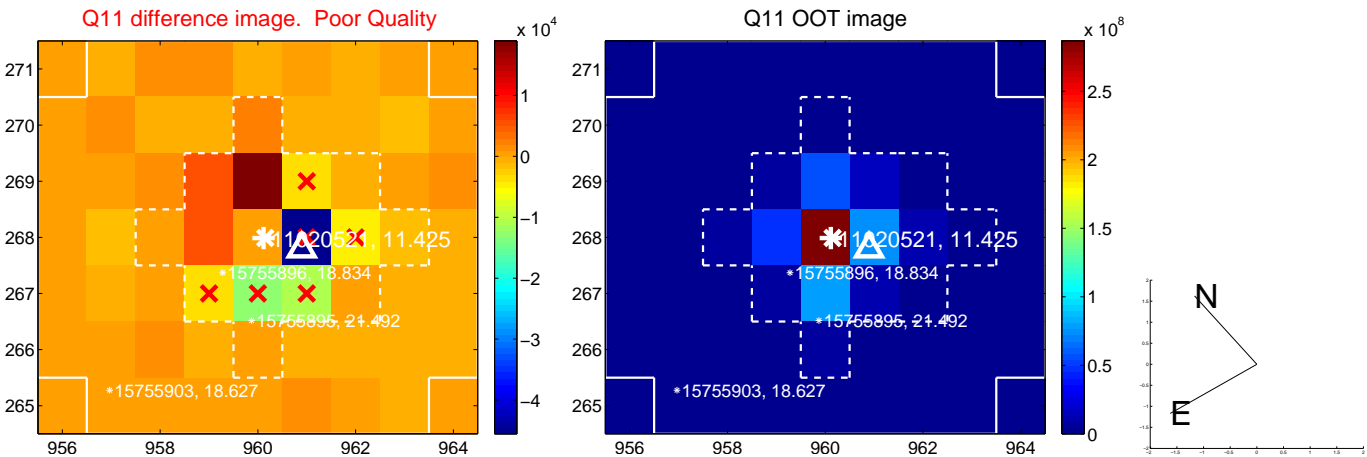
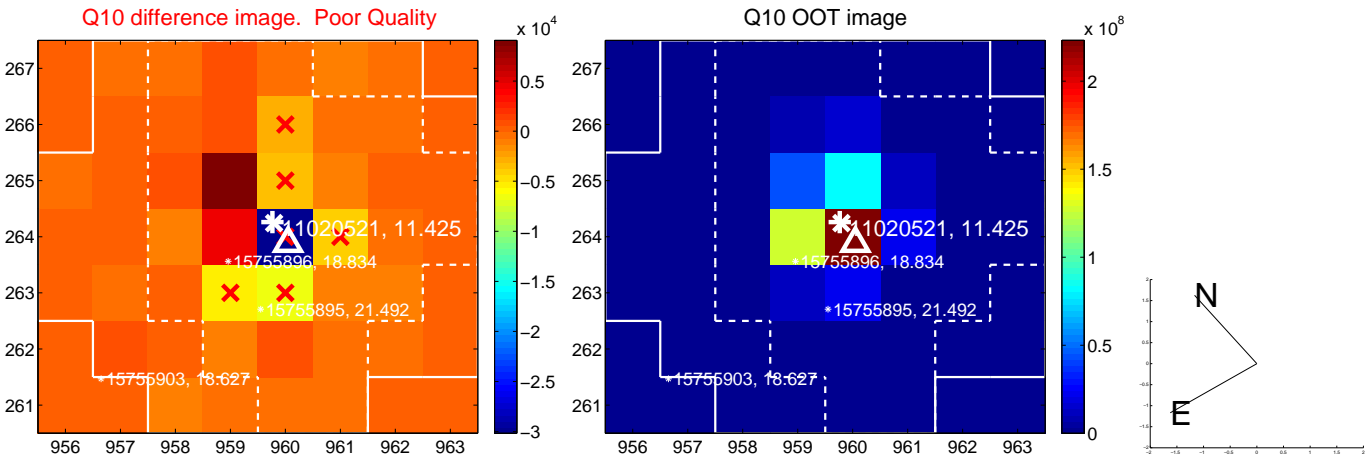
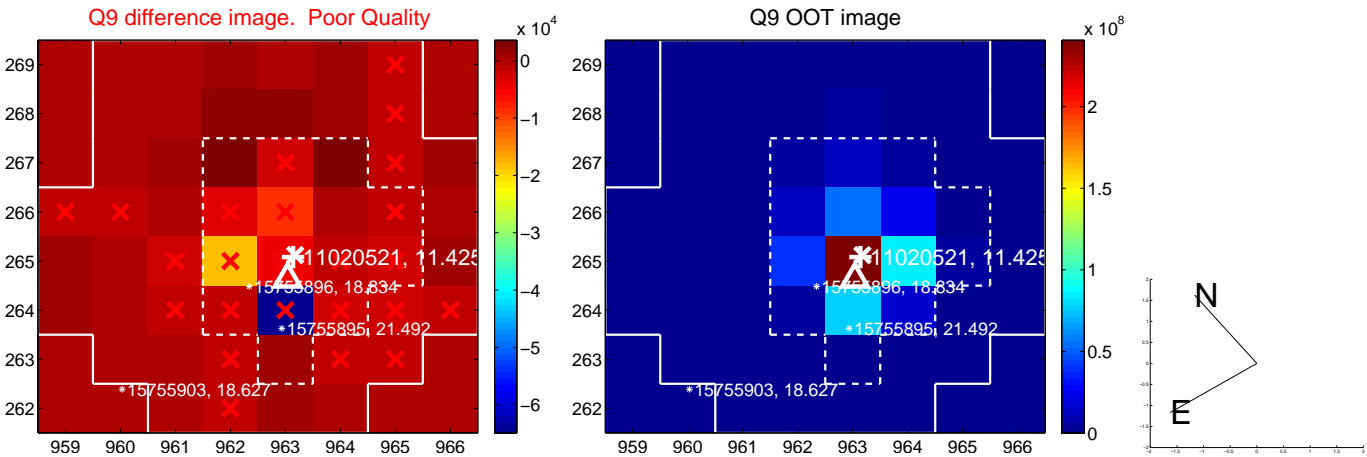
Q4 no OOT image



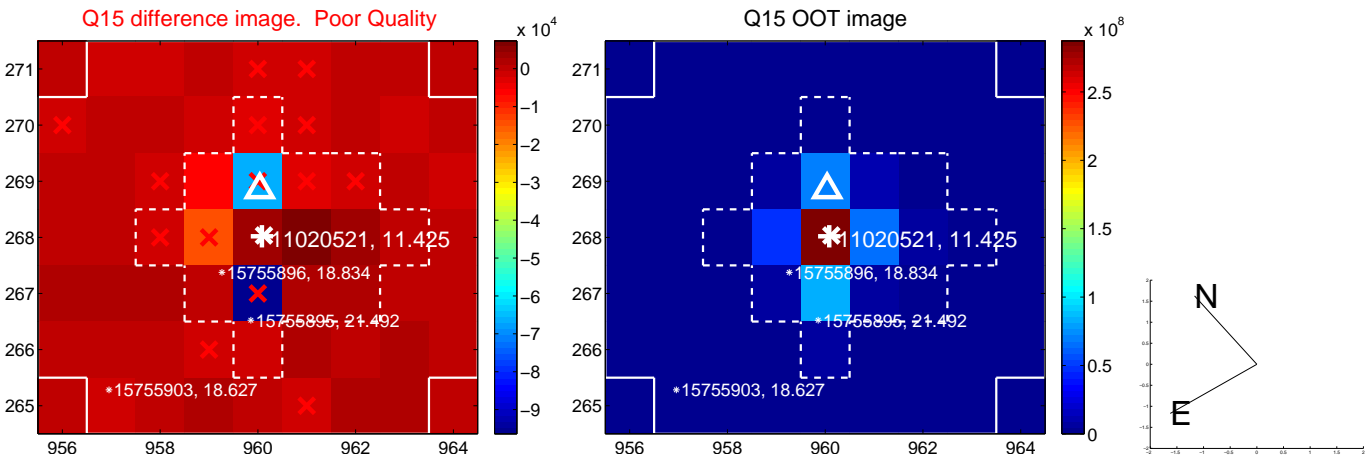
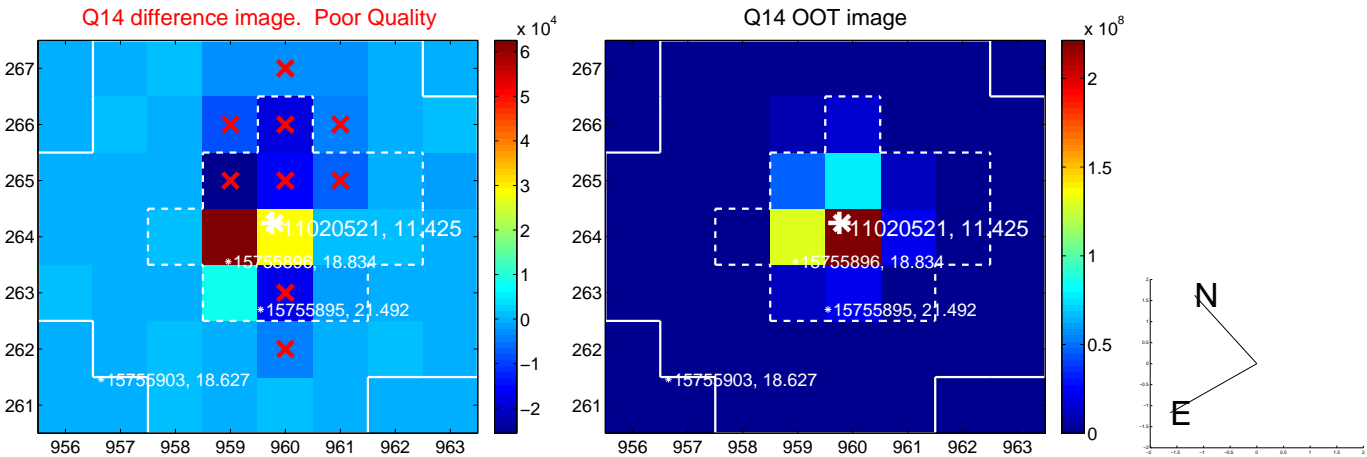
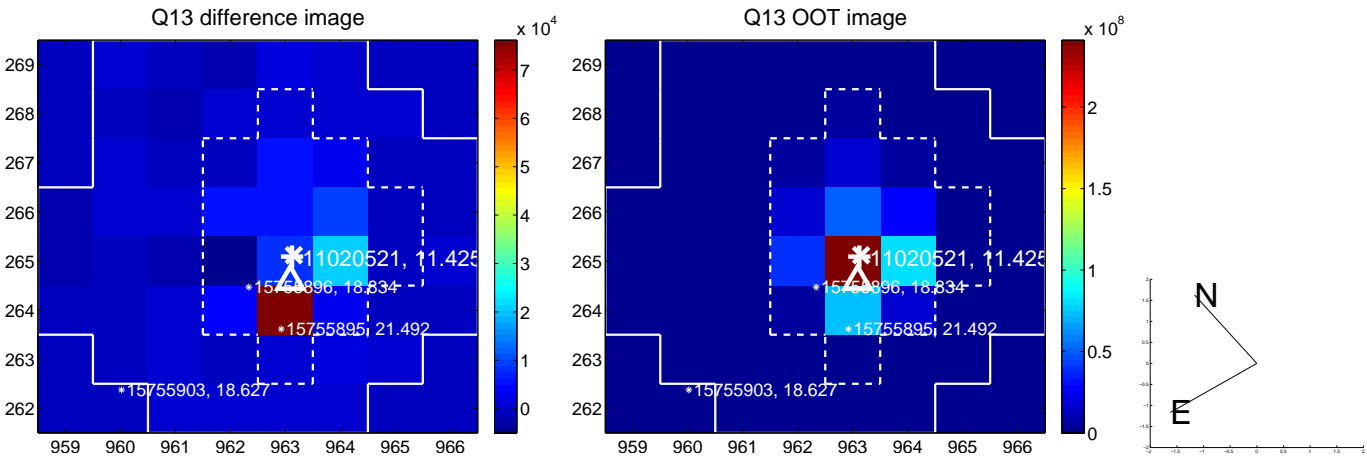
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



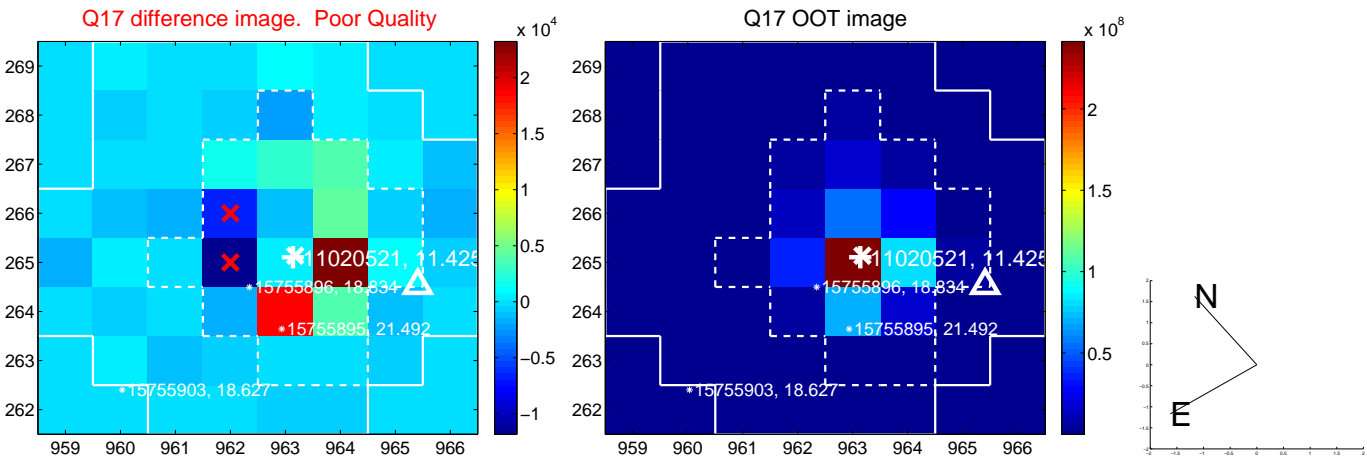
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



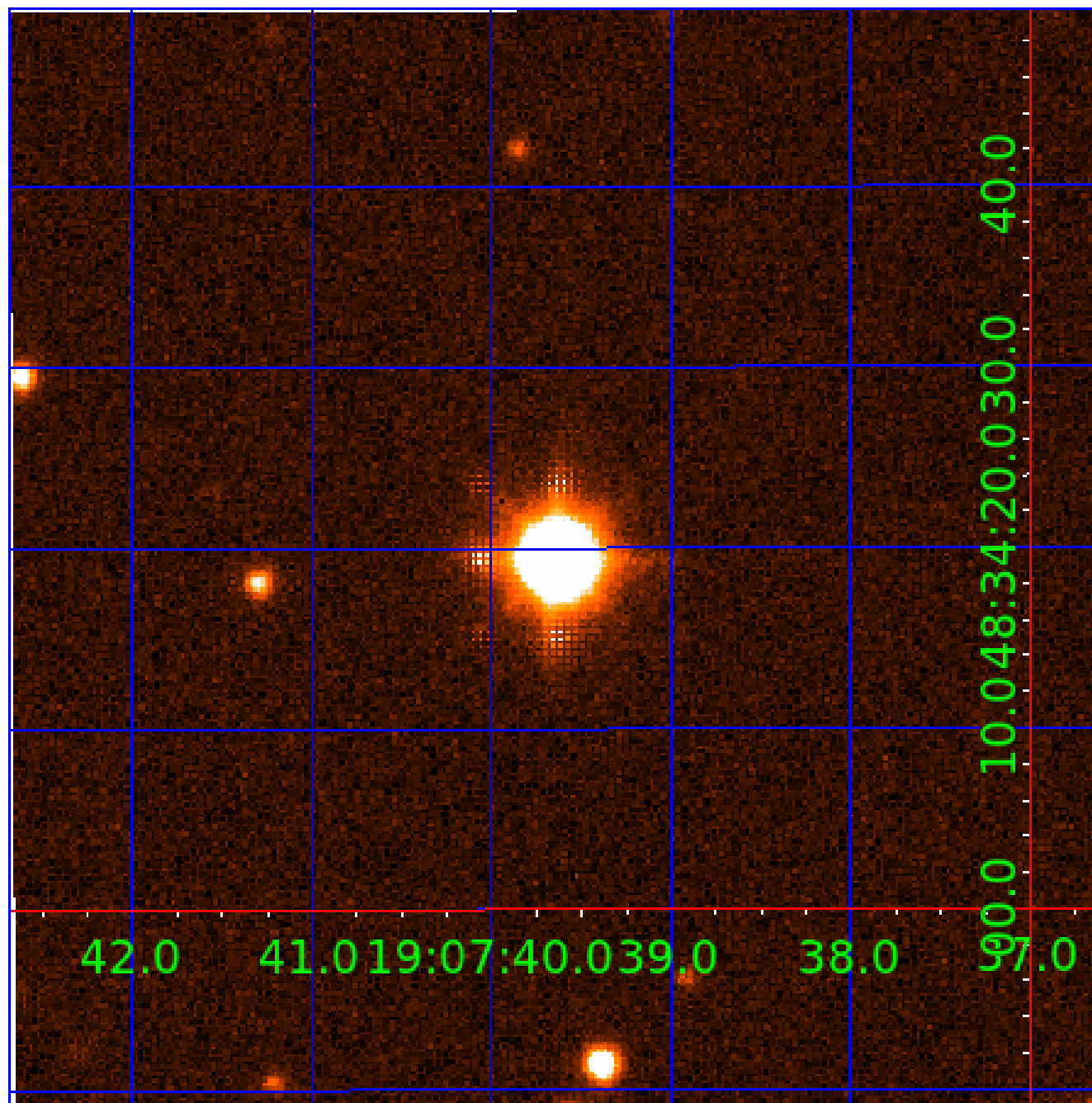
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



folded centroid time series figure for this object.

UKIRT Image

Declination



## KIC 011020521

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
011020521-01	OBS	No	2.929979	134.113706	0.1	0.514	8.2	0.0	3.22	6877	0.10	9371.70
011020521-02	OBS	No	2.930323	133.561397	22.1	5.264	8.1	6.6	3.22	6877	1.78	9370.24
011020521-03	OBS	No	2.930137	132.855754	16.9	12.993	9.2	7.9	3.22	6877	1.42	9371.03
011020521-04	OBS	No	11.171739	137.960832	85.1	3.597	8.7	9.1	3.22	6877	3.48	1573.30
011020521-05	OBS	No	293.095640	157.741380	193.4	6.042	8.2	8.1	3.22	6877	4.96	20.18
011020521-06	OBS	No	118.311612	211.553500	182.8	4.659	8.4	8.4	3.22	6877	5.08	67.65
011020521-07	OBS	No	131.858819	143.359611	66.9	9.614	8.3	5.6	3.22	6877	2.71	58.55
011020521-08	OBS	No	81.557176	178.687435	165.2	4.488	8.1	7.6	3.22	6877	4.58	111.09
011020521-09	OBS	No	36.435749	160.151233	162.1	3.382	8.0	9.4	3.22	6877	4.66	325.29
011020521-10	OBS	No	34.792680	149.579268	94.8	5.285	7.8	7.4	3.22	6877	3.67	345.93

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
011020521-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-04	OBS	FP	0.00	1	0	1	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
011020521-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-07	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-09	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_ALT—CENT_SATURATED
011020521-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—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.

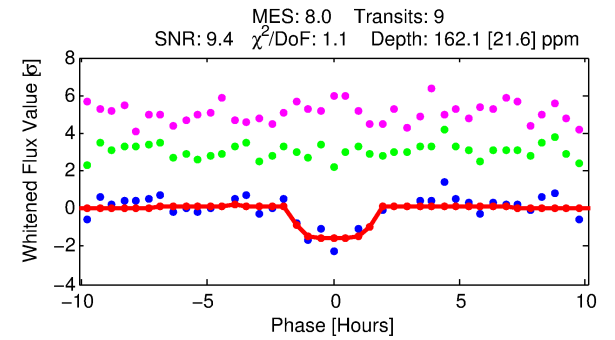
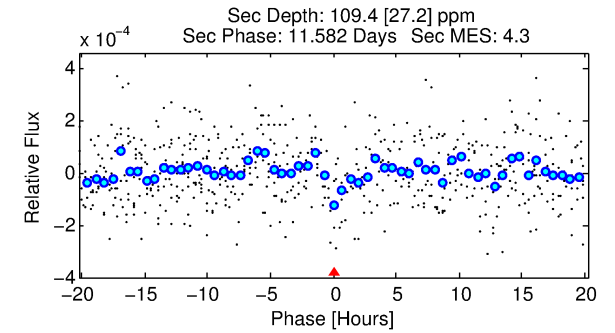
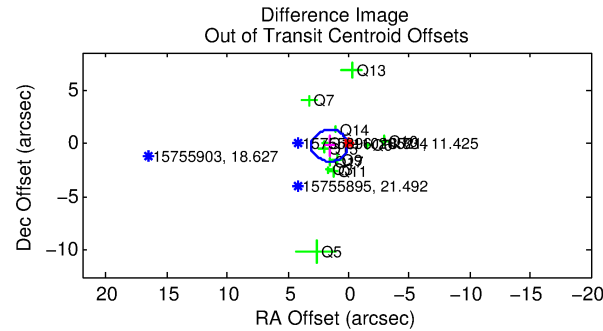
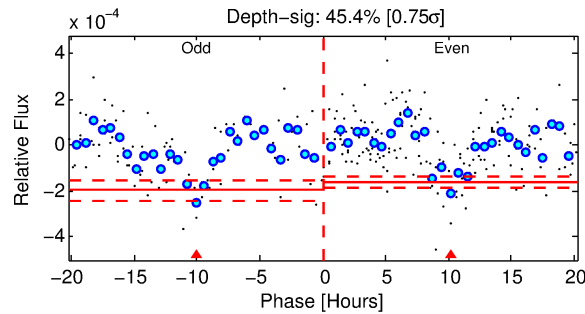
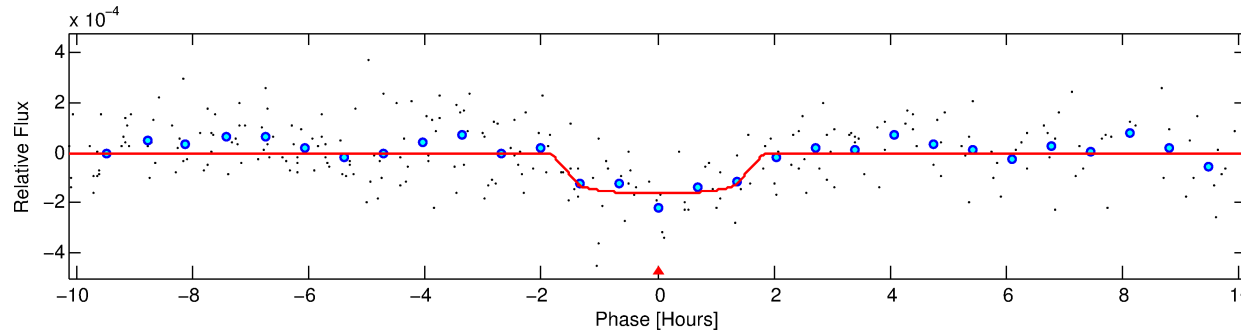
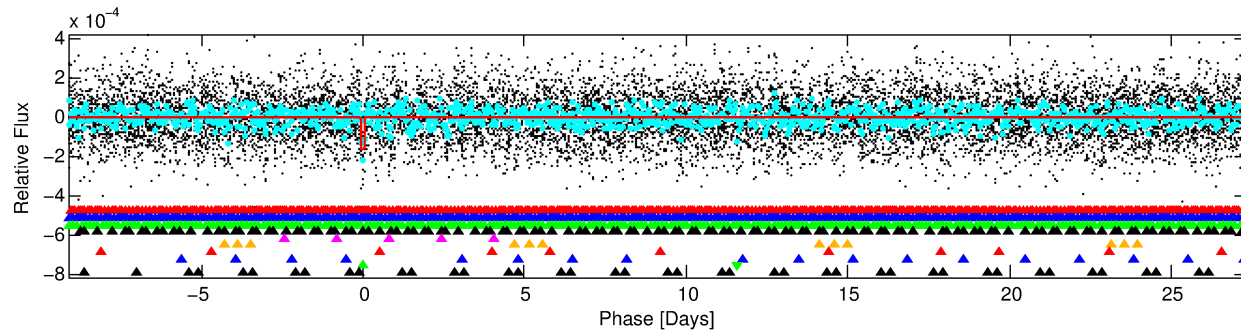
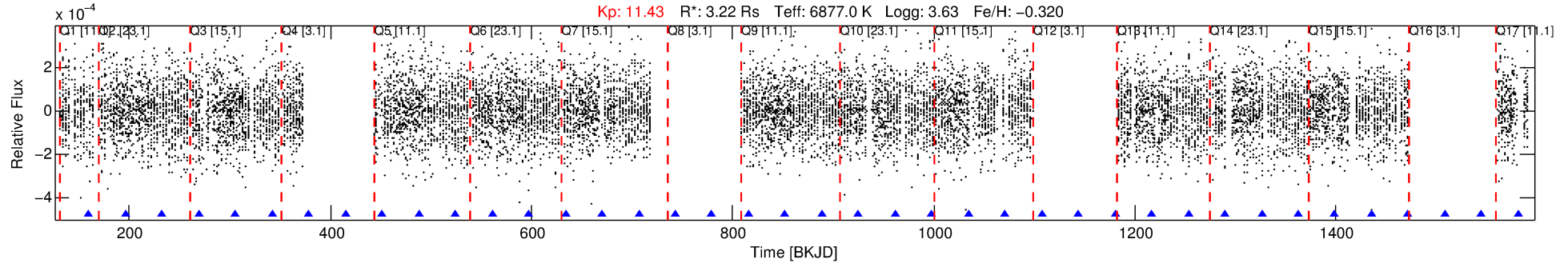
Ephemeris Match Information For 011020521-09

No Significant Match Found



# DV One-Page Summary

KIC: 11020521 Candidate: 9 of 10 Period: 36.436 d



## DV Fit Results:

Period = 36.43575 [0.00044] d  
Epoch = 160.1512 [0.0087] BKJD  
Rp/R\* = 0.0133 [0.0090]  
a/R\* = 43.39 [176.05]  
b = 0.87 [1.19]  
Seff = 325.29 [176.79]  
Teq = 1083 [147] K  
Rp = 4.66 [3.61] Re  
a = 0.2527 [0.0868] AU  
Ag = 177.07 [260.89] [0.67 $\sigma$ ]  
Teffp = 6108 [2107] K [2.38 $\sigma$ ]

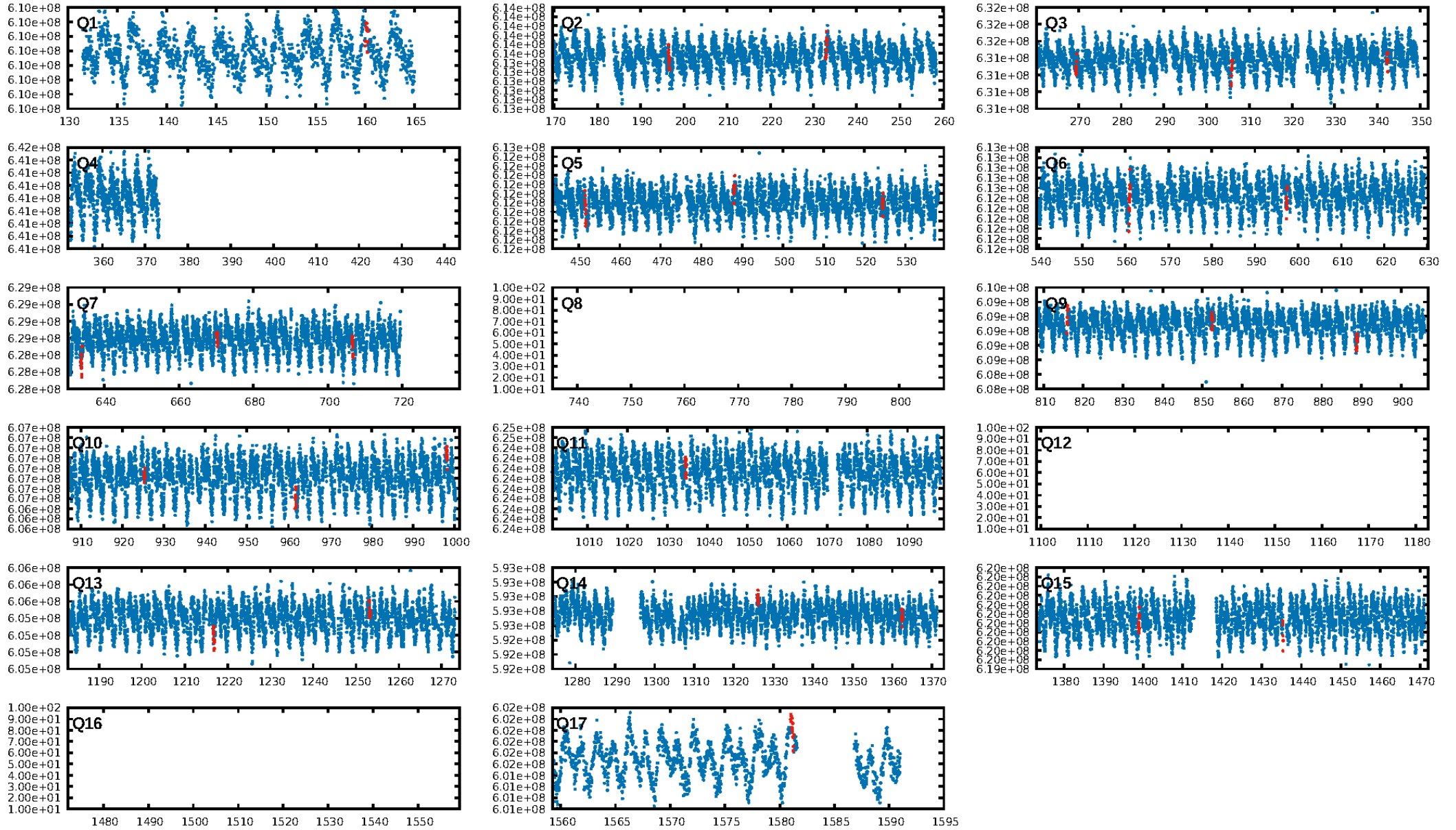
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [6.28 $\sigma$ ]  
LongPeriod-sig: 100.0% [192.72 $\sigma$ ]  
ModelChiSquare2-sig: 3.3%  
ModelChiSquareGof-sig: 99.7%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [9/9]  
GhostDiagnostic-chr: 0.3959  
Centroid-sig: N/A  
Centroid-so: N/A  
OotOffset-rm: 1.604 arcsec [3.23 $\sigma$ ]  
KicOffset-rm: 1.782 arcsec [3.50 $\sigma$ ]  
OotOffset-st: 3/4/0/5 [12]  
KicOffset-st: 3/4/0/5 [12]  
DiffImageQuality-fgm: 0.33 [4/12]  
DiffImageOverlap-fno: 0.46 [6/13]

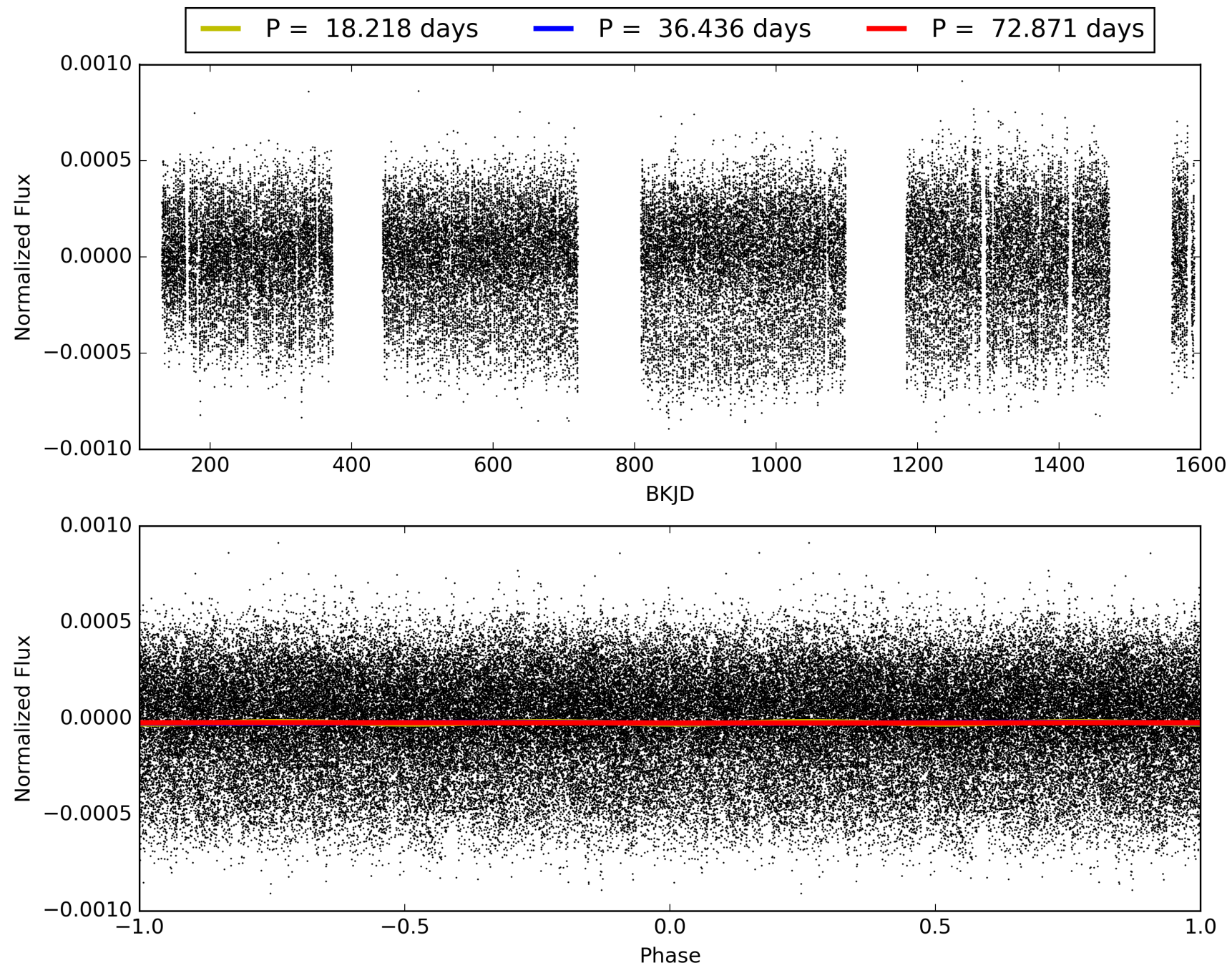
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 05:45:19 Z

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

# TCE 011020521-09, PDC Light Curves

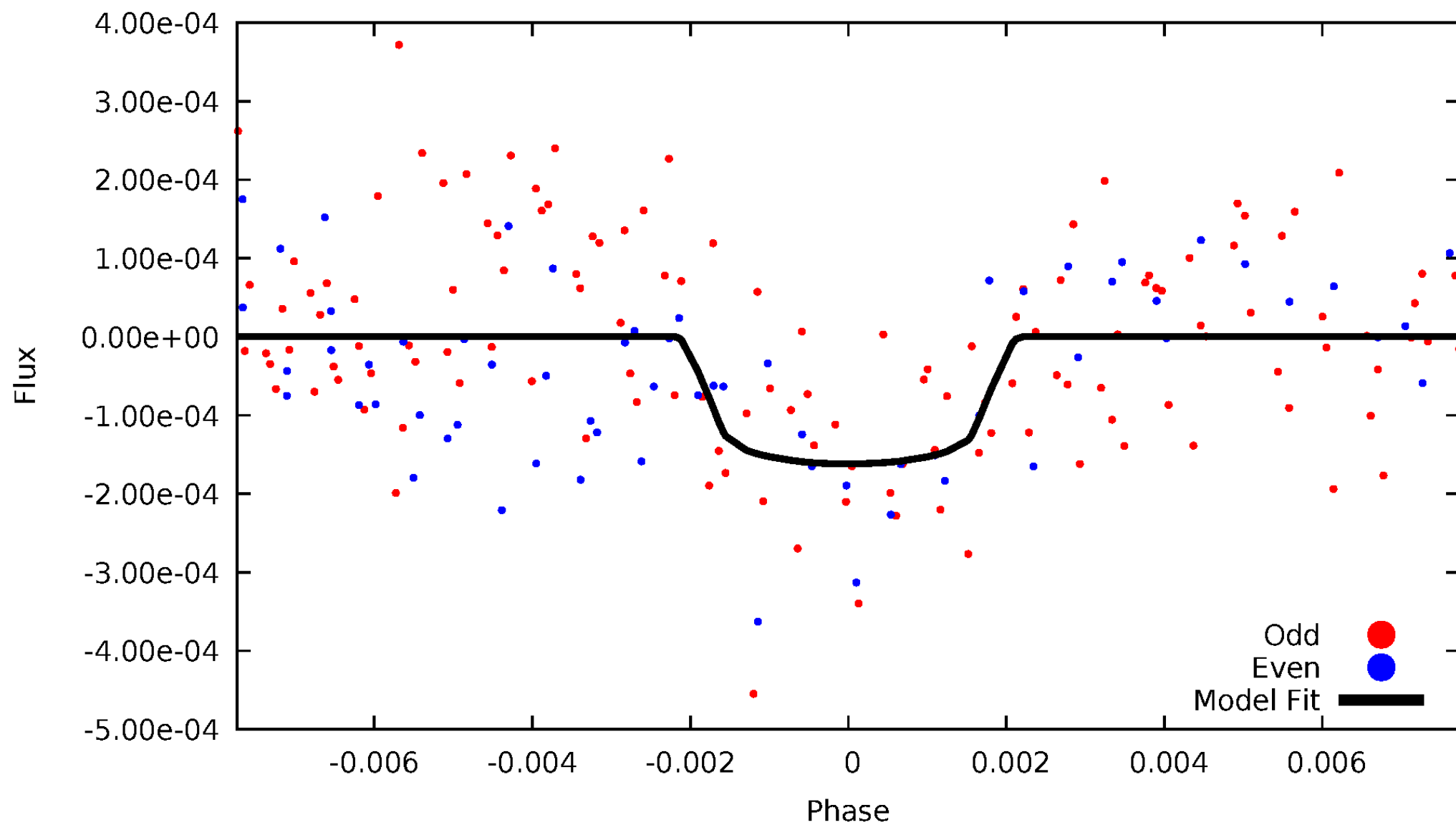


TCE 011020521-09



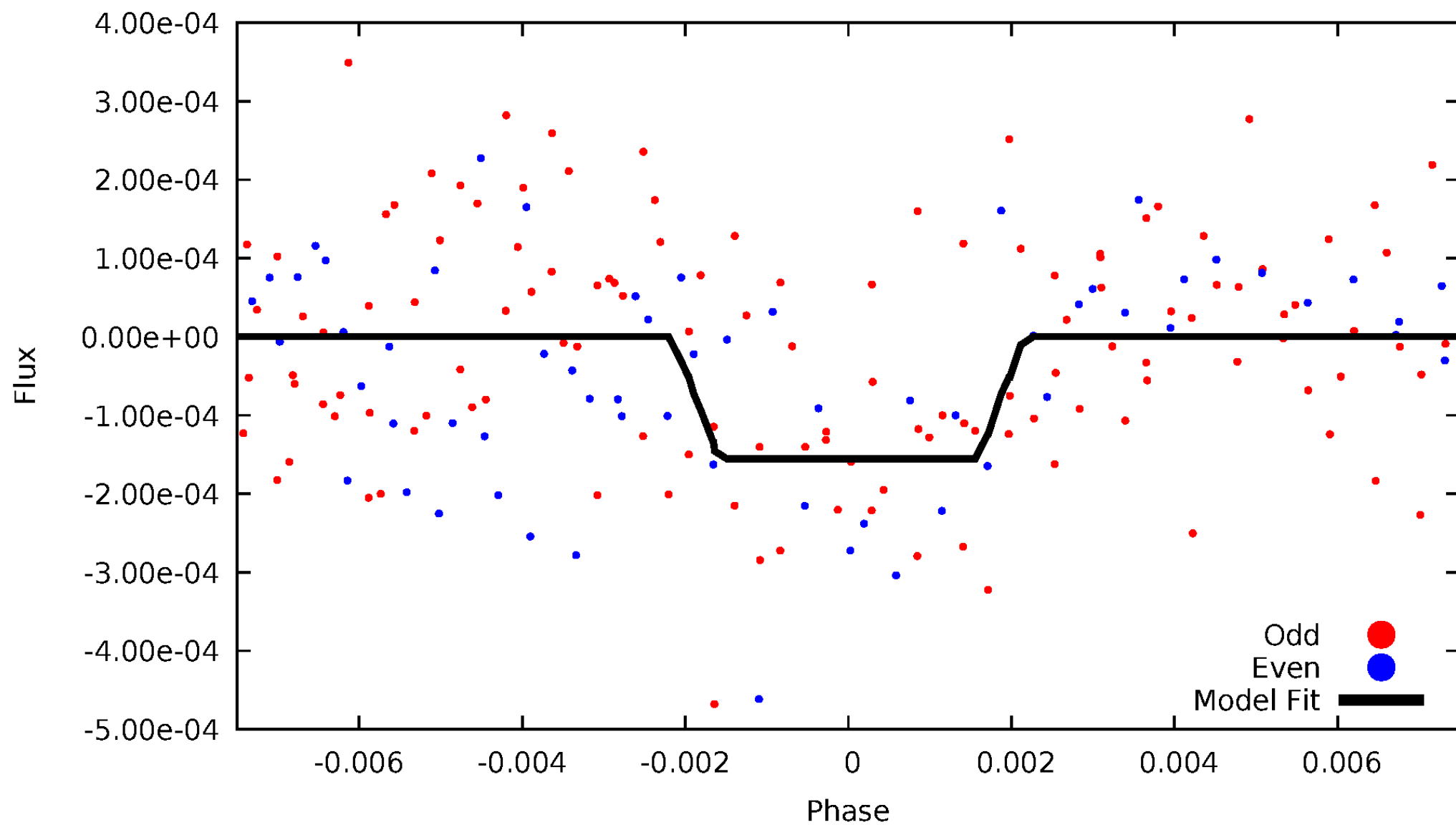
# DV Odd/Even

TCE 011020521-09



# ALT Odd/Even

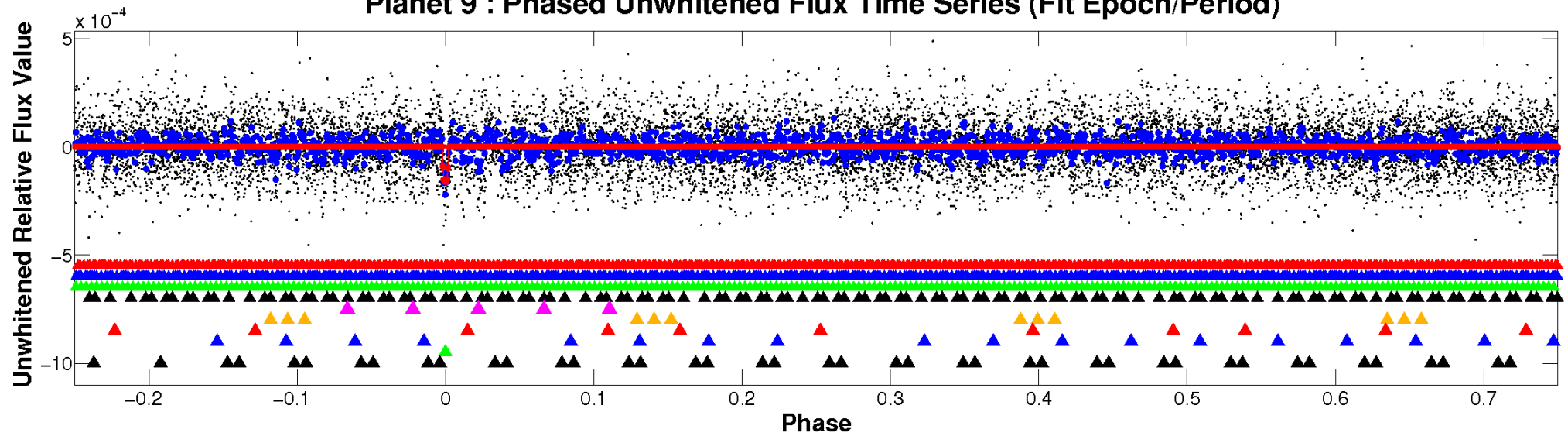
TCE 011020521-09



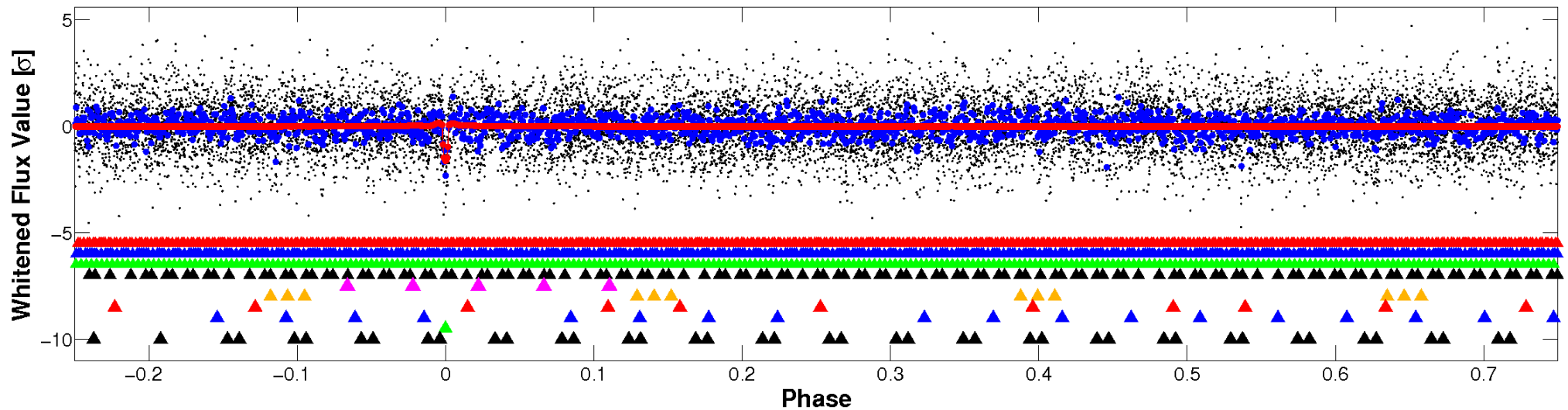


# Non-Whitened Vs. Whitened Light Curve

## Planet 9 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

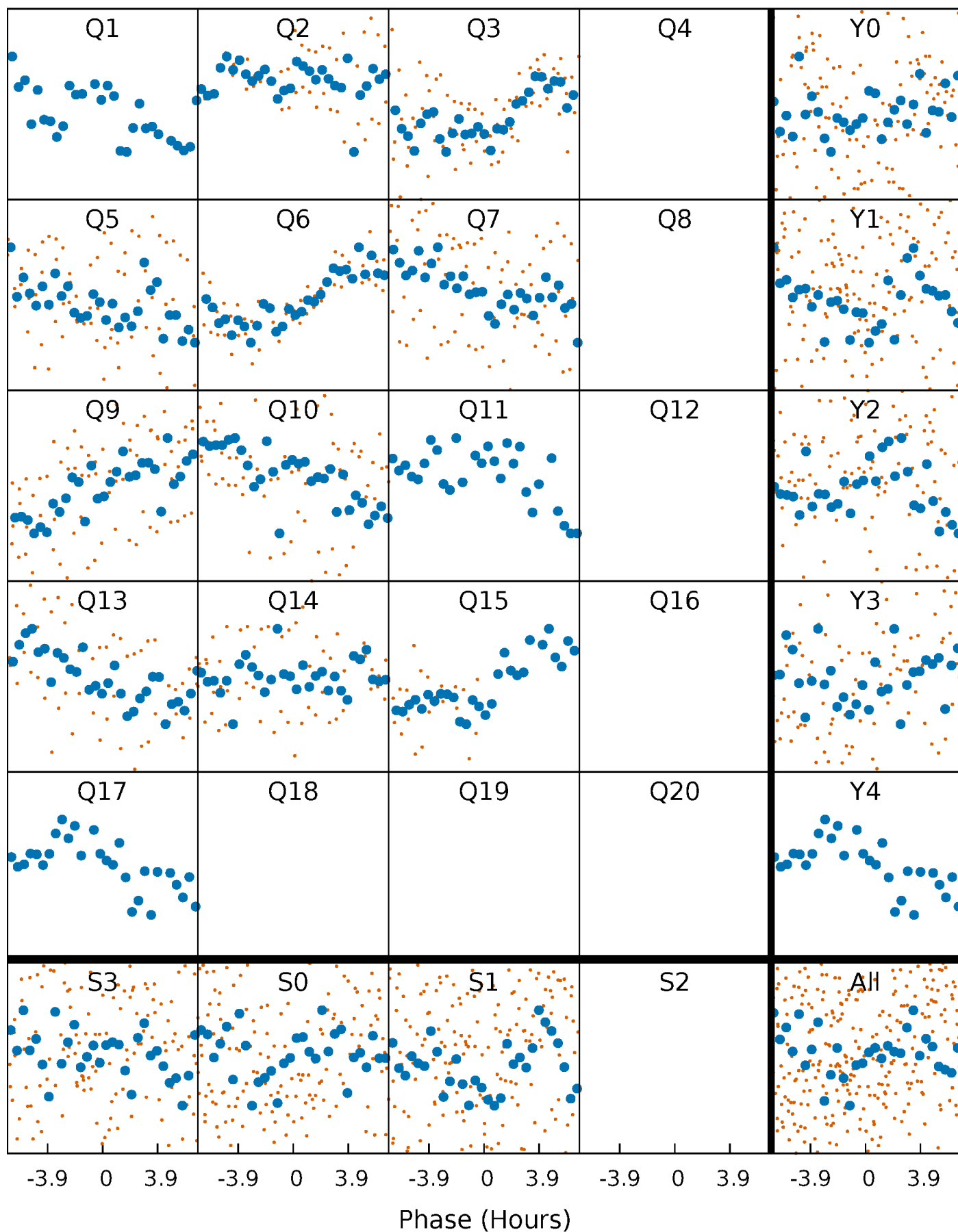


## Planet 9 : Phased Whitened Flux Time Series (Fit Epoch/Period)



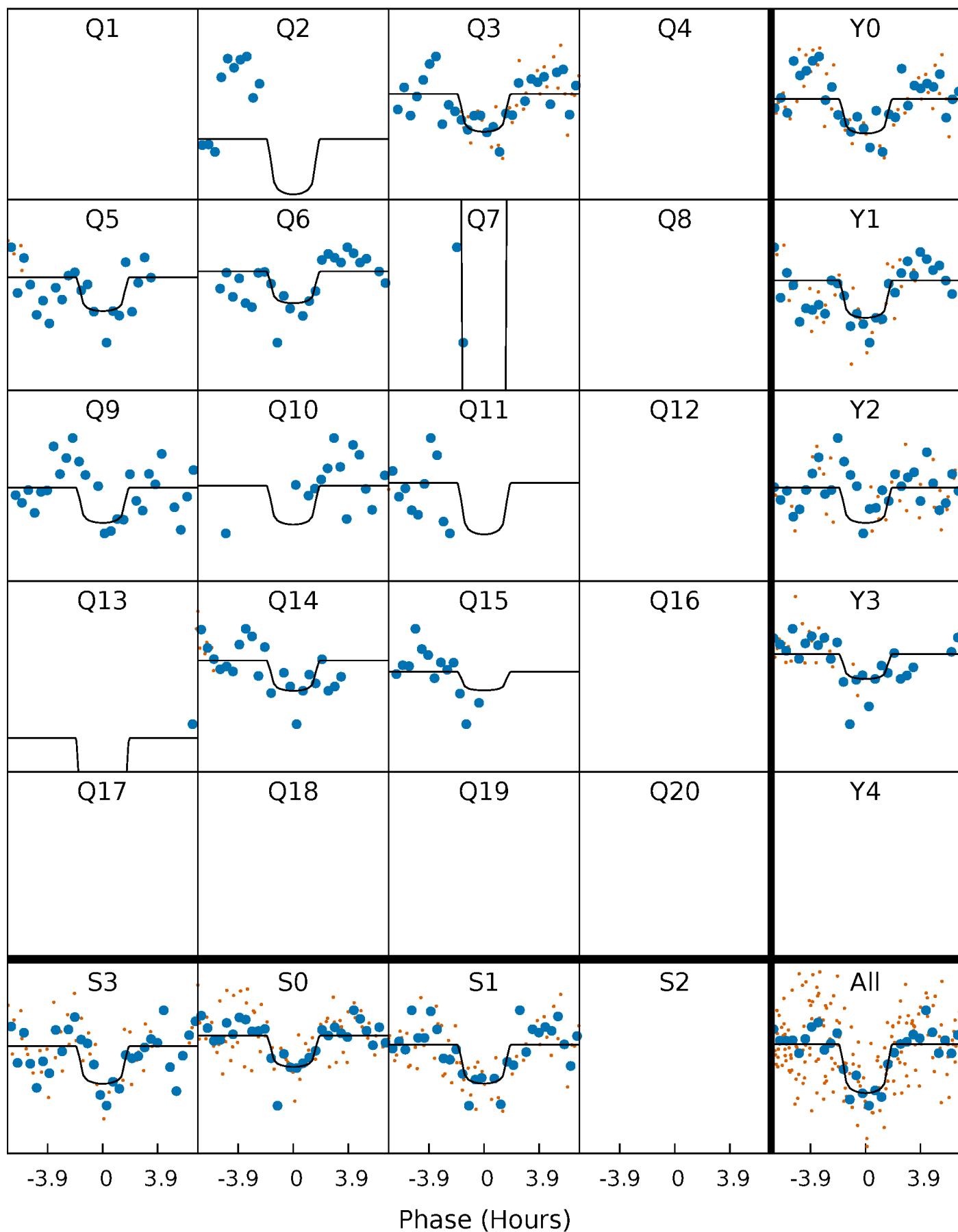
# PDC Quarter-Phased Transit Curves

TCE 011020521-09 P= 36.435749 Days  $T_0=160.151233$  (BKJD)



# DV Quarter-Phased Transit Curves

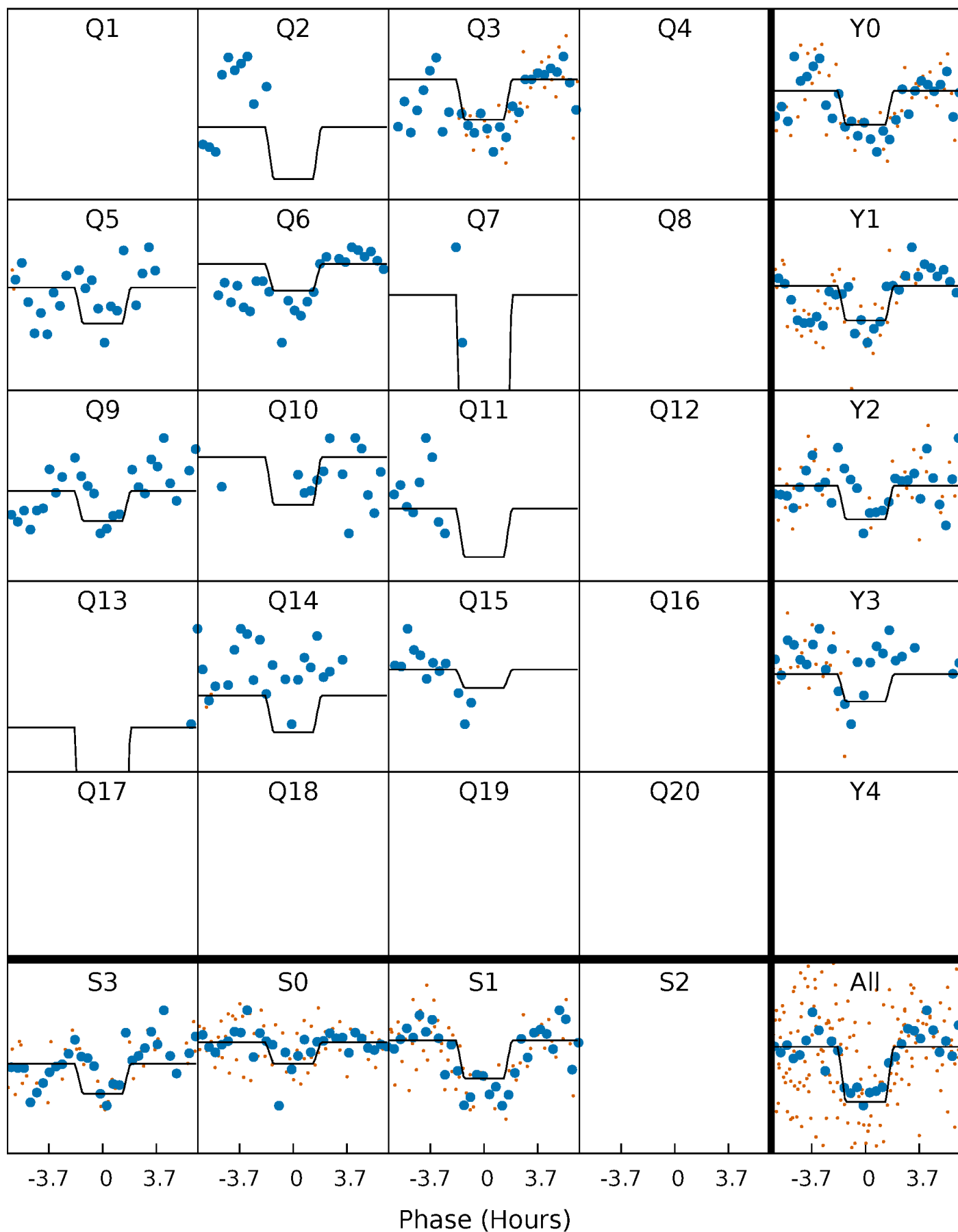
TCE 011020521-09 P= 36.435749 Days  $T_0=160.151233$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

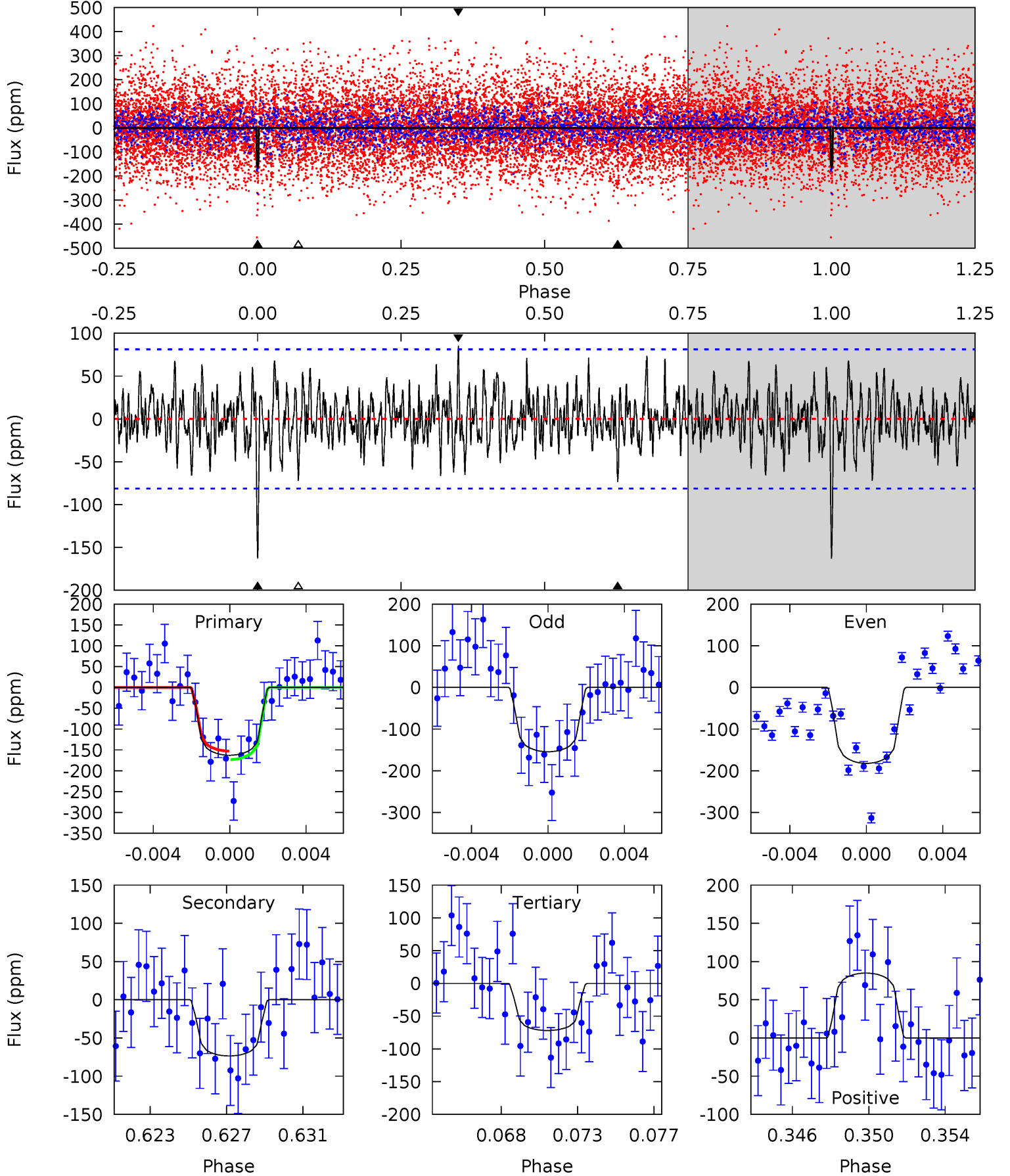
TCE 011020521-09 P= 36.436528 Days  $T_0=160.140081$  (BKJD)



# DV Model-Shift Uniqueness Test

011020521-09, P = 36.435749 Days, E = 123.715484 Days

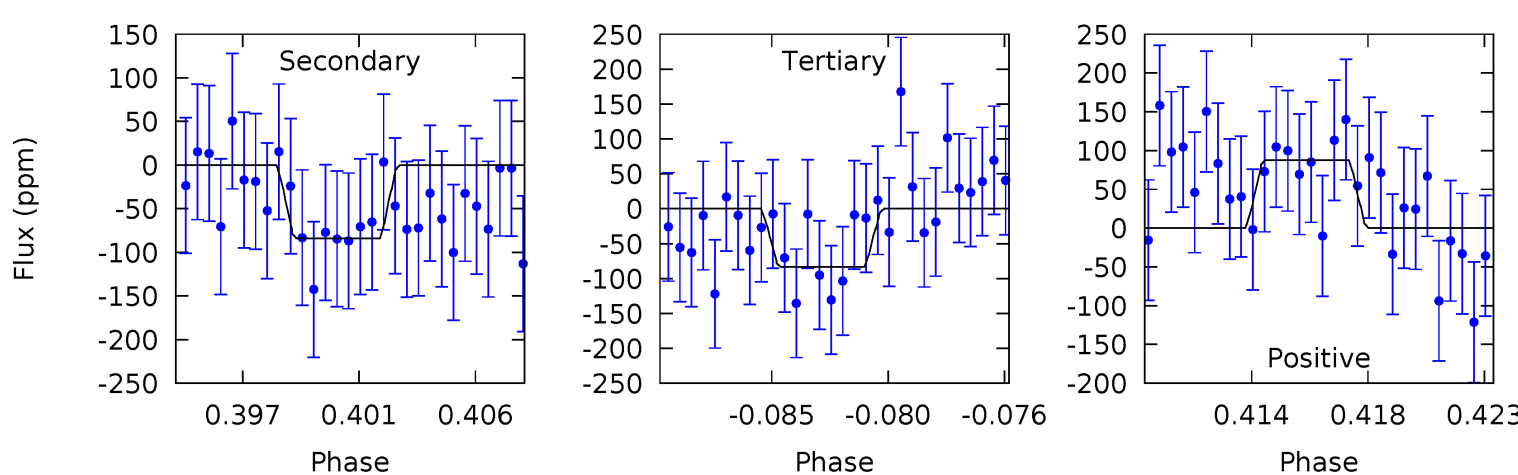
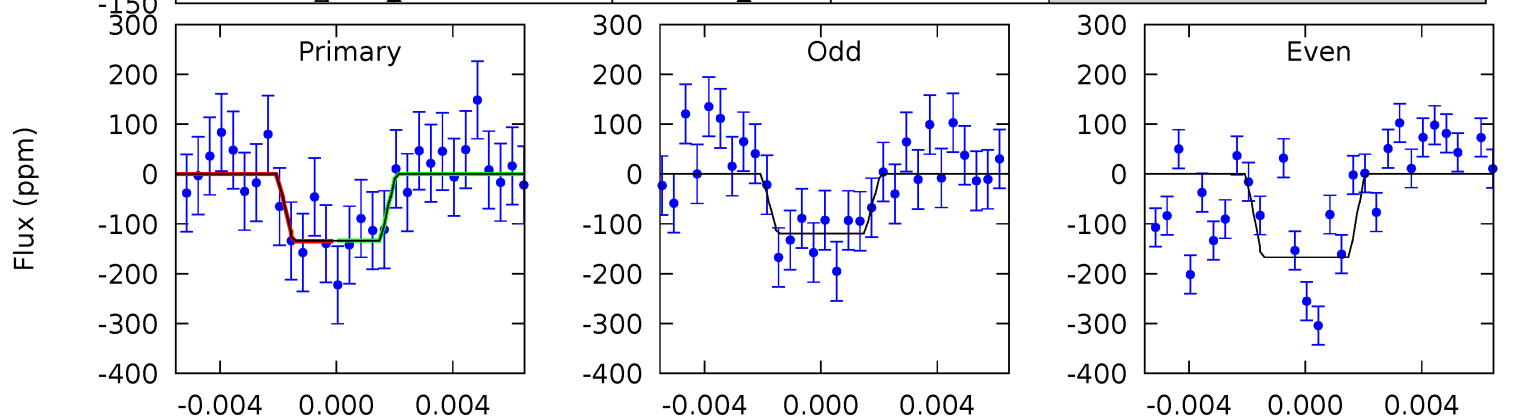
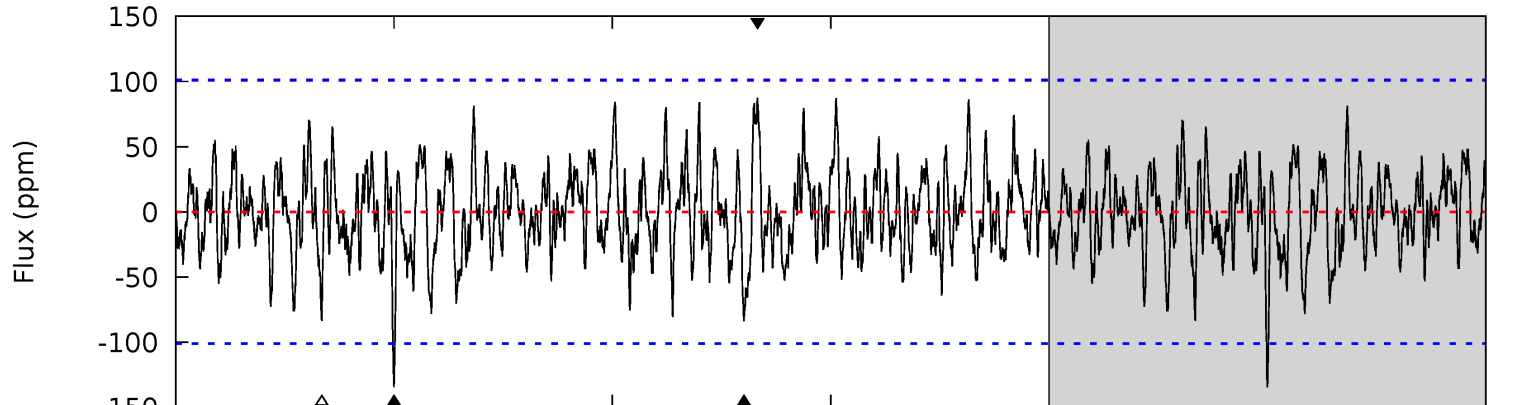
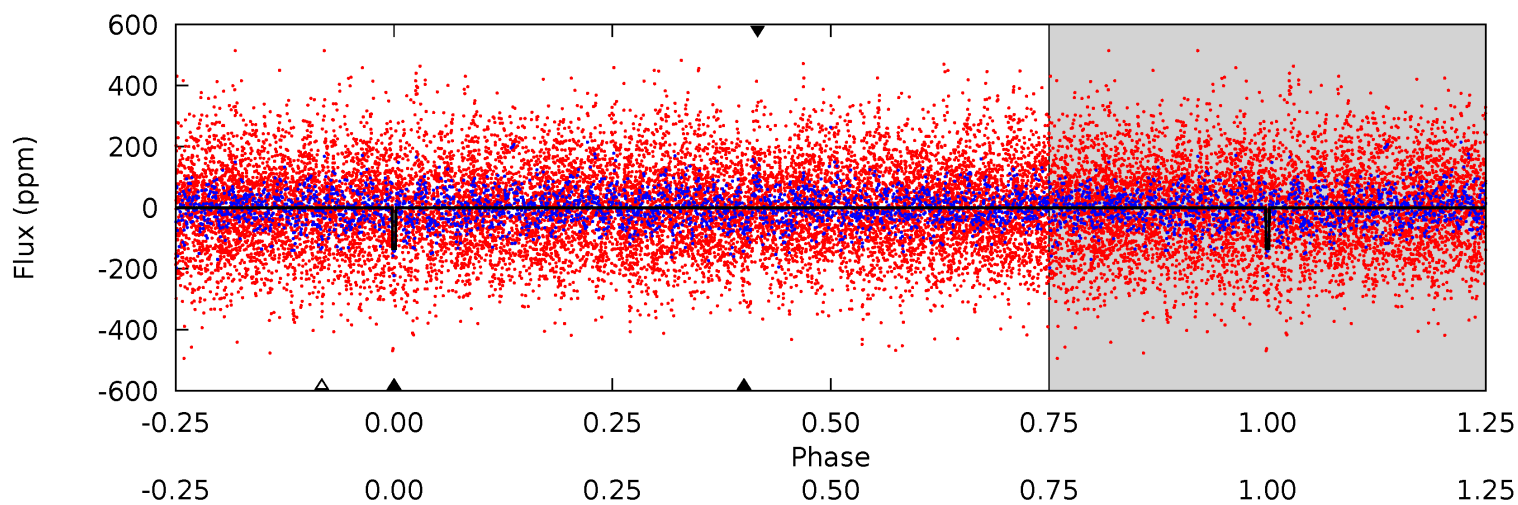
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
10.4	4.70	4.59	5.42	5.19	2.86	1.55	5.80	4.97	0.10	-0.73	0.84	1.02	0.34	0.65



# Alt Model-Shift Uniqueness Test

011020521-09, P = 36.436528 Days, E = 123.703553 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
6.90	4.31	4.28	4.50	5.19	2.86	1.51	2.62	2.39	0.03	-0.19	1.12	1.16	0.40	0.03



### Stellar Parameters For KIC 011020521

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6877^{+170}_{-204}$	$3.632^{+0.304}_{-0.076}$	$-0.320^{+0.300}_{-0.250}$	$3.219^{+0.406}_{-1.217}$	$1.619^{+0.227}_{-0.312}$	$0.068^{+0.149}_{-0.017}$
	+2%/-3%	+8%/-2%	+94%/-78%	+13%/-38%	+14%/-19%	+218%/-25%
Source	PHO1	FLK73	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 011020521-09 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-74 \pm 16$	$4.74^{+2.84}_{-2.68}$	$1477^{+88}_{-126}$	$5302^{+2795}_{-950}$	$114^{+485}_{-69}$
Alt.	$-84 \pm 19$	$4.26^{+2.90}_{-2.46}$	$1477^{+80}_{-122}$	$5662^{+3721}_{-1045}$	$158^{+709}_{-101}$

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

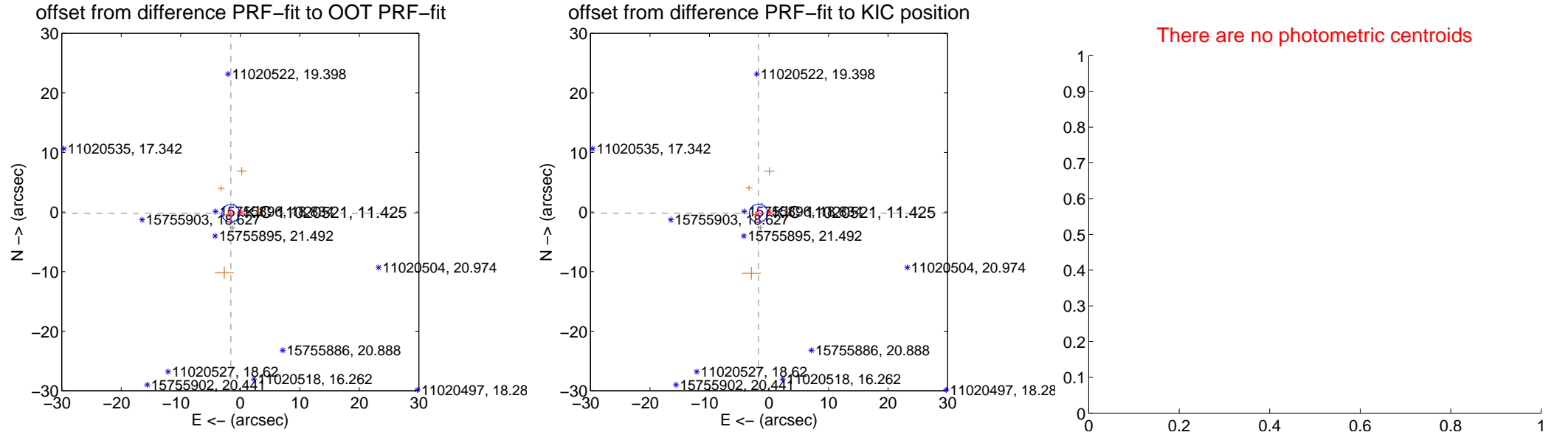
## DV Centroid Data

Supplemental centroid analysis for 011020521-09. **Kepler magnitude: 11.43.** Transit SNR 9.41

There are 4 quarters with good PRF difference image offsets

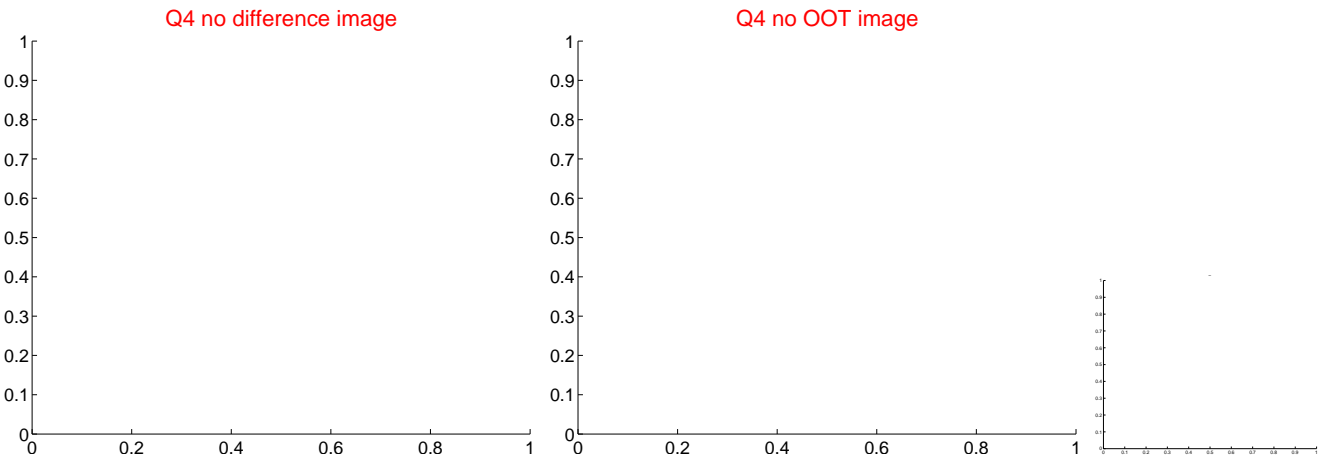
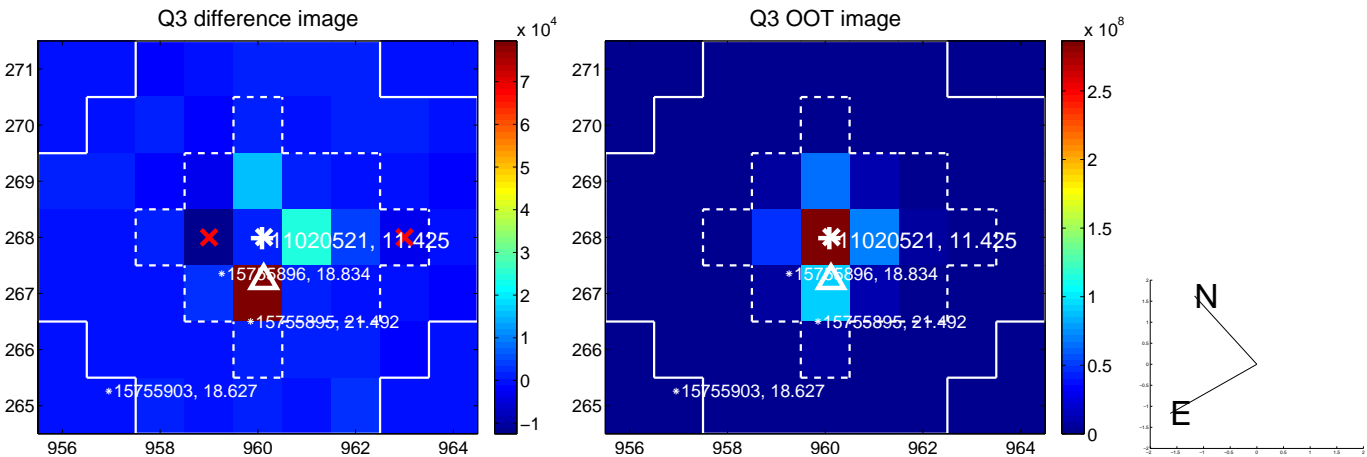
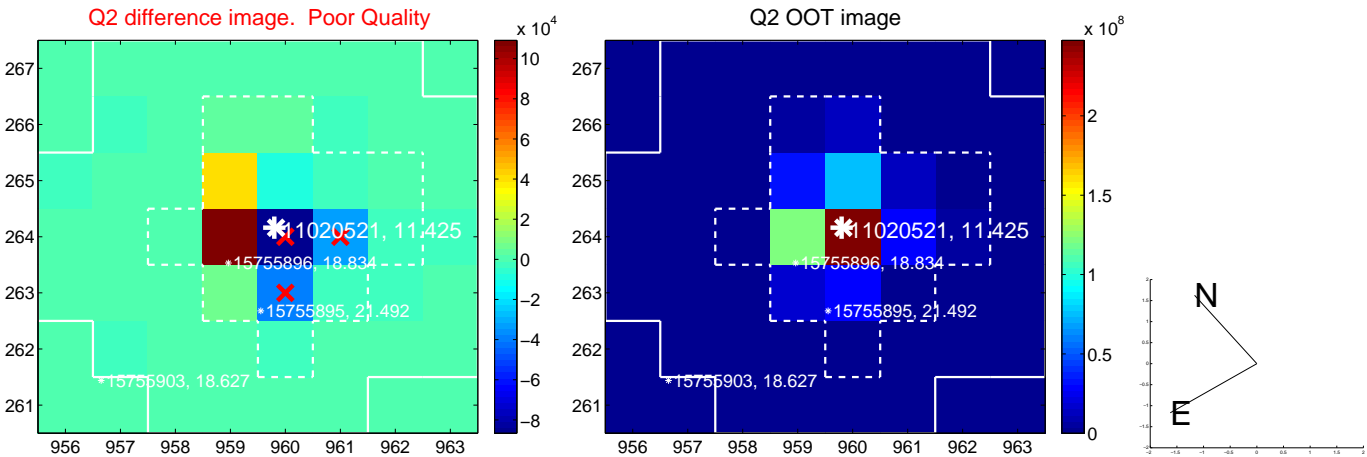
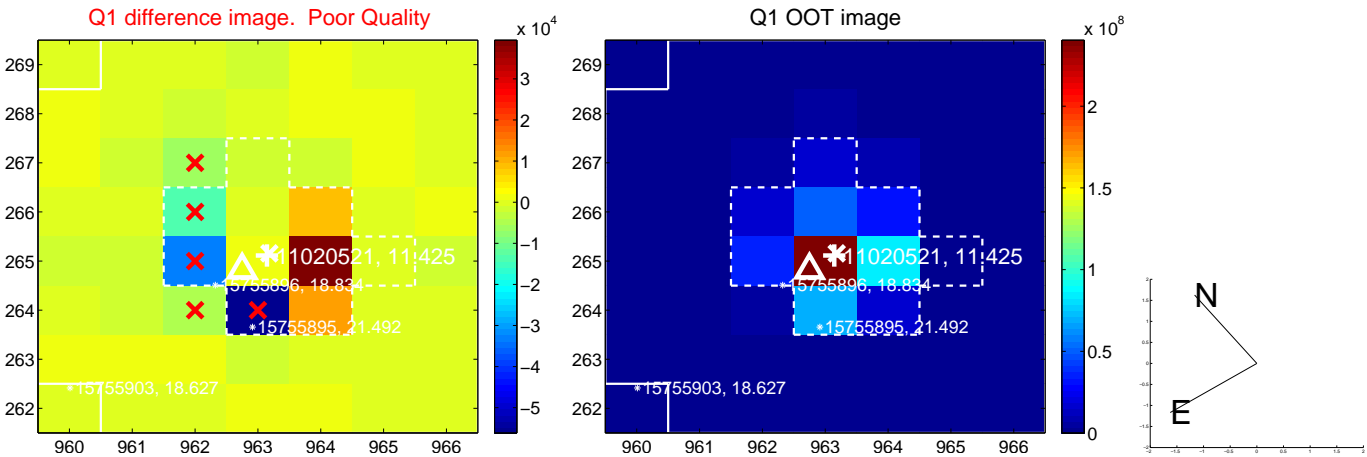
The direct PRF centroid is offset from the target star catalog position by about 0.18 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	<b>1.604 <math>\pm</math> 0.497</b>	<b>3.23</b>	1.590 $\pm$ 0.467	-0.213 $\pm$ 1.013
PRF-fit source offset from KIC position	<b>1.782 <math>\pm</math> 0.510</b>	<b>3.50</b>	1.772 $\pm$ 0.464	-0.193 $\pm$ 1.086
photometric centroid source offset	—	—	—	—

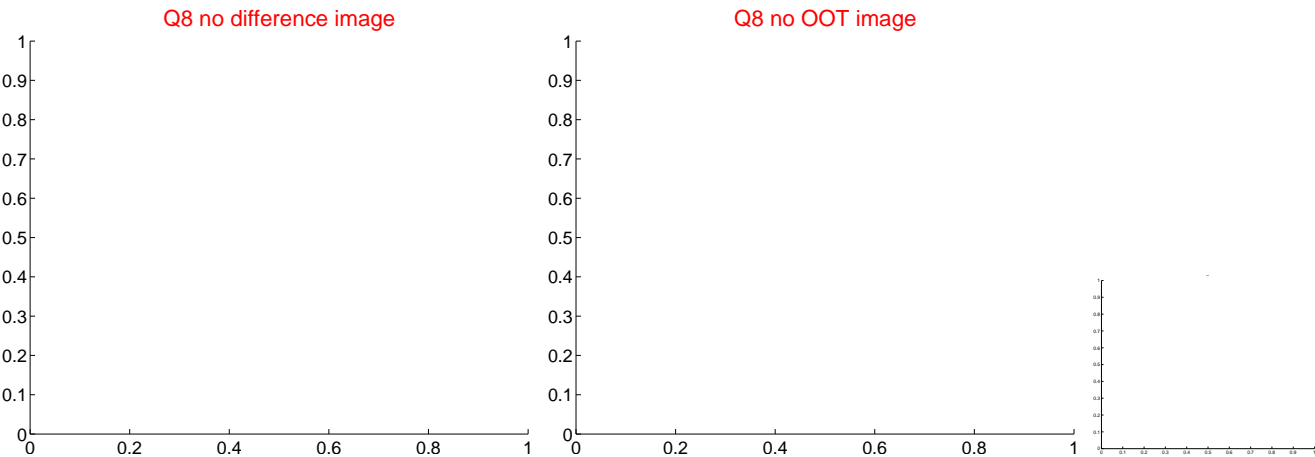
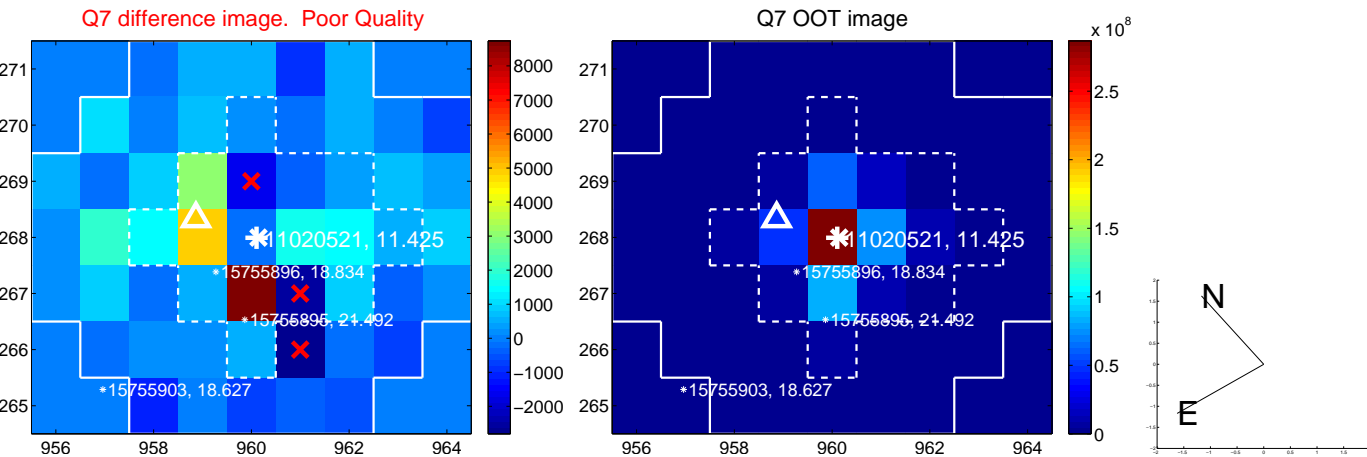
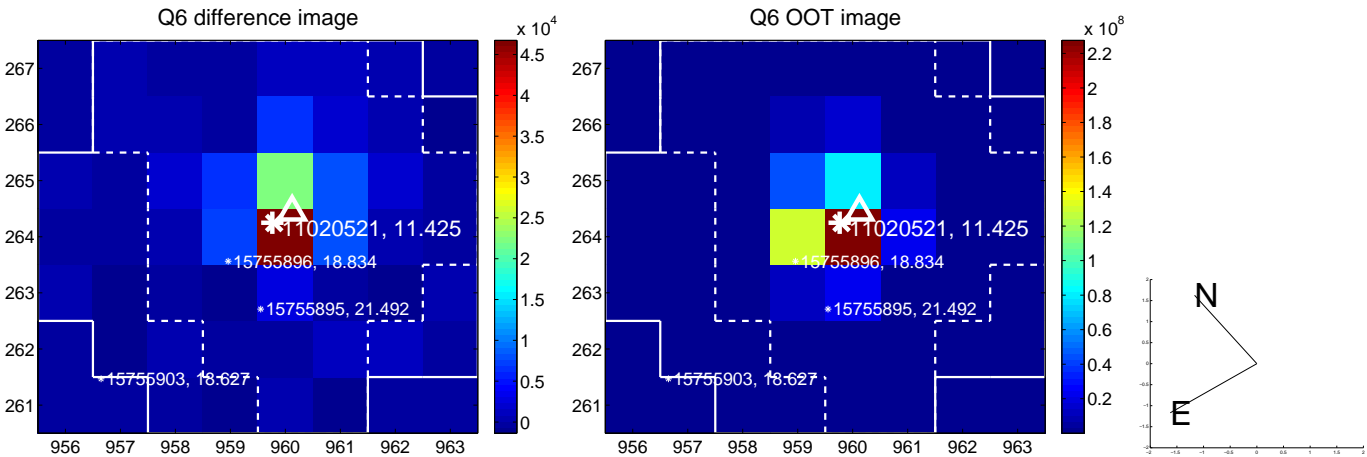
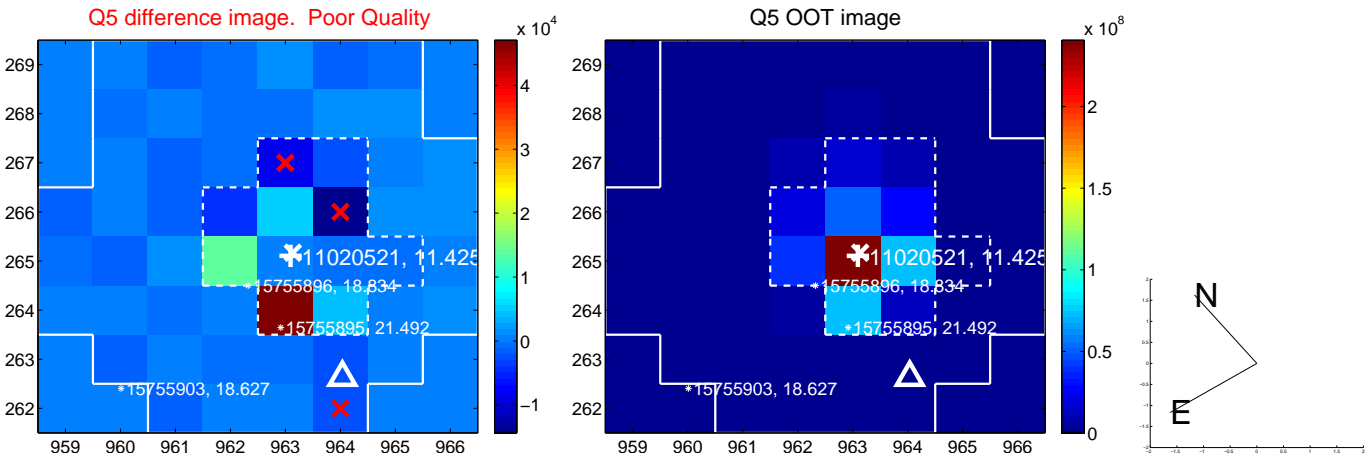


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

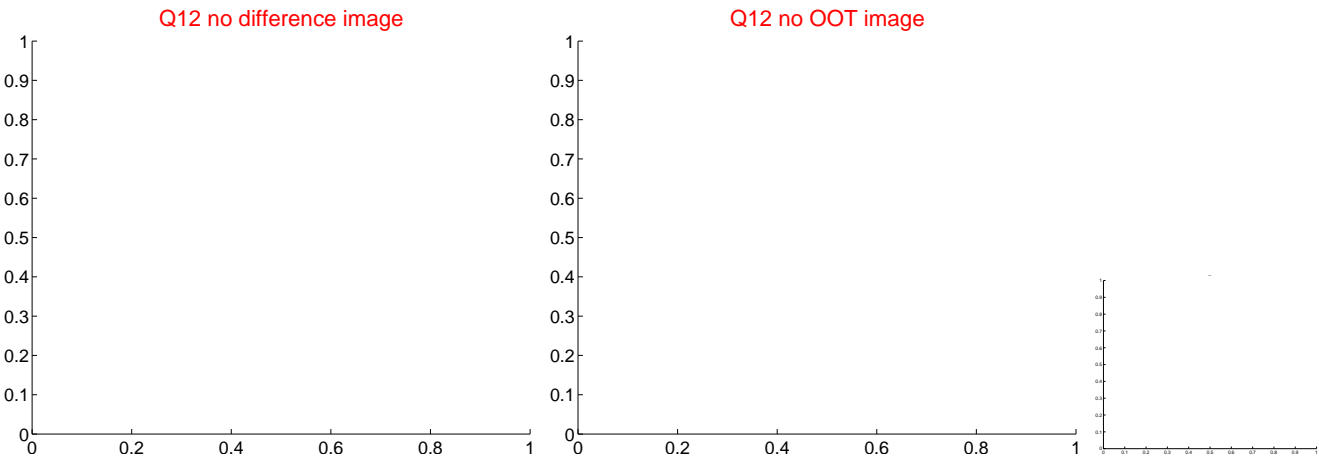
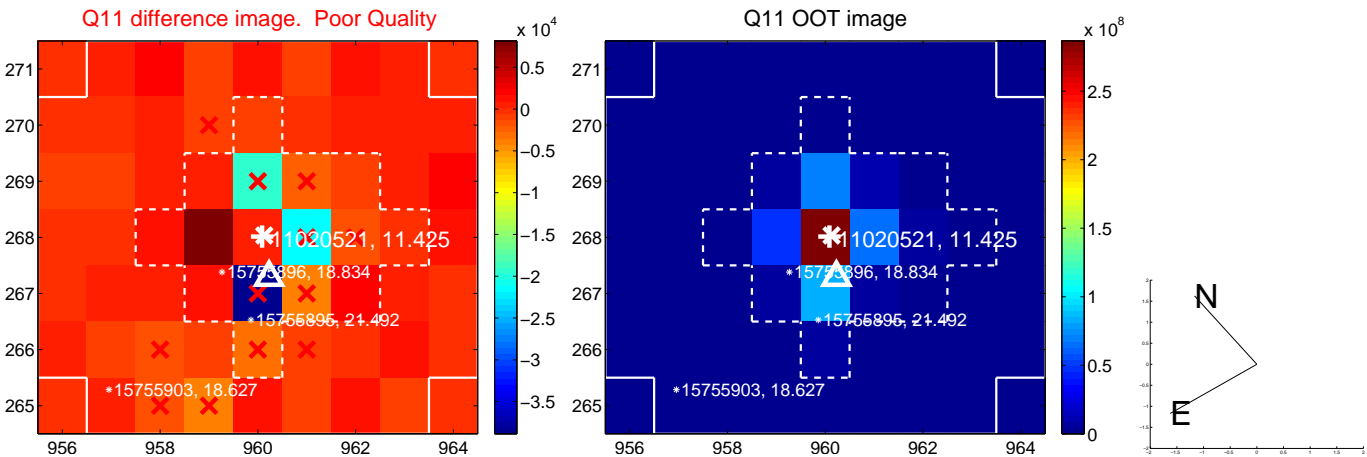
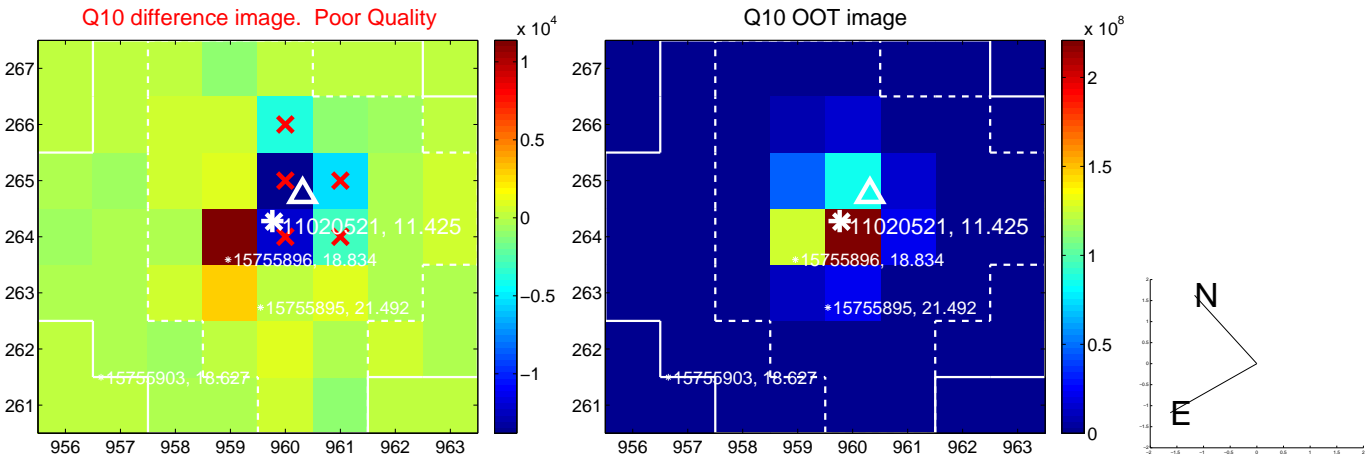
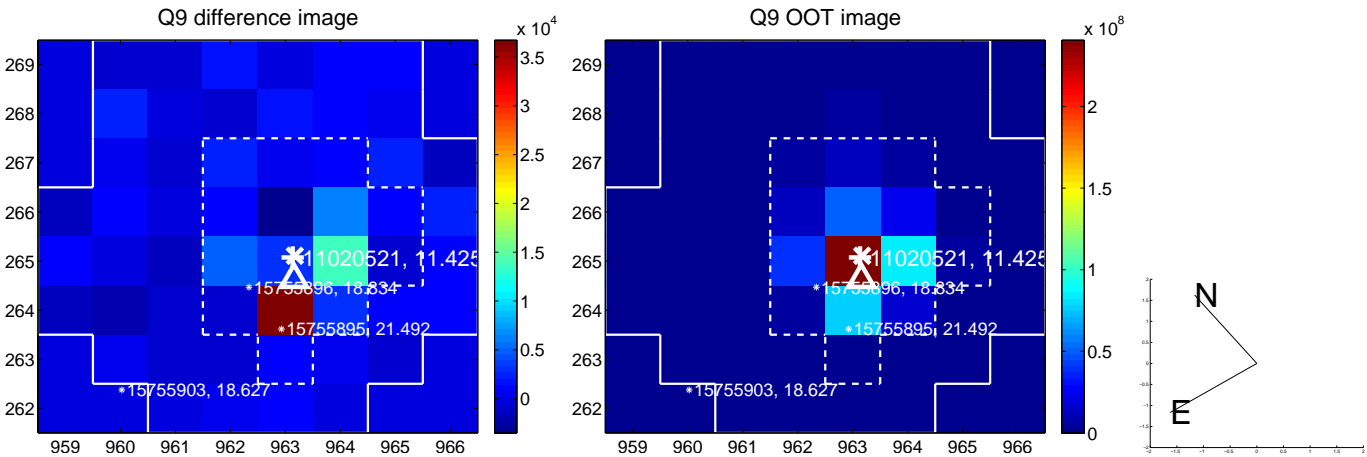
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

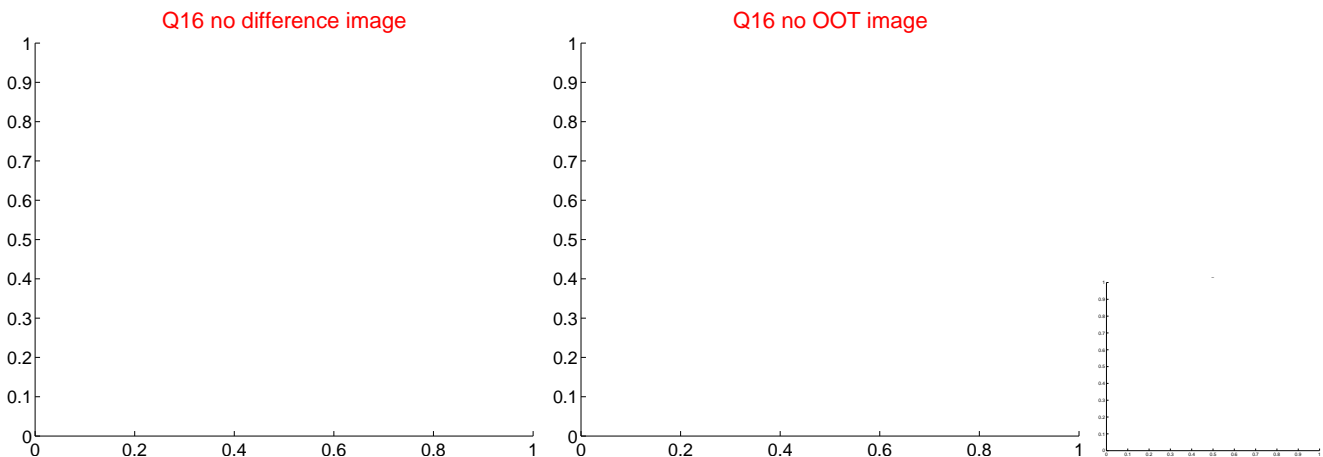
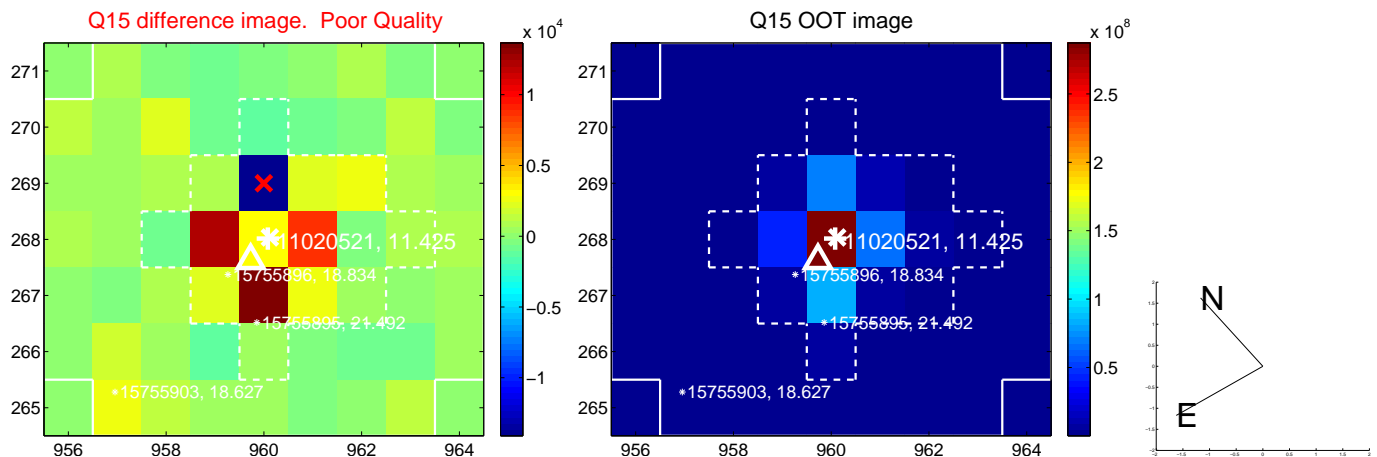
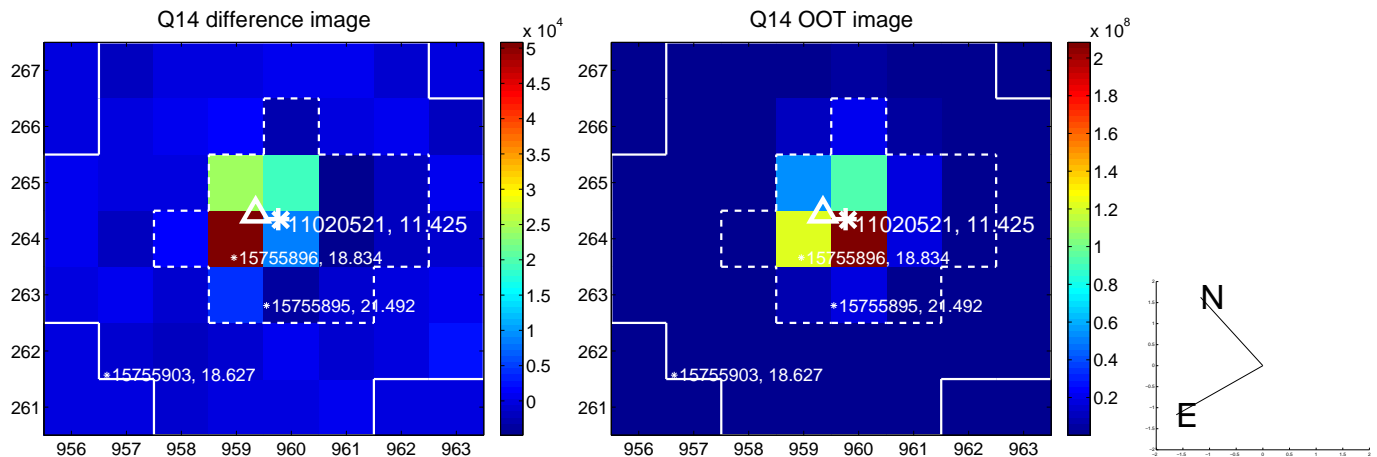
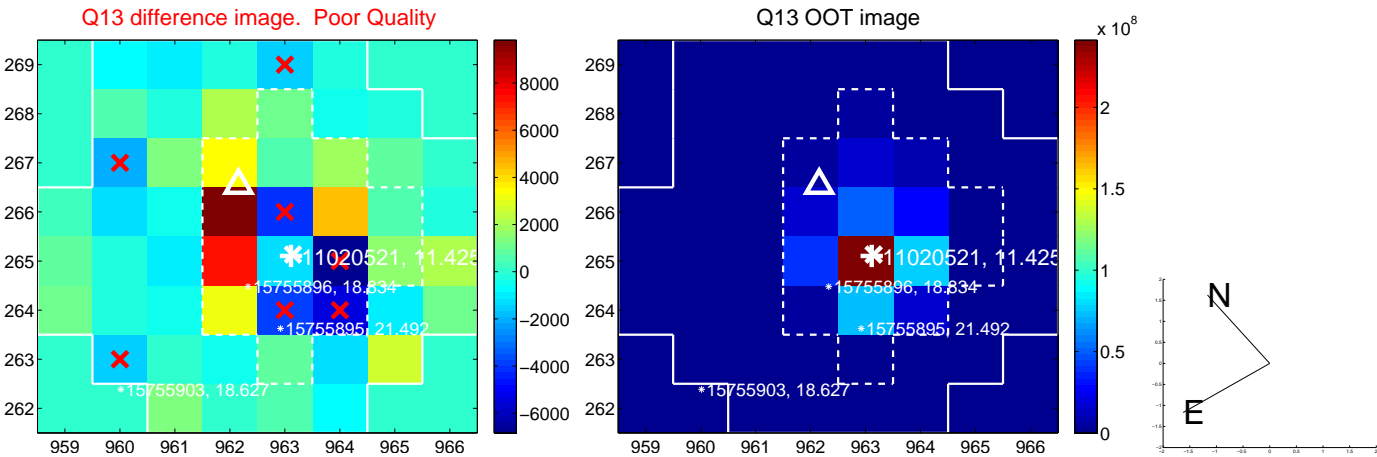


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

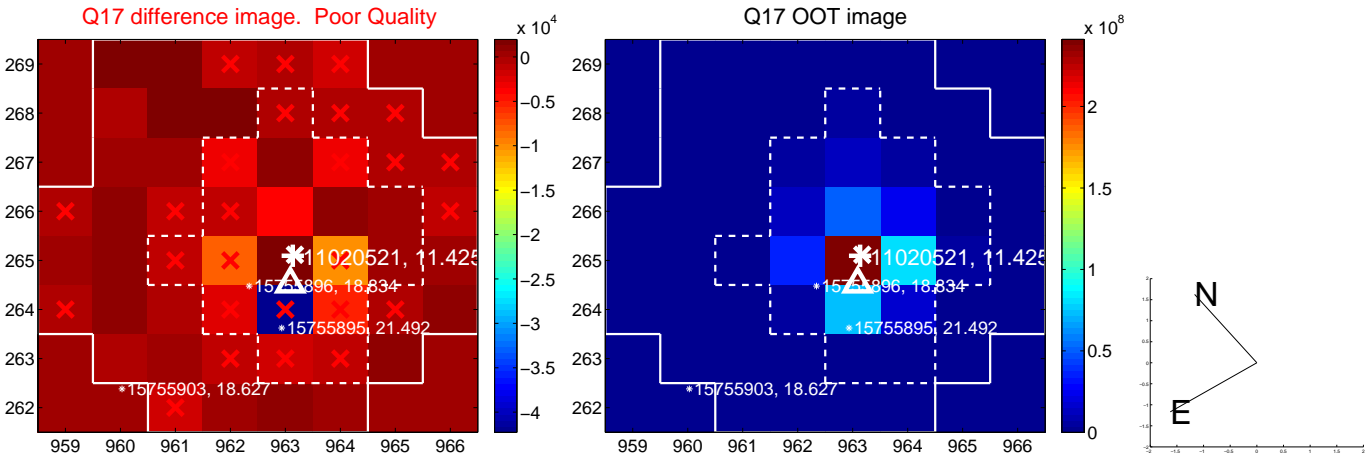




white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



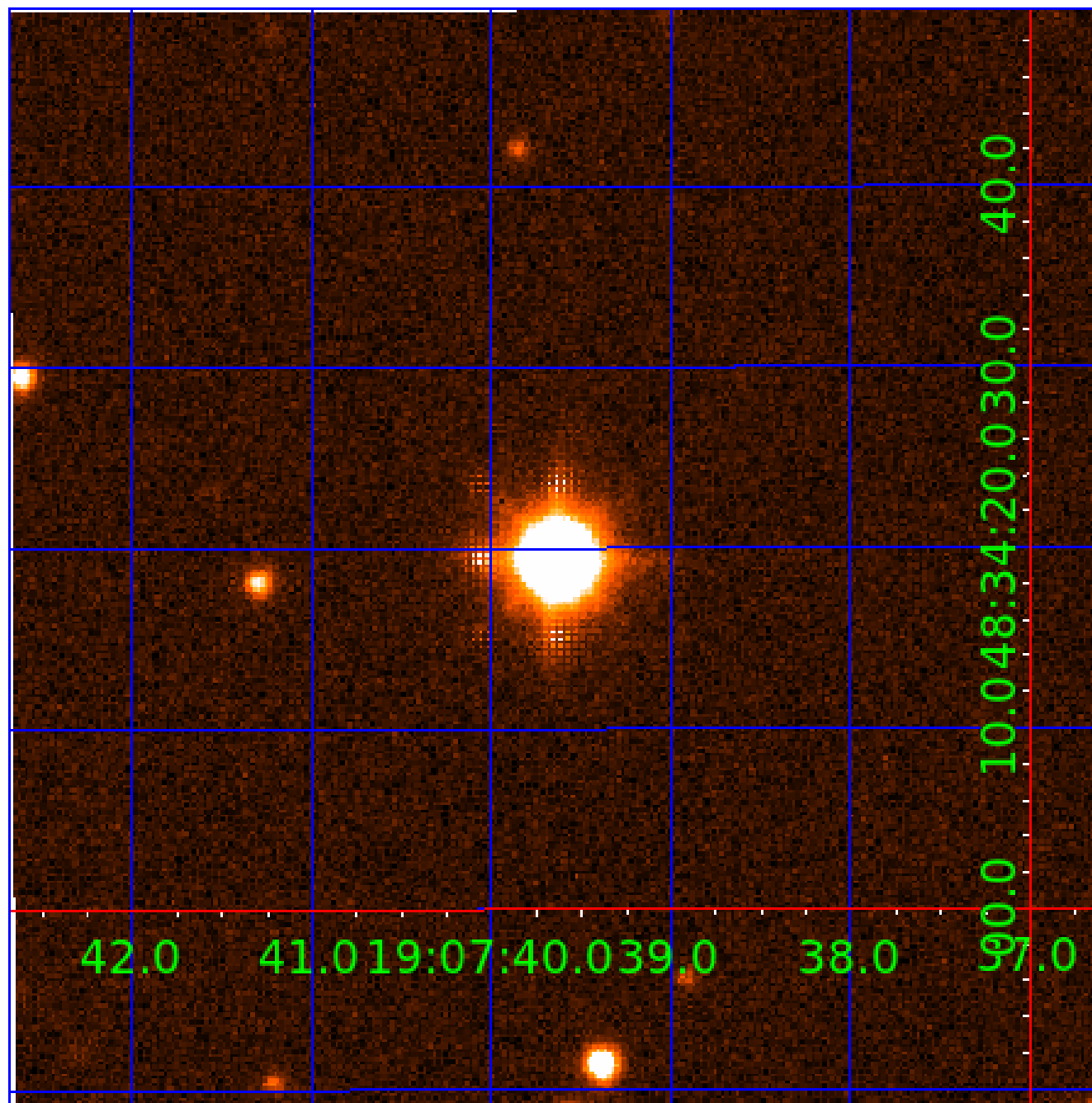
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



folded centroid time series figure for this object.

UKIRT Image

Declination



## KIC 011020521

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
011020521-01	OBS	No	2.929979	134.113706	0.1	0.514	8.2	0.0	3.22	6877	0.10	9371.70
011020521-02	OBS	No	2.930323	133.561397	22.1	5.264	8.1	6.6	3.22	6877	1.78	9370.24
011020521-03	OBS	No	2.930137	132.855754	16.9	12.993	9.2	7.9	3.22	6877	1.42	9371.03
011020521-04	OBS	No	11.171739	137.960832	85.1	3.597	8.7	9.1	3.22	6877	3.48	1573.30
011020521-05	OBS	No	293.095640	157.741380	193.4	6.042	8.2	8.1	3.22	6877	4.96	20.18
011020521-06	OBS	No	118.311612	211.553500	182.8	4.659	8.4	8.4	3.22	6877	5.08	67.65
011020521-07	OBS	No	131.858819	143.359611	66.9	9.614	8.3	5.6	3.22	6877	2.71	58.55
011020521-08	OBS	No	81.557176	178.687435	165.2	4.488	8.1	7.6	3.22	6877	4.58	111.09
011020521-09	OBS	No	36.435749	160.151233	162.1	3.382	8.0	9.4	3.22	6877	4.66	325.29
011020521-10	OBS	No	34.792680	149.579268	94.8	5.285	7.8	7.4	3.22	6877	3.67	345.93

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
011020521-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED
011020521-04	OBS	FP	0.00	1	0	1	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
011020521-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-07	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
011020521-09	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—MOD_NONUNIQ_ALT—CENT_SATURATED
011020521-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

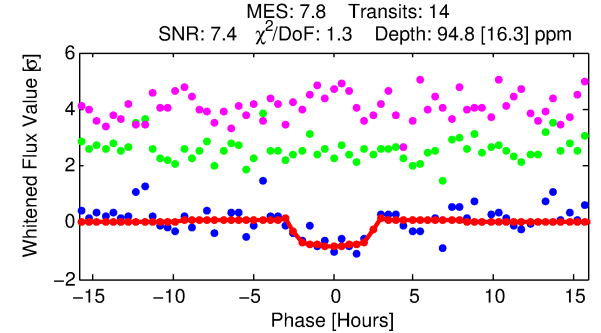
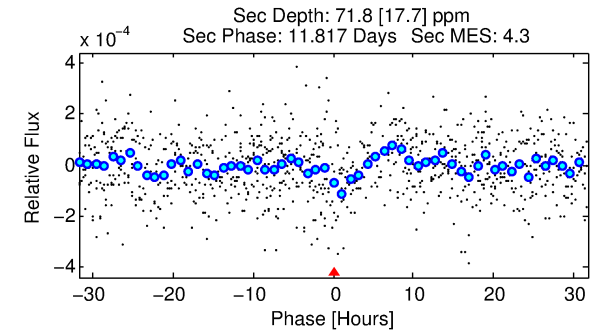
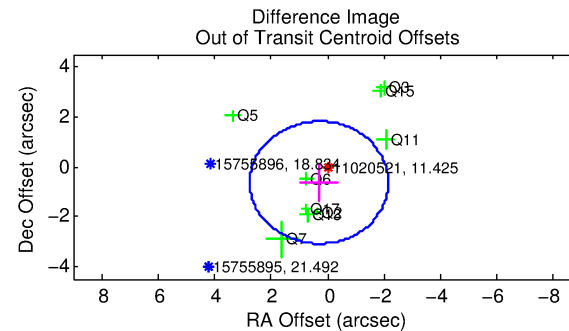
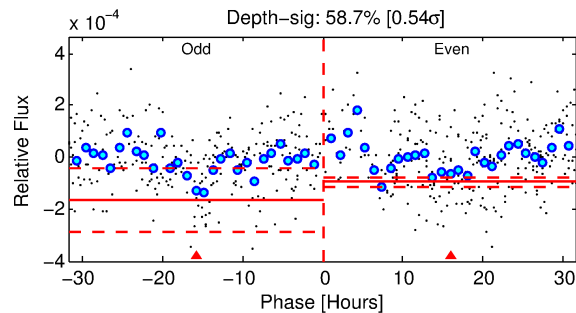
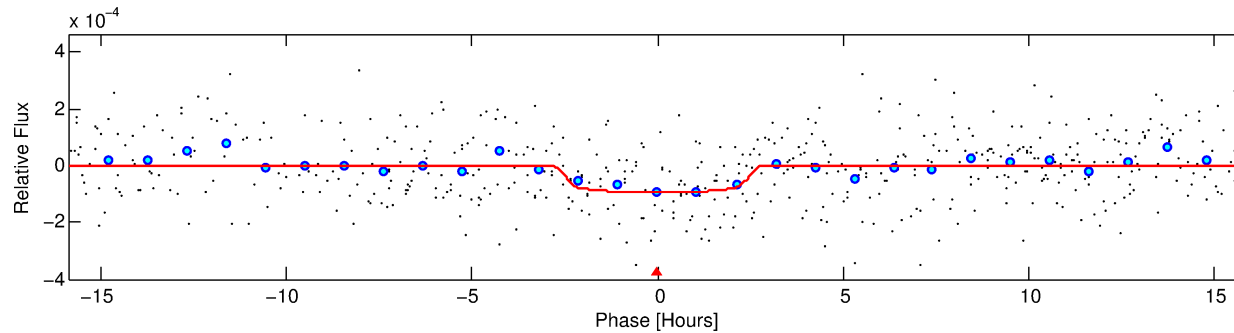
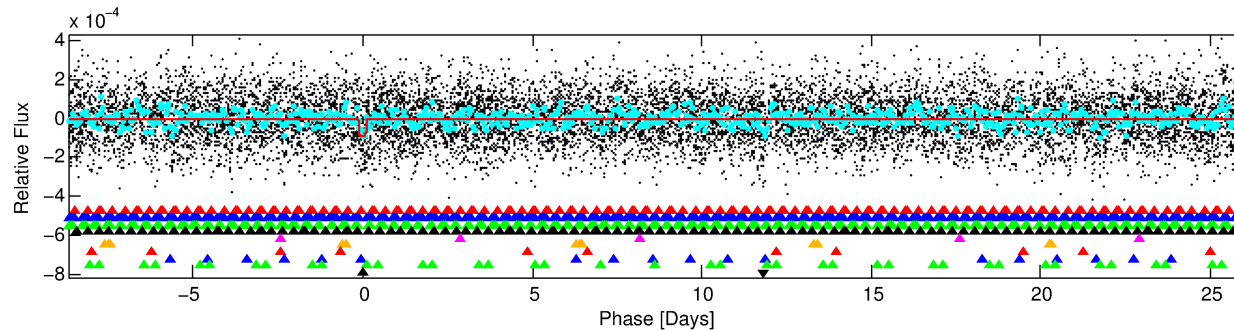
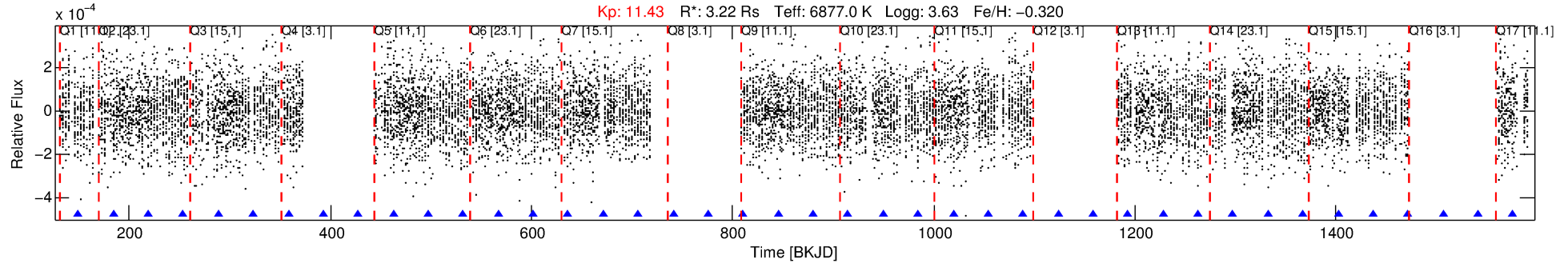
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 011020521-10

No Significant Match Found

# DV One-Page Summary

KIC: 11020521 Candidate: 10 of 10 Period: 34.793 d



## DV Fit Results:

Period = 34.79268 [0.00050] d  
Epoch = 149.5793 [0.0138] BKJD  
Rp/R\* = 0.0105 [0.0047]  
a/R\* = 22.11 [59.76]  
b = 0.91 [0.51]  
Seff = 345.93 [188.01]  
Teq = 1100 [149] K  
Rp = 3.67 [2.16] Re  
a = 0.2450 [0.0841] AU  
Ag = 175.95 [188.78] [0.93 $\sigma$ ]  
Teffp = 6192 [1456] K [3.48 $\sigma$ ]

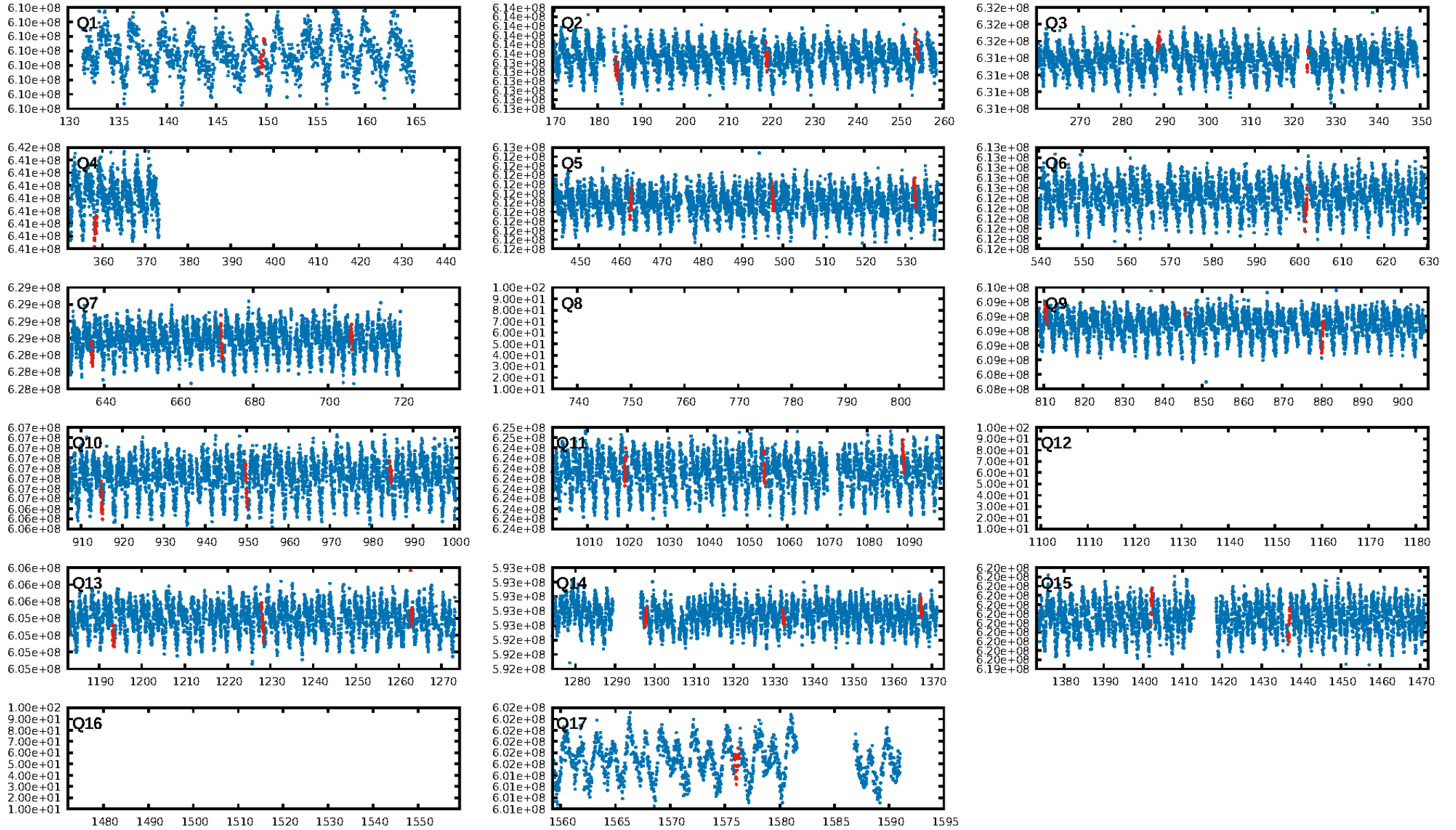
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [88.67 $\sigma$ ]  
LongPeriod-sig: 100.0% [6.28 $\sigma$ ]  
ModelChiSquare2-sig: 10.8%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [12/12]  
GhostDiagnostic-chr: -0.4057  
Centroid-sig: N/A  
Centroid-so: N/A  
OotOffset-rm: 0.705 arcsec [0.86 $\sigma$ ]  
Centroid-so: N/A  
OotOffset-st: 2/4/0/3 [9]  
KicOffset-rm: 0.738 arcsec [0.95 $\sigma$ ]  
OotOffset-st: 2/4/0/3 [9]  
KicOffset-st: 2/4/0/3 [9]  
DiffImageQuality-fgm: 0.67 [6/9]  
DiffImageOverlap-fno: 0.14 [2/14]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 05:45:23 Z

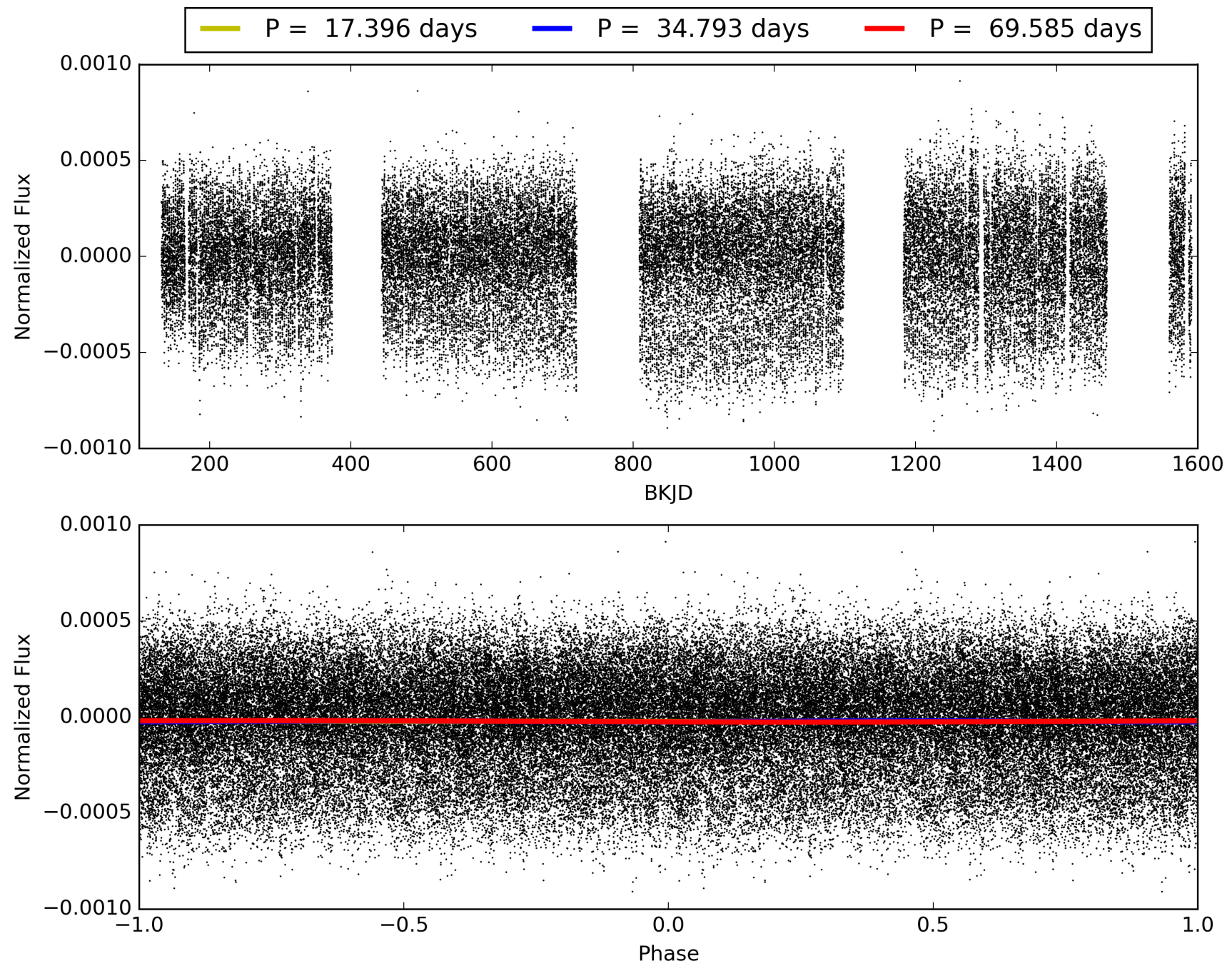
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 011020521-10, PDC Light Curves



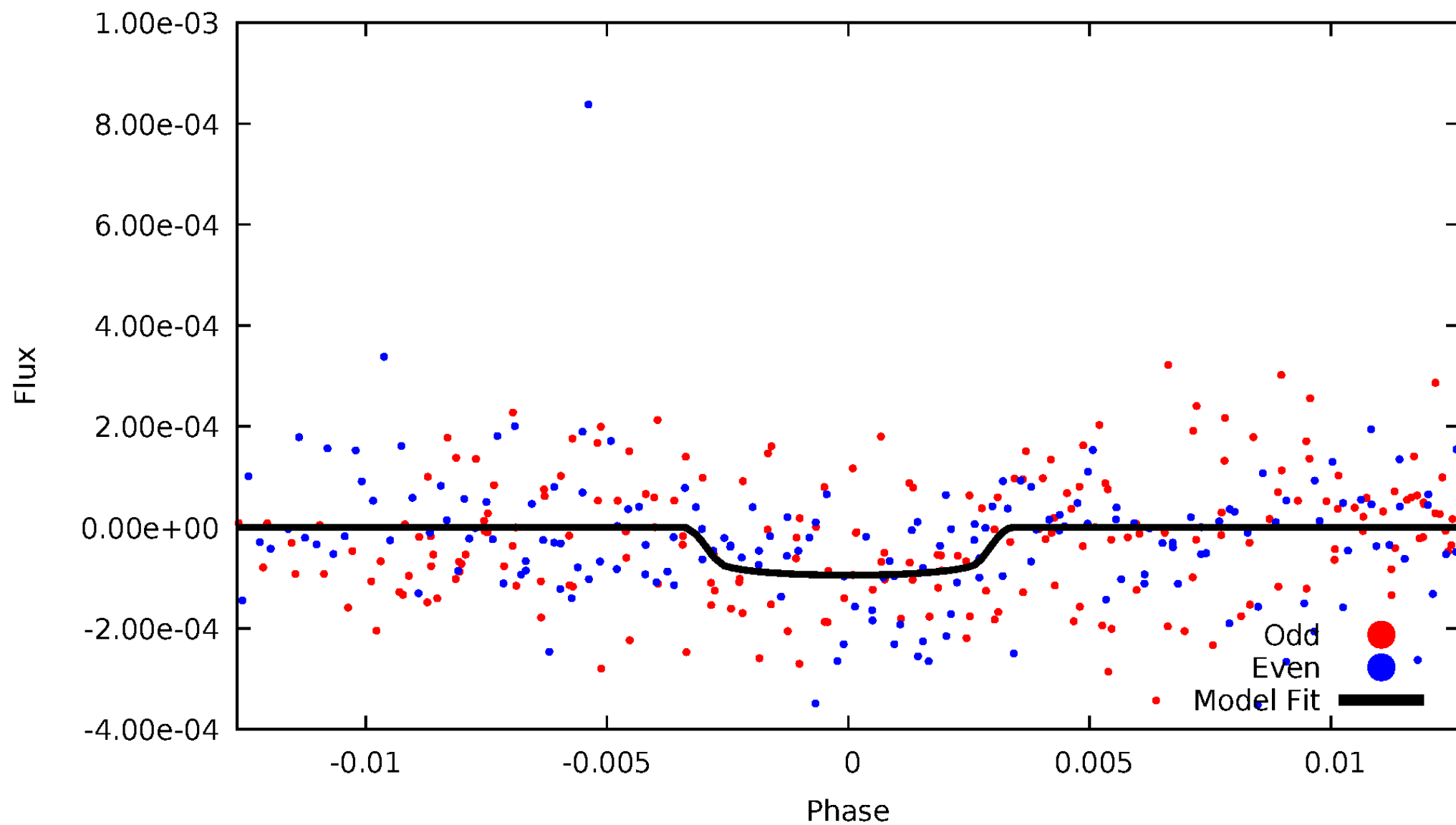


TCE 011020521-10



# DV Odd/Even

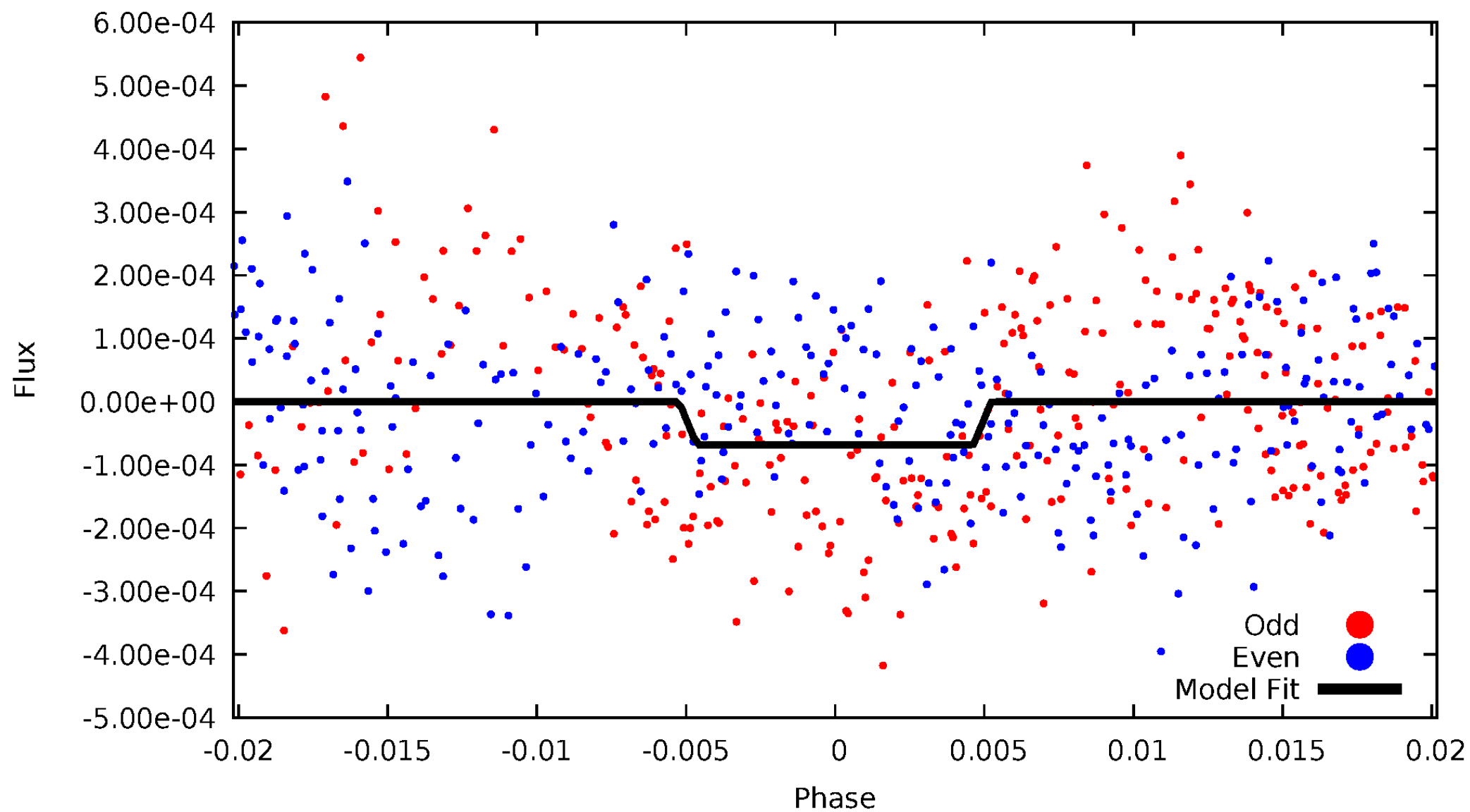
TCE 011020521-10





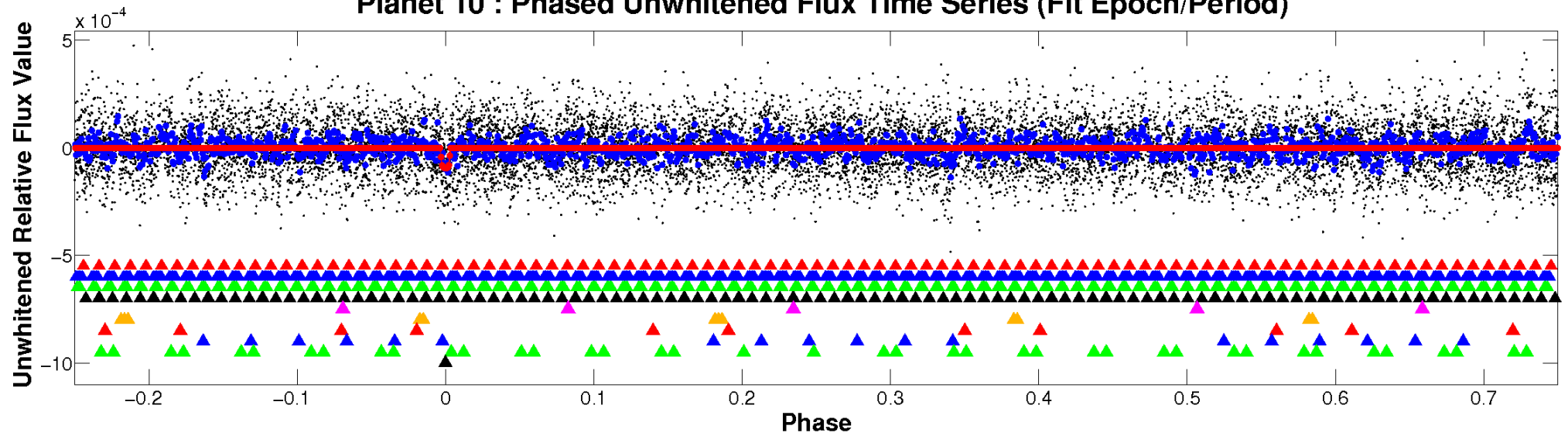
# ALT Odd/Even

TCE 011020521-10

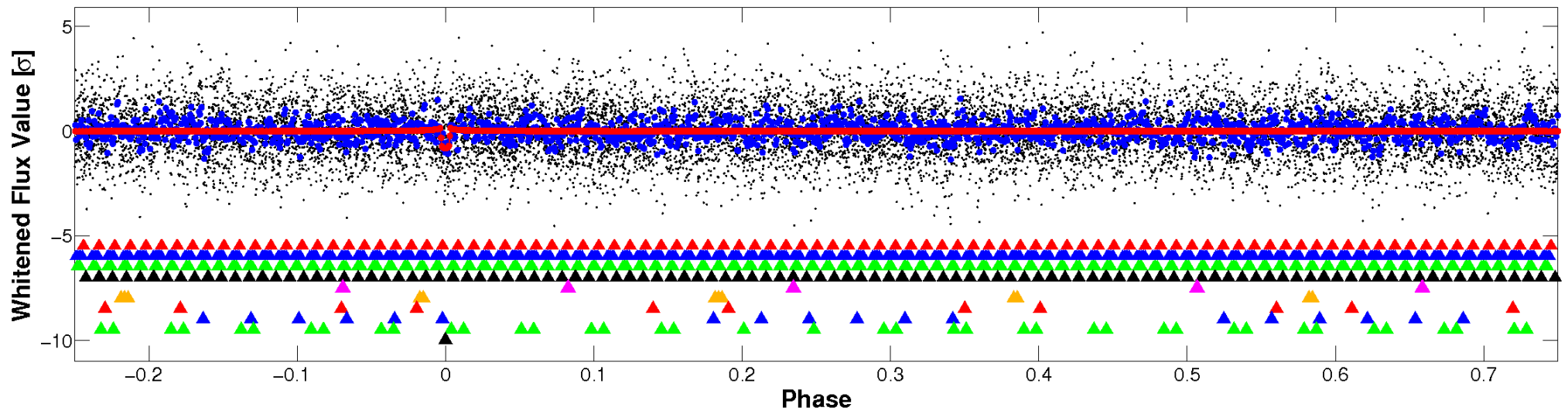


# Non-Whitened Vs. Whitened Light Curve

Planet 10 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

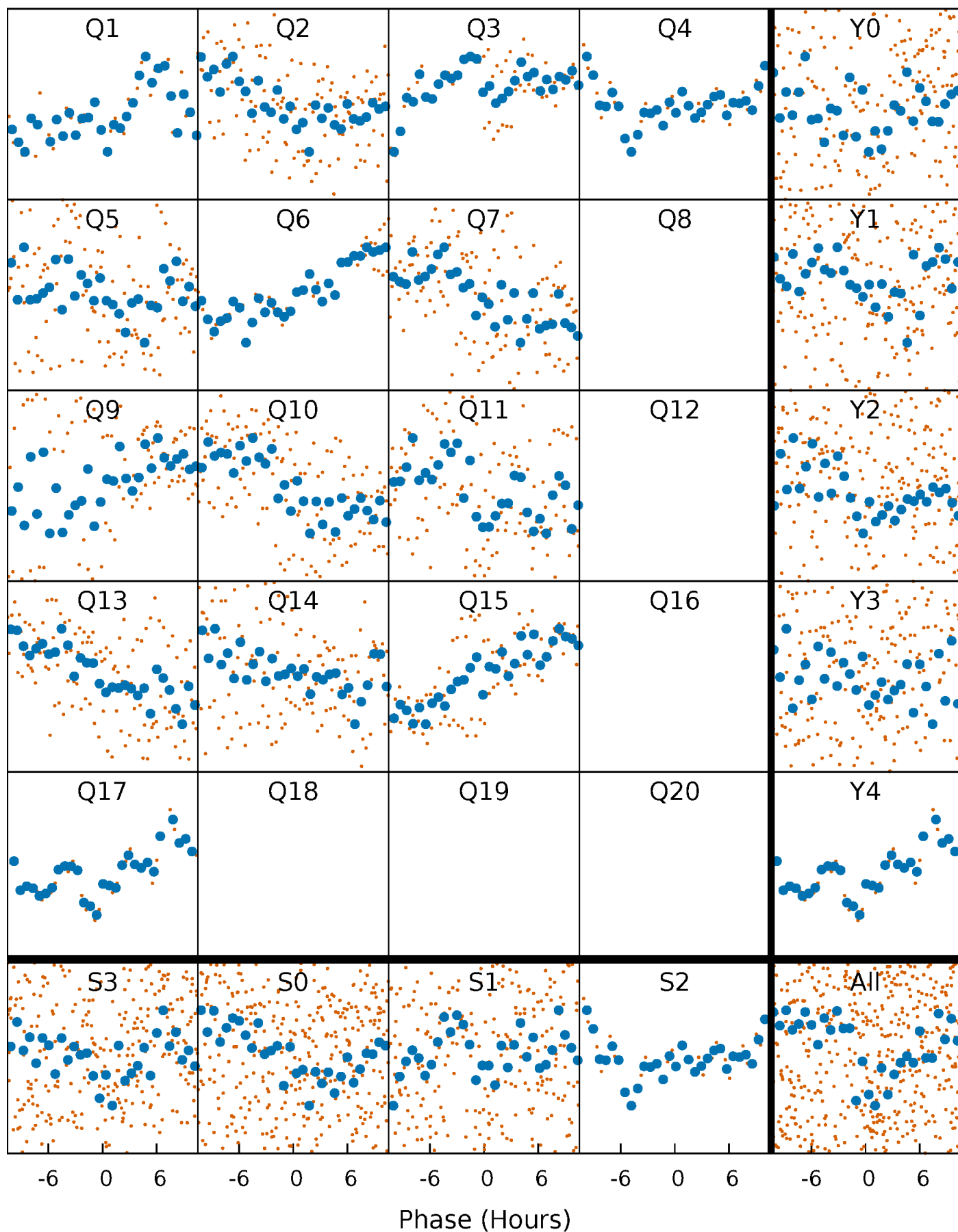


Planet 10 : Phased Whitened Flux Time Series (Fit Epoch/Period)



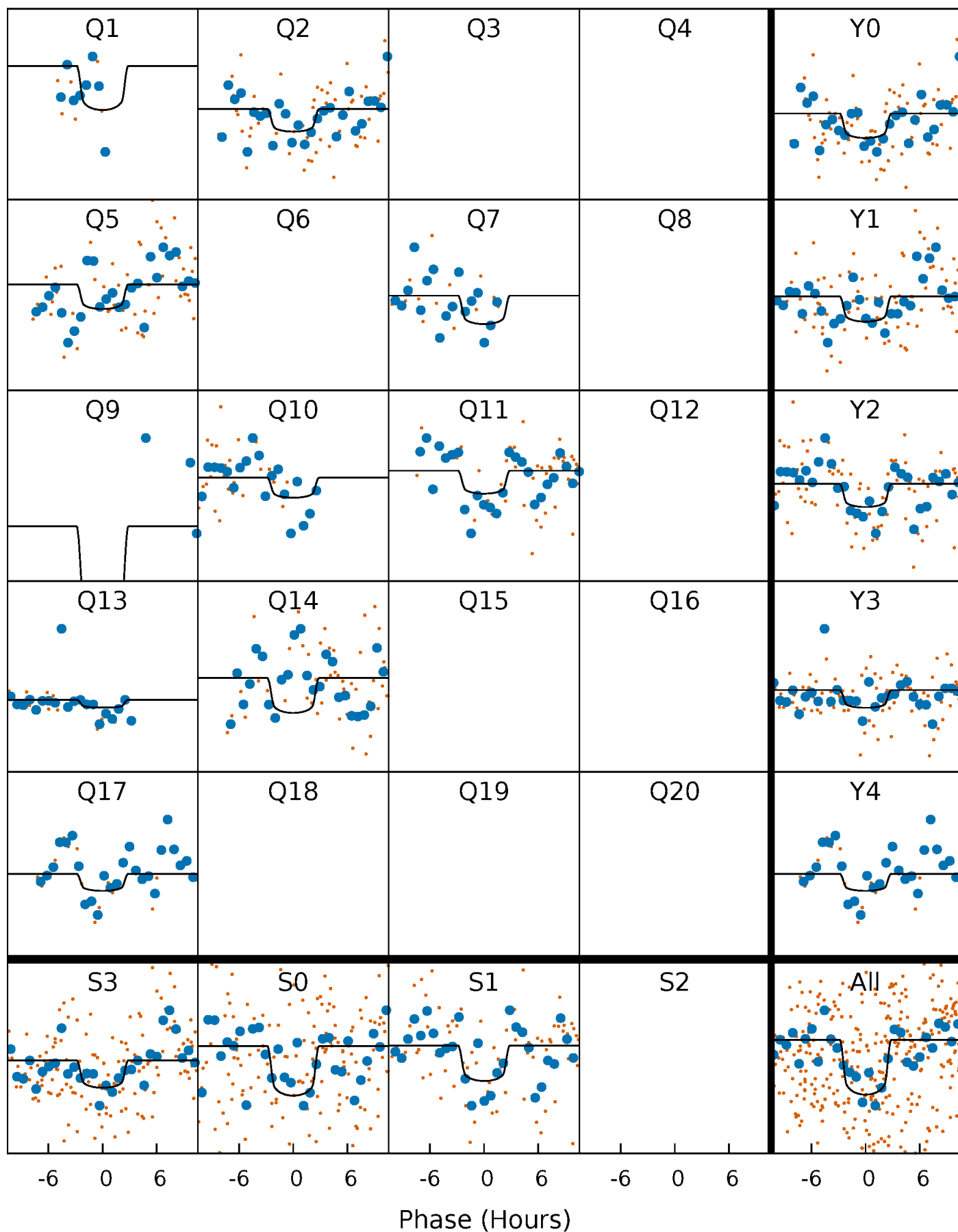
# PDC Quarter-Phased Transit Curves

TCE 011020521-10 P= 34.792680 Days  $T_0=149.579267$  (BKJD)



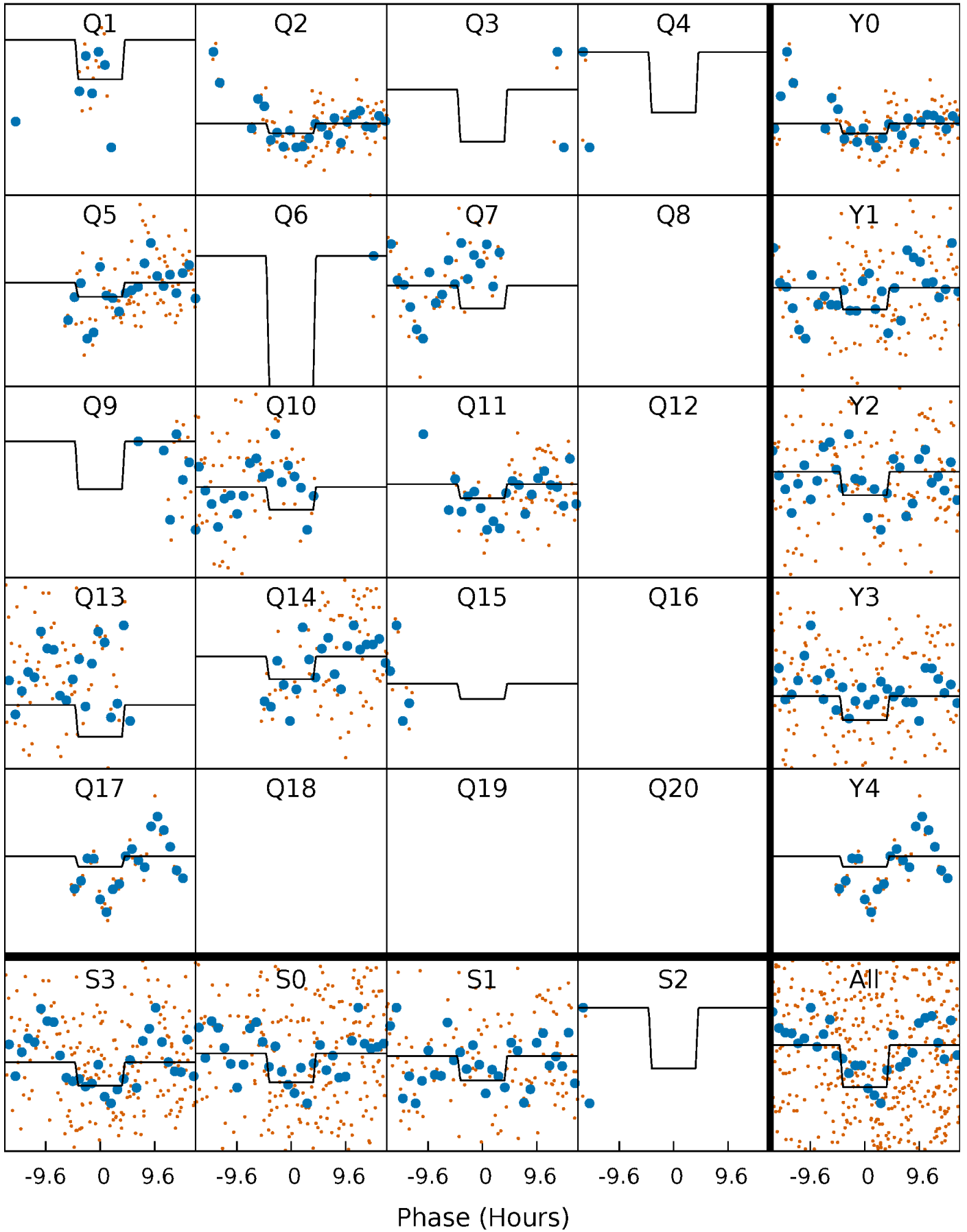
# DV Quarter-Phased Transit Curves

TCE 011020521-10   P= 34.792680 Days    $T_0=149.579267$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

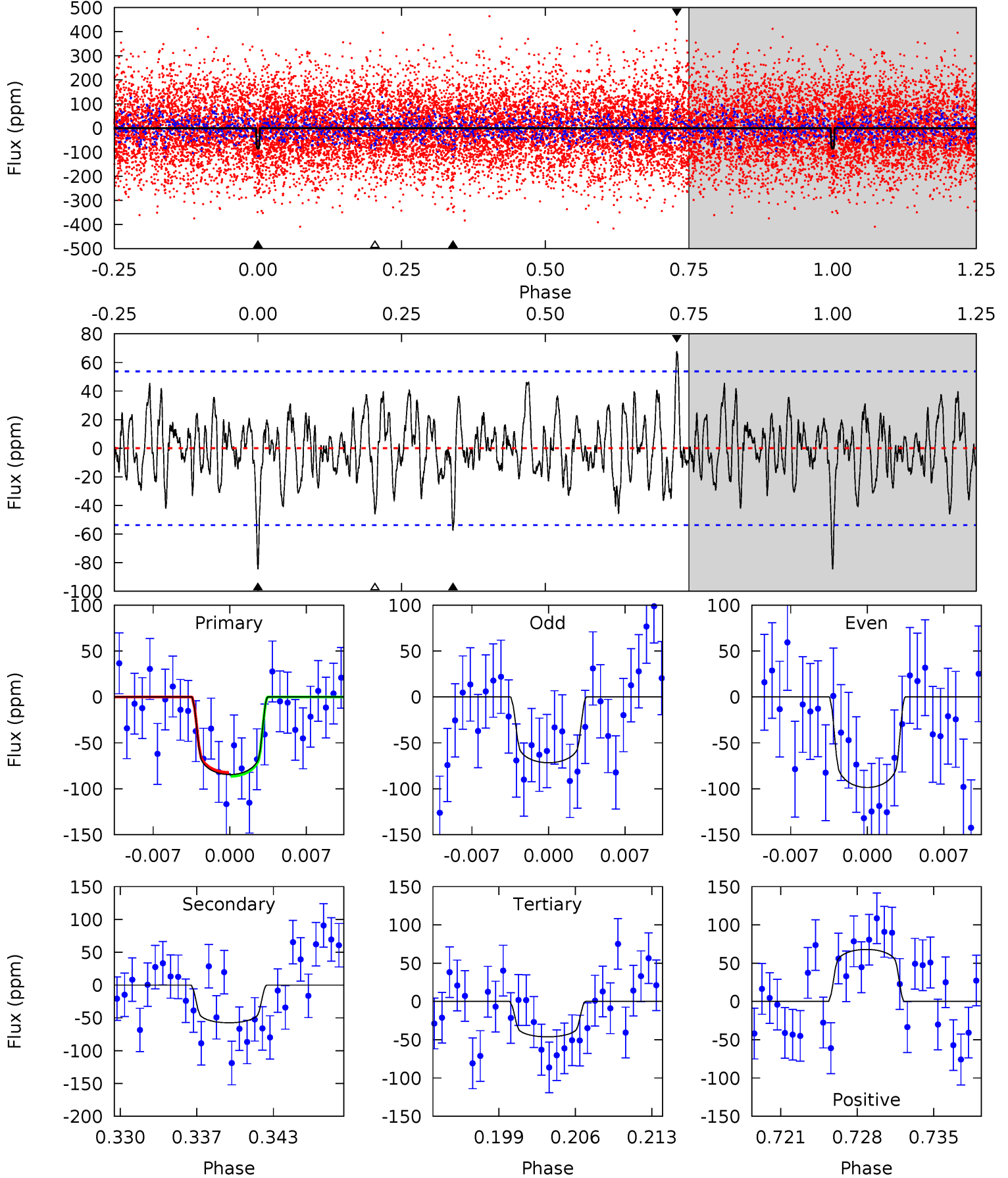
TCE 011020521-10 P= 34.791798 Days  $T_0=149.524288$  (BKJD)



# DV Model-Shift Uniqueness Test

011020521-10, P = 34.792680 Days, E = 114.786587 Days

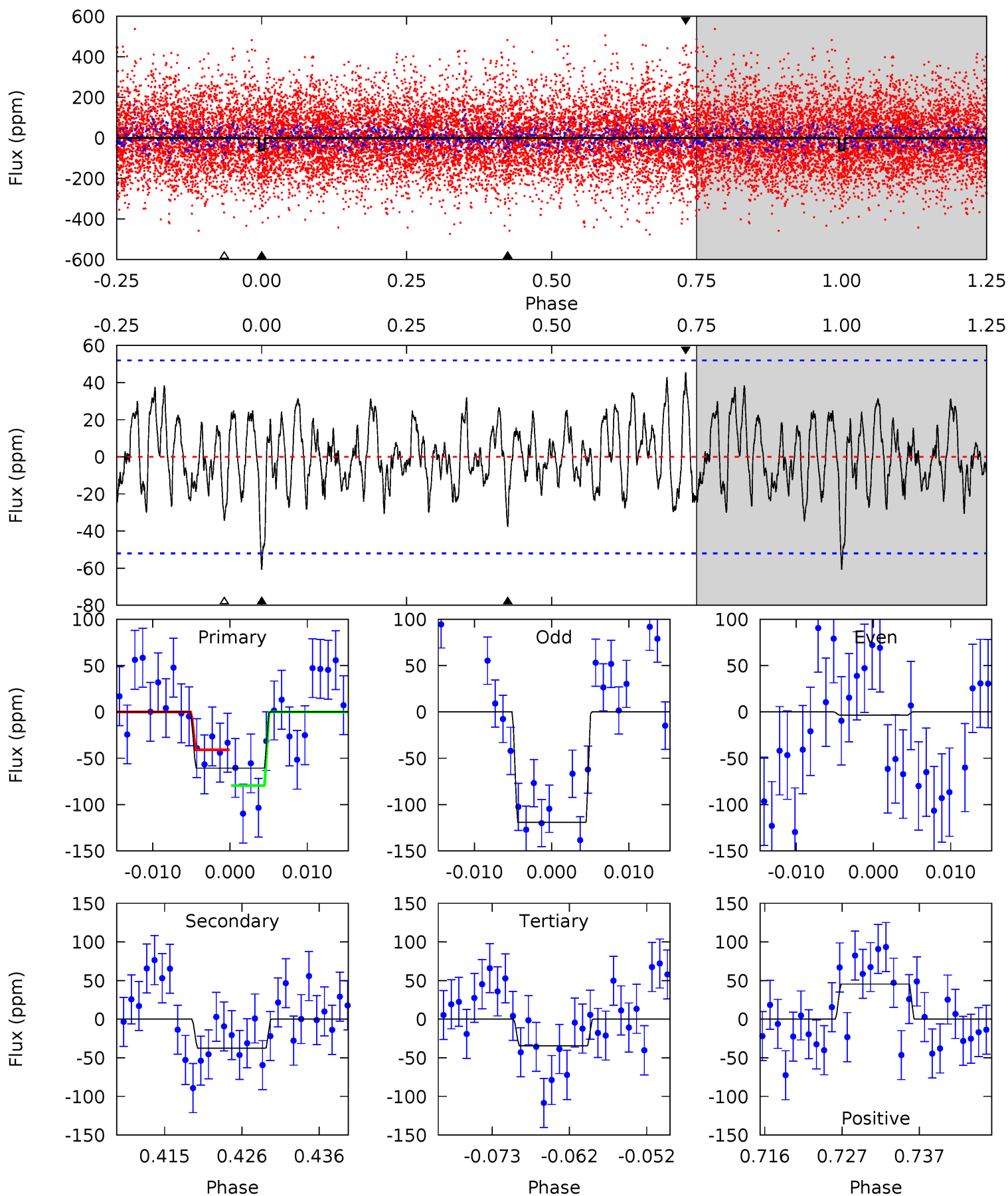
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.01	5.45	4.38	6.45	5.10	2.70	1.71	3.63	1.57	1.07	-0.99	1.28	0.92	0.45	0.20



# Alt Model-Shift Uniqueness Test

011020521-10, P = 34.791798 Days, E = 114.732490 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
5.86	3.62	3.32	4.39	5.02	2.56	1.49	2.55	1.47	0.30	-0.77	5.61	0.67	0.43	1.85



### Stellar Parameters For KIC 011020521

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6877^{+170}_{-204}$	$3.632^{+0.304}_{-0.076}$	$-0.320^{+0.300}_{-0.250}$	$3.219^{+0.406}_{-1.217}$	$1.619^{+0.227}_{-0.312}$	$0.068^{+0.149}_{-0.017}$
	+2%/-3%	+8%/-2%	+94%/-78%	+13%/-38%	+14%/-19%	+218%/-25%
Source	PHO1	FLK73	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 011020521-10 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-57 \pm 11$	$3.41^{+1.70}_{-1.61}$	$1505^{+83}_{-130}$	$5829^{+2350}_{-928}$	$166^{+430}_{-95}$
Alt.	$-37 \pm 10$	$2.85^{+1.69}_{-1.46}$	$1508^{+80}_{-123}$	$5672^{+2680}_{-972}$	$146^{+472}_{-89}$

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



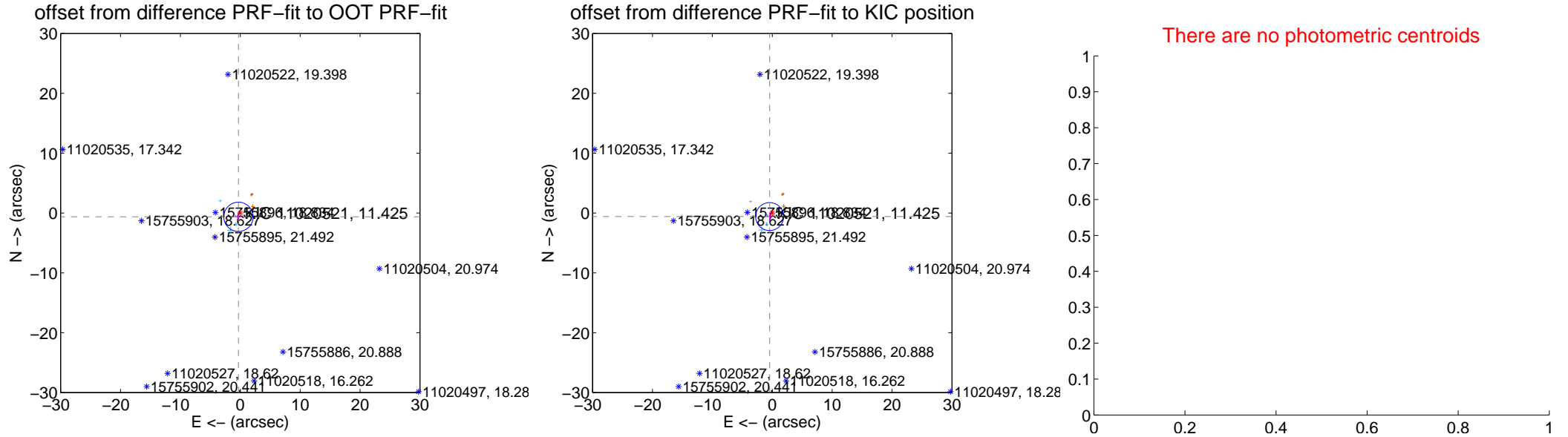
## DV Centroid Data

Supplemental centroid analysis for 011020521-10. **Kepler magnitude: 11.43.** Transit SNR 7.42

There are 6 quarters with good PRF difference image offsets

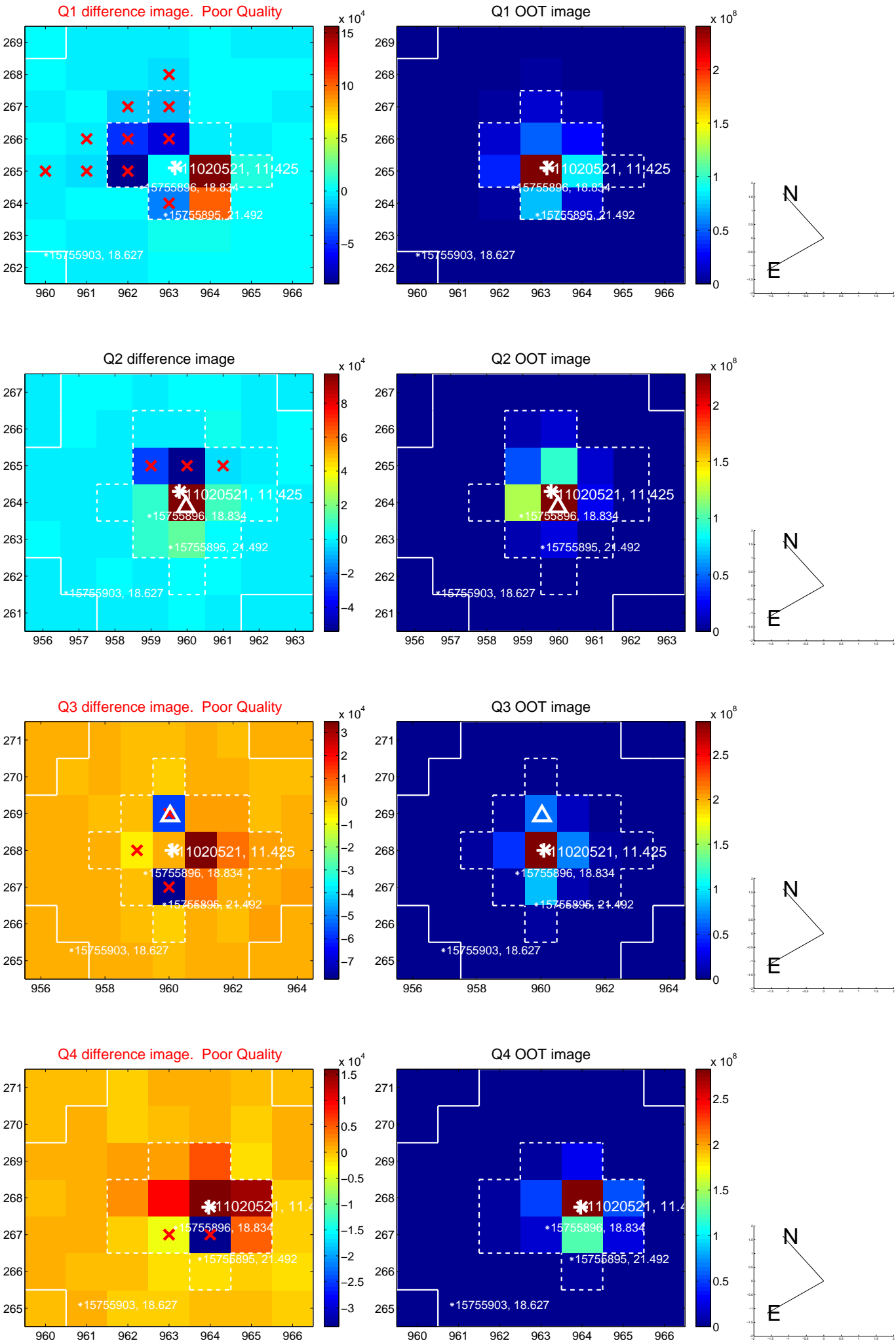
The direct PRF centroid is offset from the target star catalog position by about 0.18 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.705 \pm 0.816$	0.86	$0.304 \pm 0.643$	$-0.637 \pm 0.721$
PRF-fit source offset from KIC position	$0.738 \pm 0.778$	0.95	$0.439 \pm 0.493$	$-0.593 \pm 0.732$
photometric centroid source offset	—	—	—	—

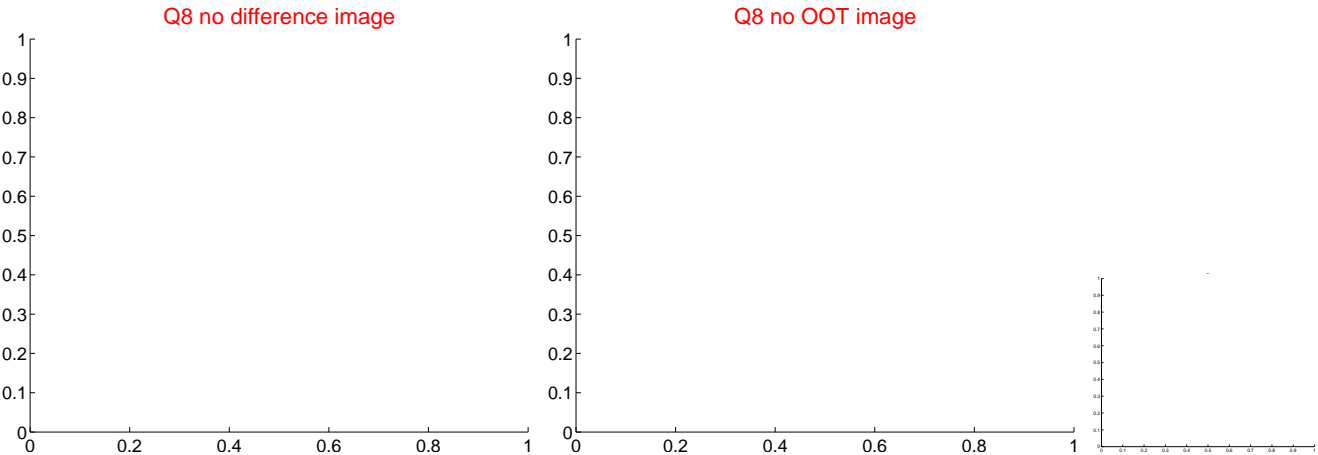
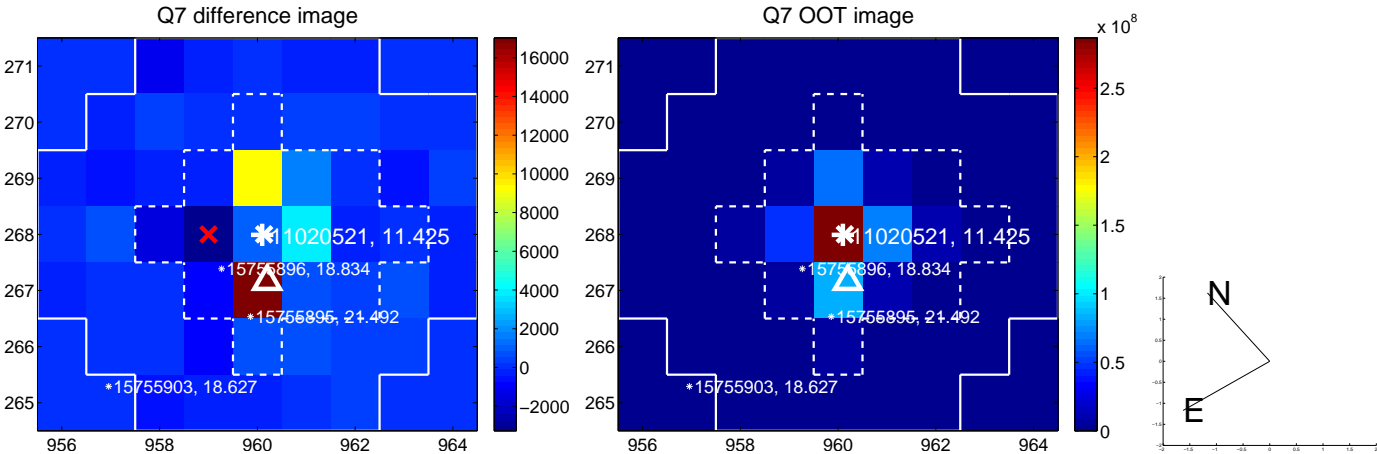
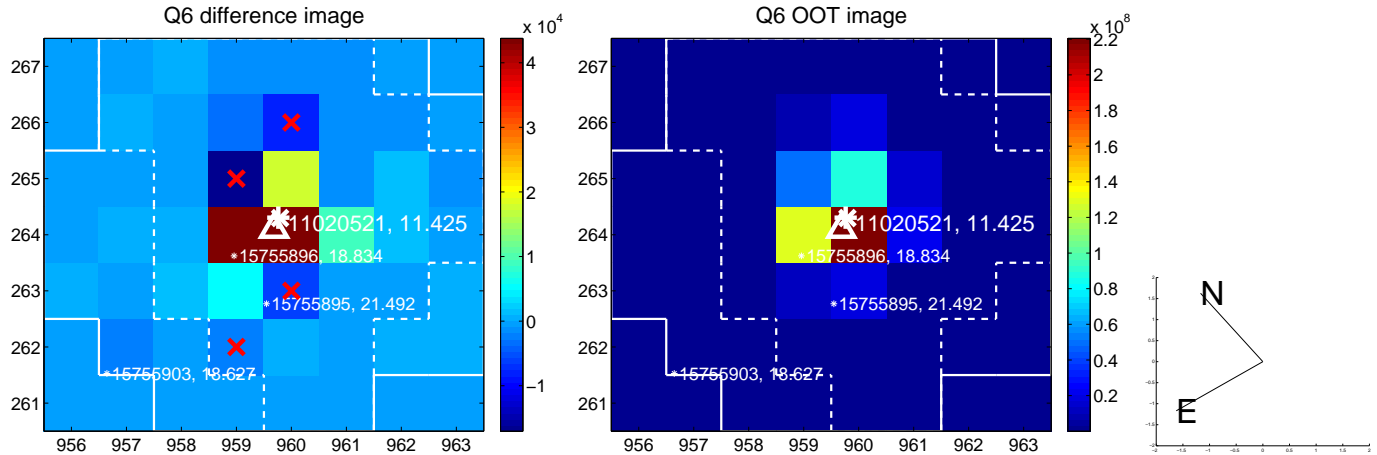
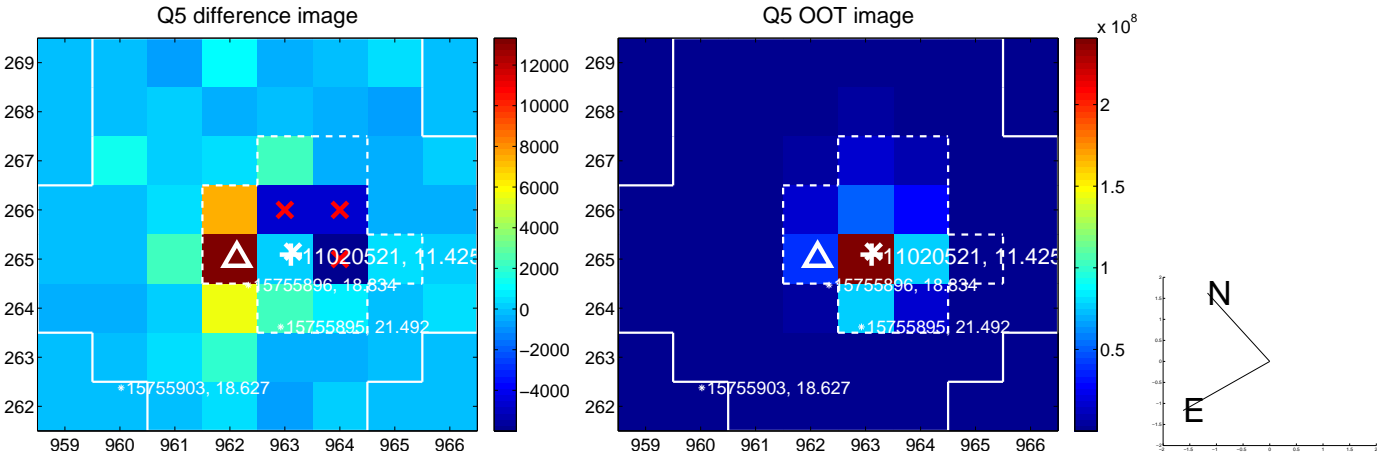


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

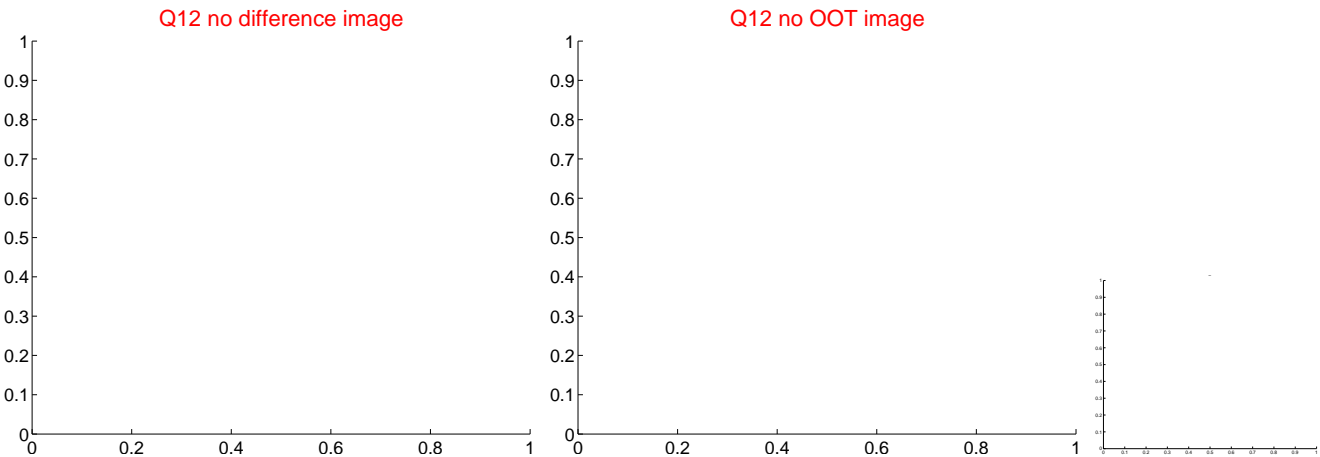
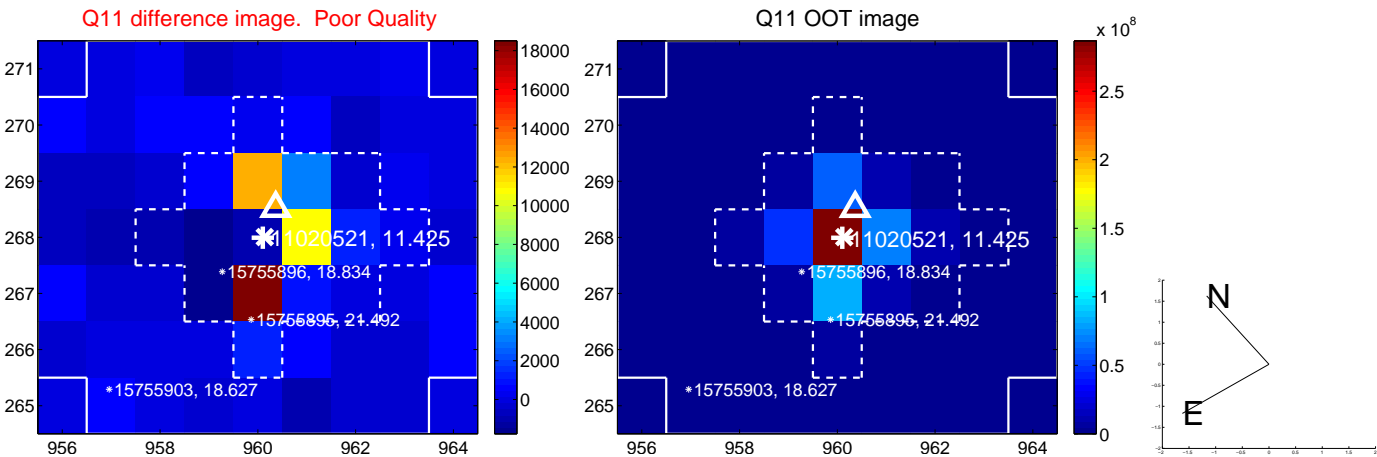
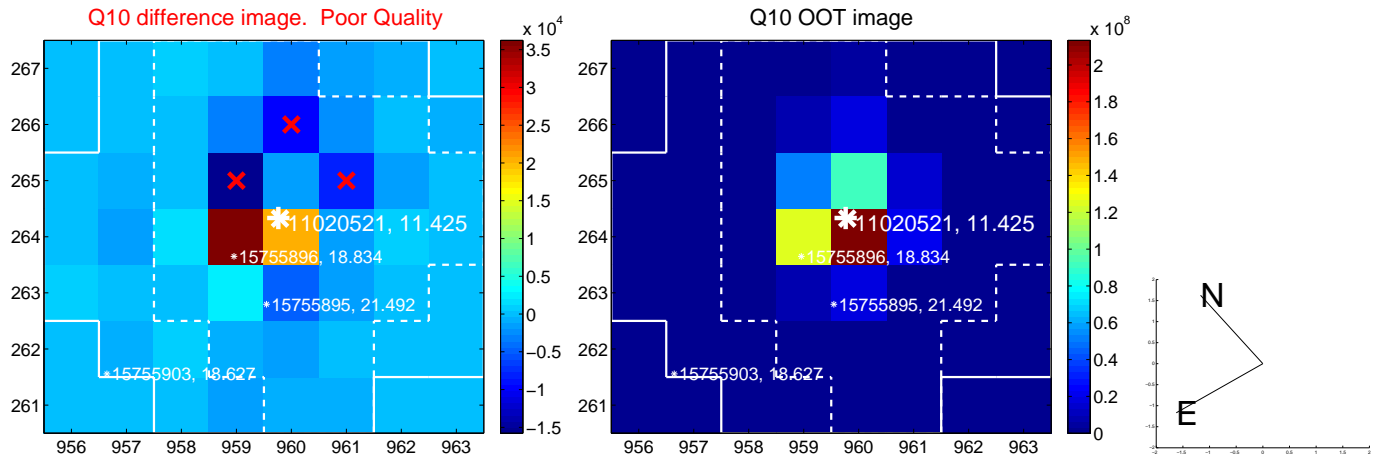
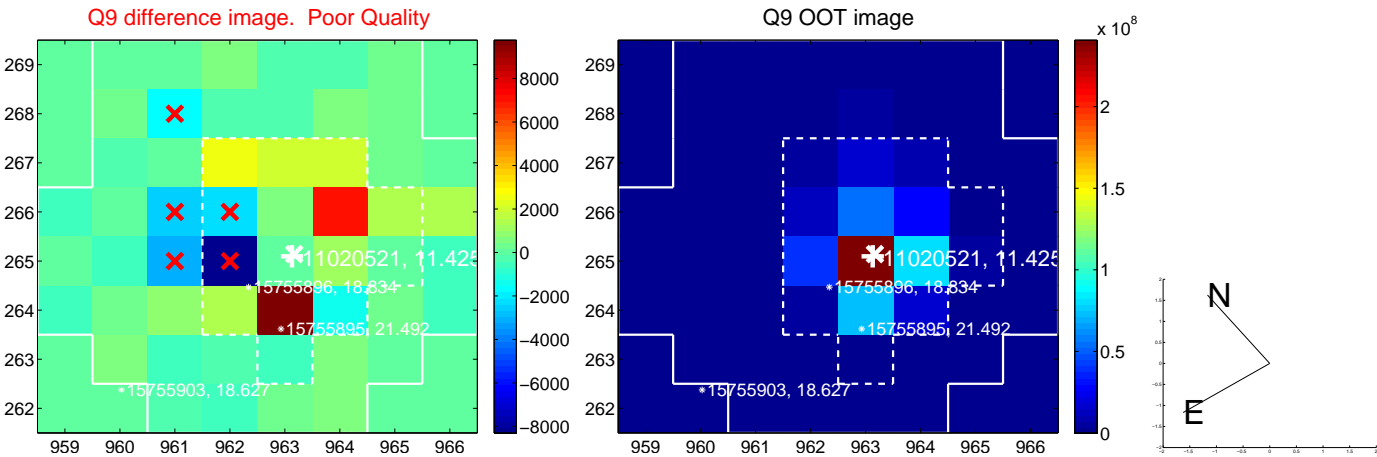
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



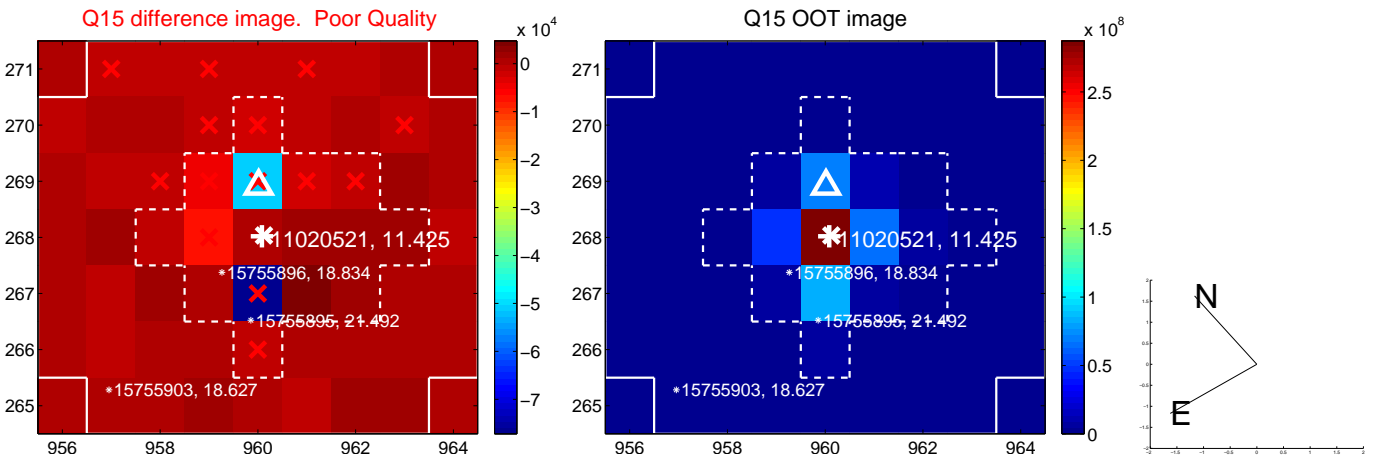
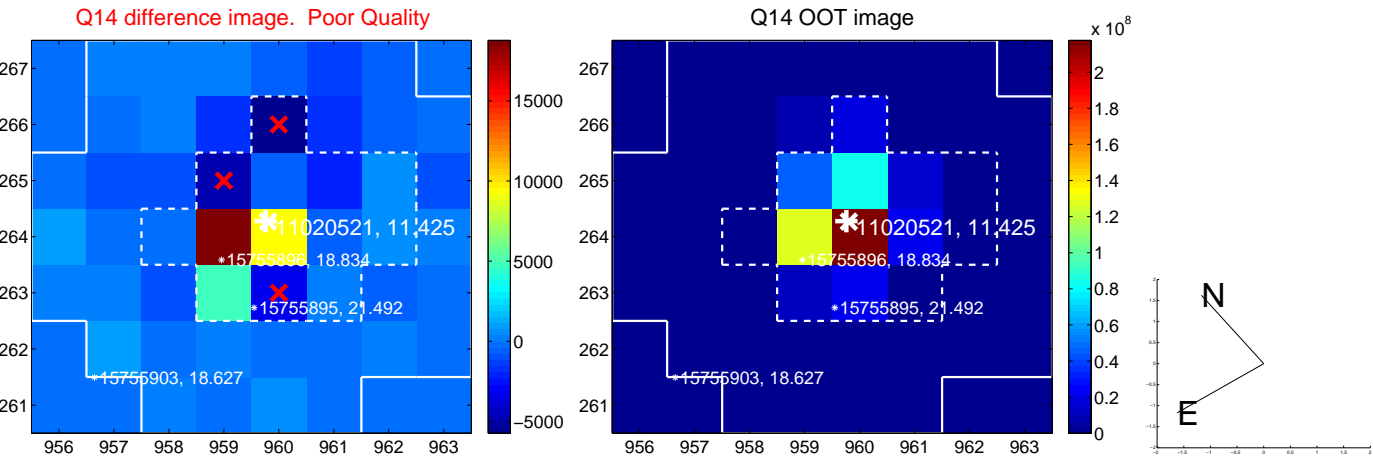
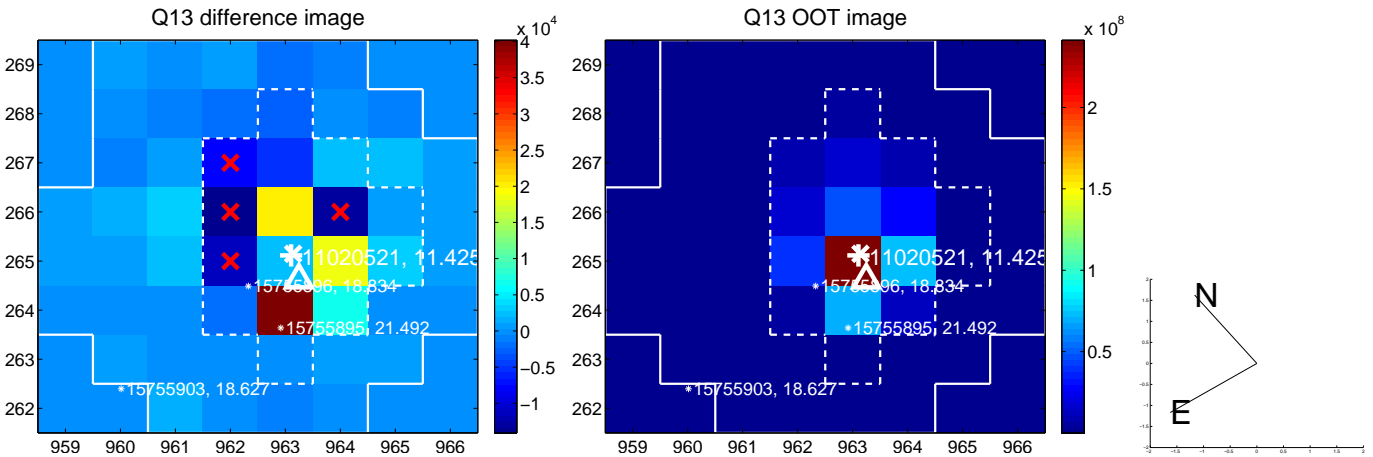
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



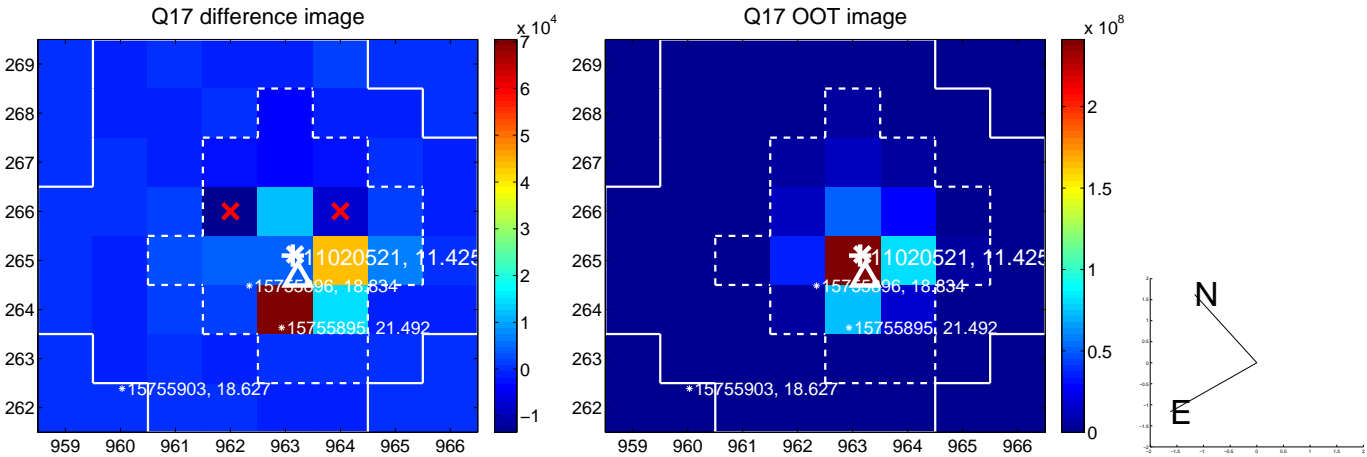
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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.



folded centroid time series figure for this object.

UKIRT Image

Declination

