

# KIC 012453624

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012453624-01	OBS	No	3.322161	132.942957	113.4	11.096	8.6	7.2	0.50	3776	0.59	37.59
012453624-02	OBS	No	175.767110	137.750287	897.5	11.095	8.4	5.9	0.50	3776	1.58	0.19

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012453624-01	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV—CENT_KIC_POS
012453624-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—TRANS_GAPPED—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_KIC_POS

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

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

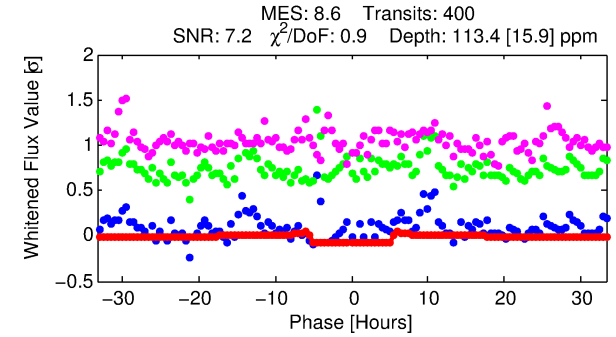
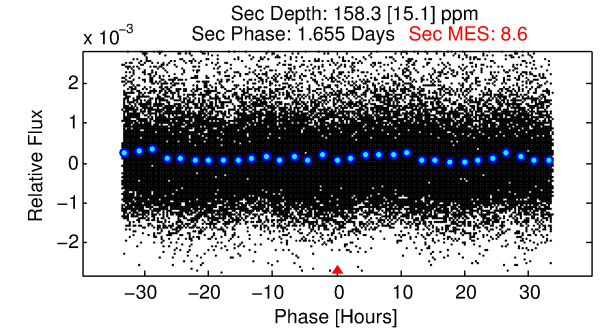
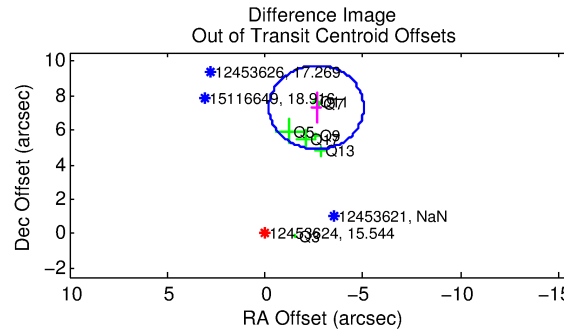
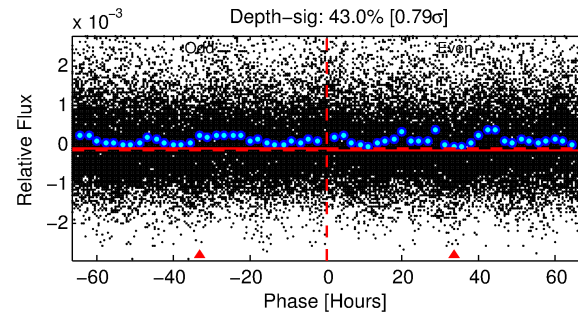
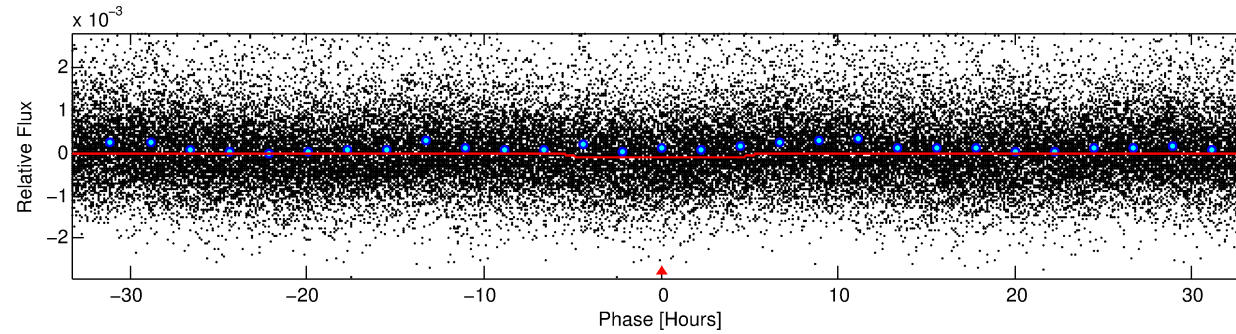
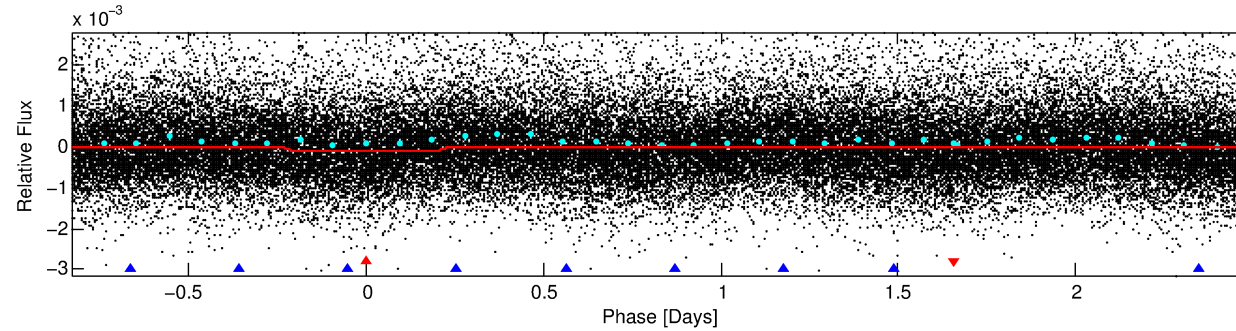
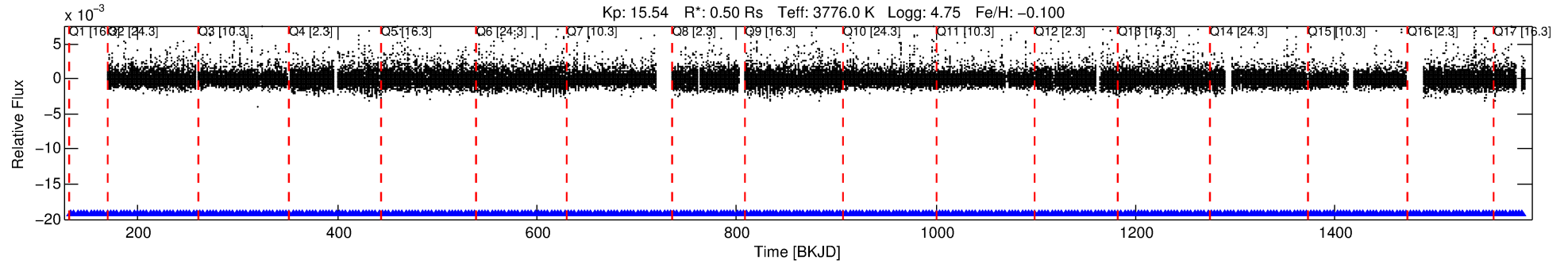
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 012453624-01

No Significant Match Found

# DV One-Page Summary

KIC: 12453624 Candidate: 1 of 2 Period: 3.322 d



## DV Fit Results:

Period = 3.32216 [0.00005] d  
Epoch = 132.9430 [0.0099] BKJD  
Rp/R\* = 0.0107 [0.0047]  
a/R\* = 1.69 [2.16]  
b = 0.79 [0.95]  
Seff = 37.59 [4.13]  
Teq = 631 [17] K  
Rp = 0.59 [0.26] Re  
a = 0.0348 [0.0019] AU  
Ag = 307.10 [271.52] [1.13 $\sigma$ ]  
Teffp = 4087 [904] K [3.82 $\sigma$ ]

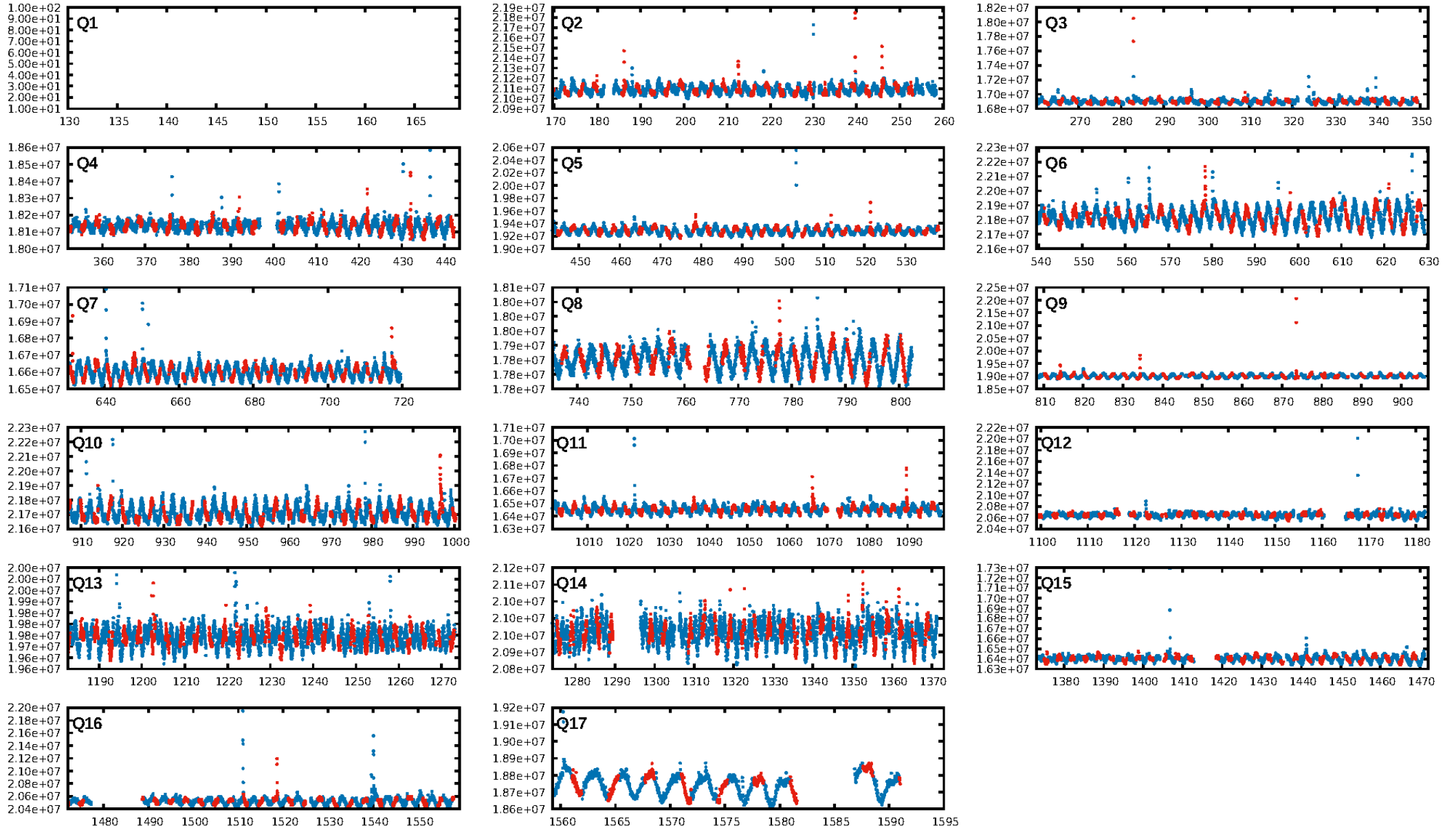
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [263.76 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 1.25e-11  
RollingBand-fgt: 1.00 [392/392]  
GhostDiagnostic-chr: 0.7827  
Centroid-sig: 0.1%  
Centroid-so: 2.714 arcsec [5.09 $\sigma$ ]  
OotOffset-rm: 7.768 arcsec [9.63 $\sigma$ ]  
KicOffset-rm: 3.608 arcsec [18.82 $\sigma$ ]  
OotOffset-st: 0/3/0/4 [7]  
KicOffset-st: 3/3/4/4 [14]  
DiffImageQuality-fgm: 0.50 [7/14]  
DiffImageOverlap-fno: 1.00 [16/16]

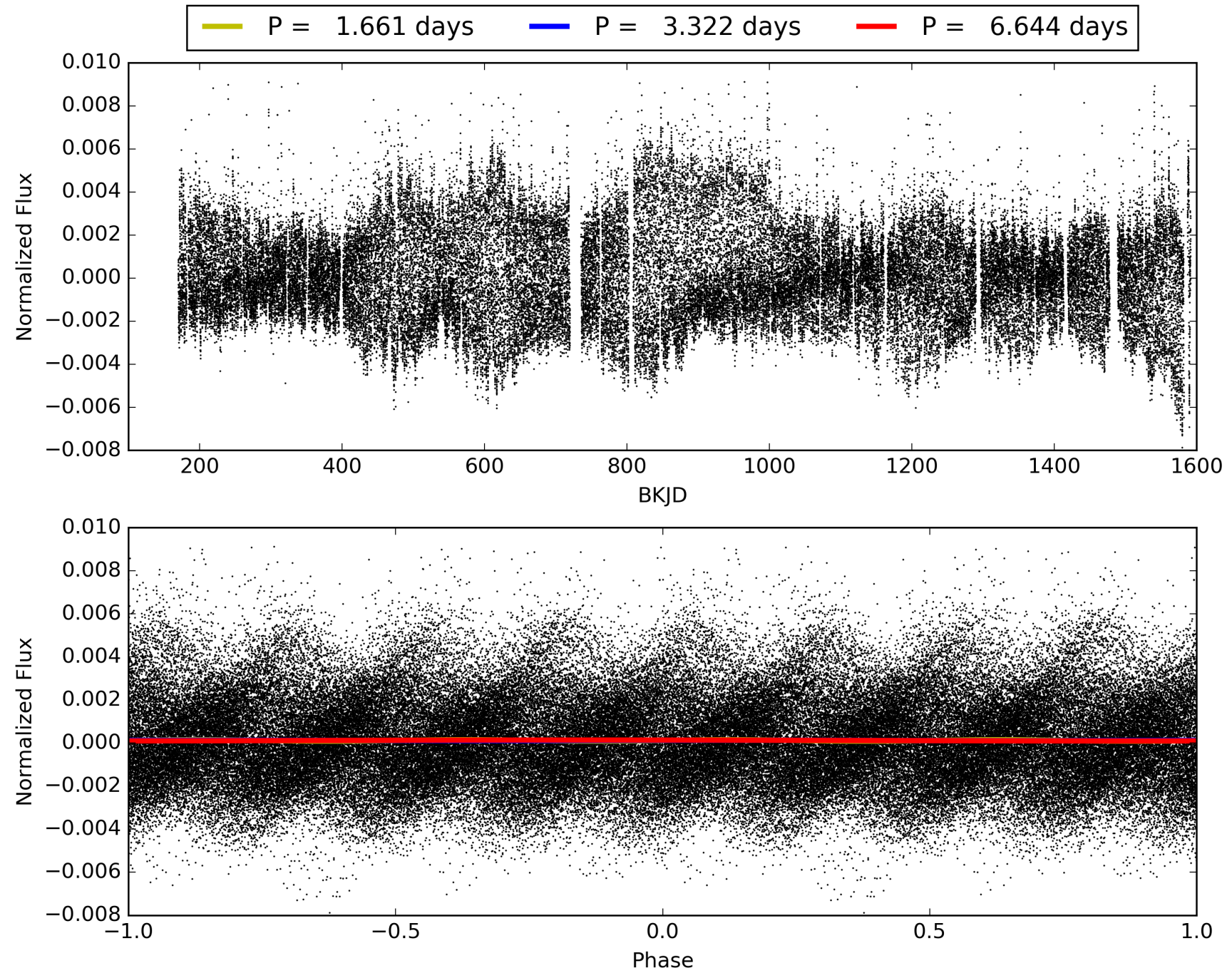
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 09:25:18 Z

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

# TCE 012453624-01, PDC Light Curves

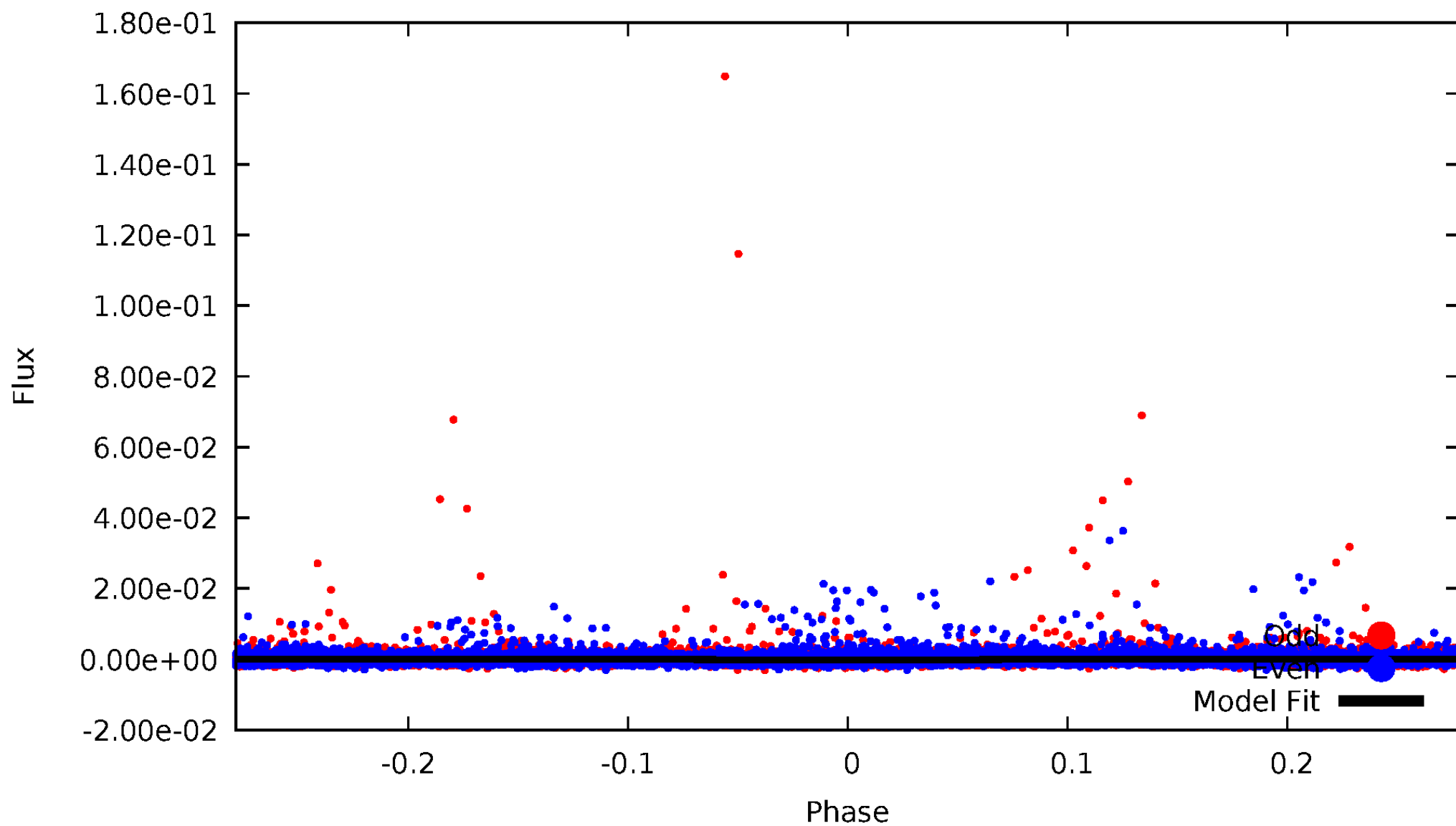


TCE 012453624-01



# DV Odd/Even

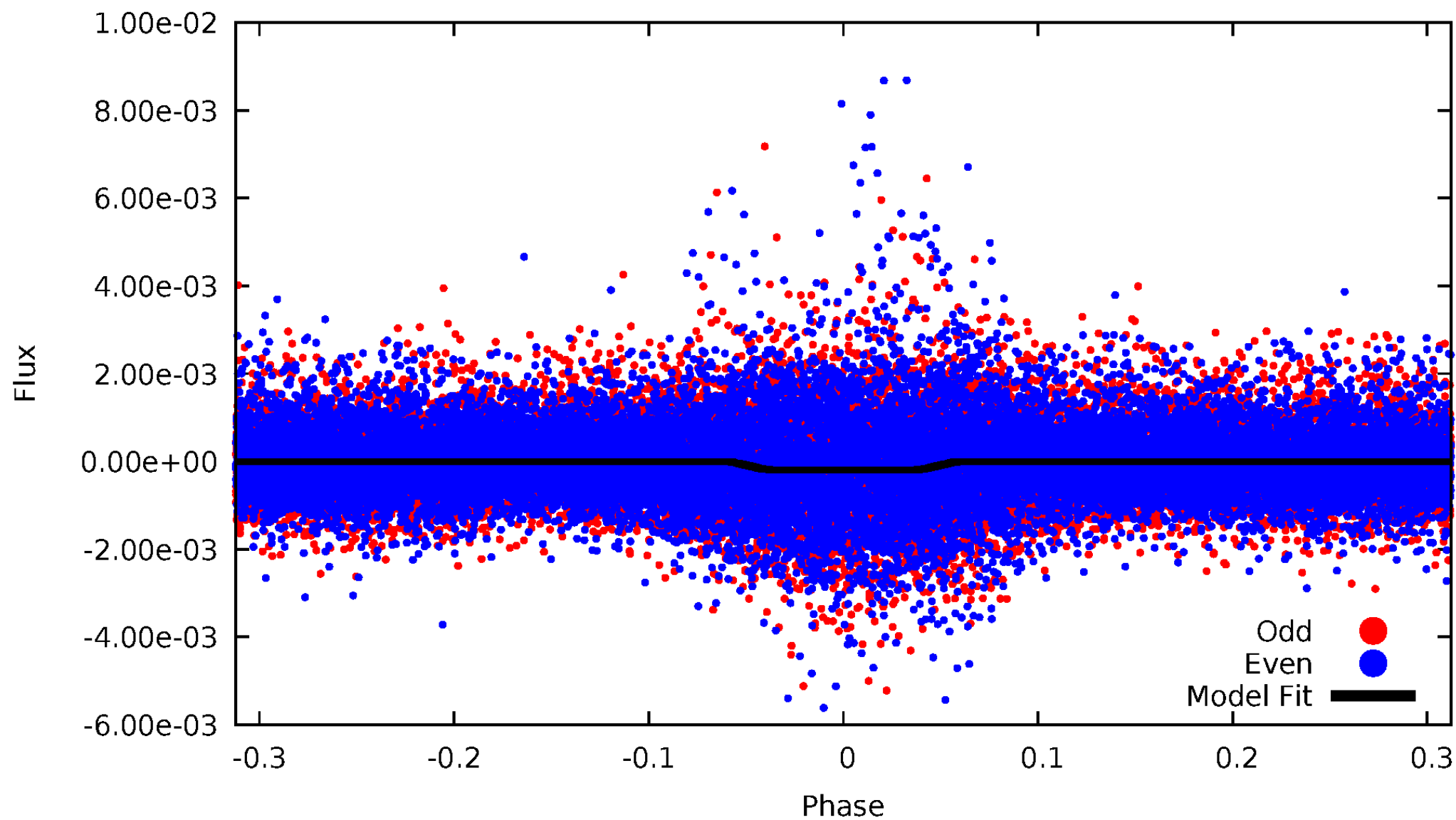
TCE 012453624-01





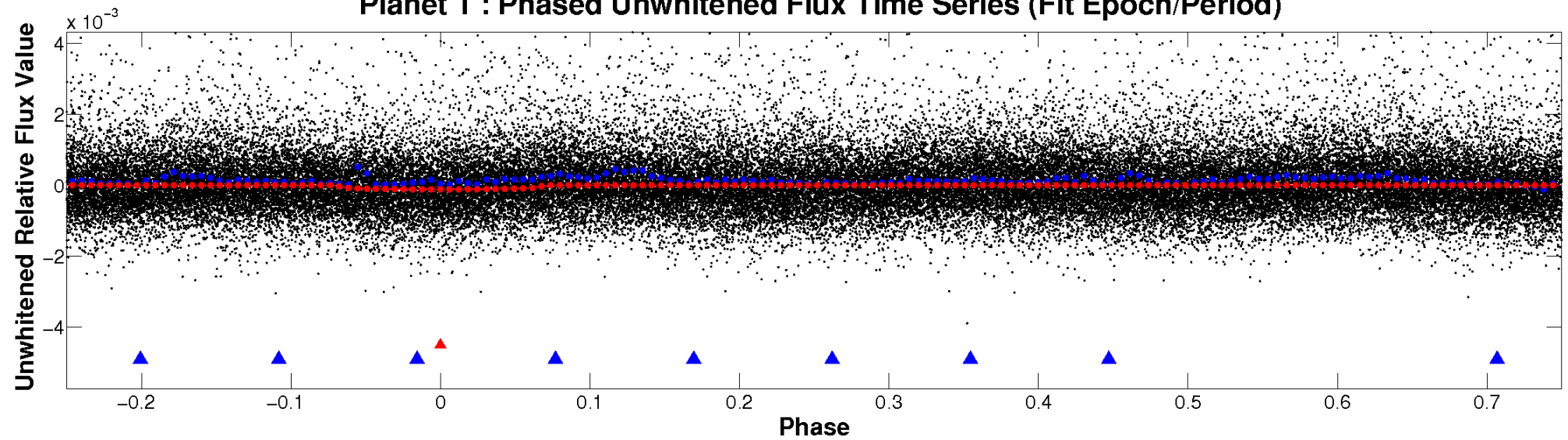
# ALT Odd/Even

TCE 012453624-01

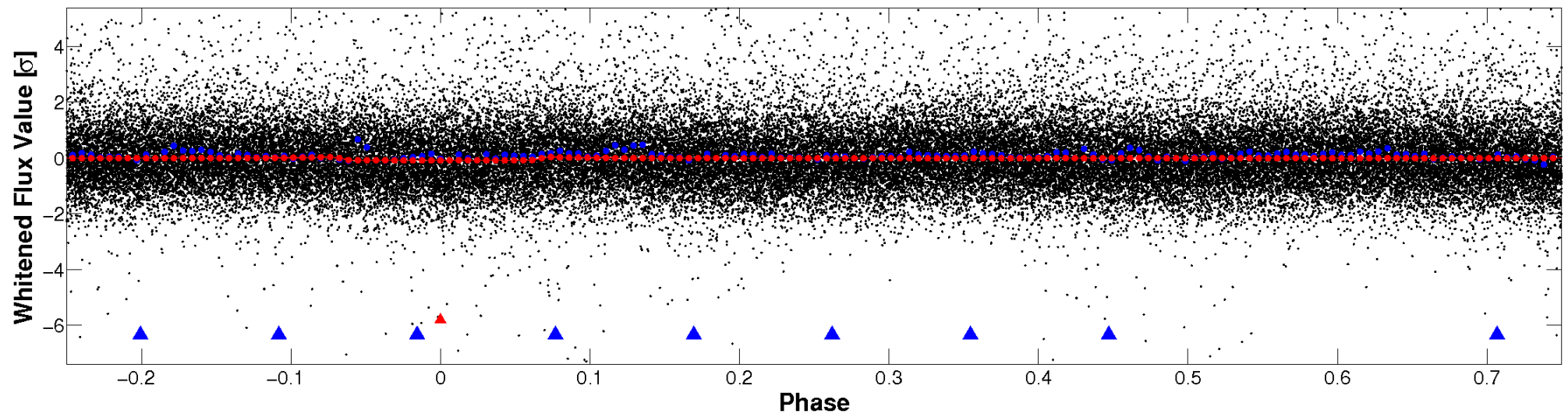


# Non-Whitened Vs. Whitened Light Curve

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

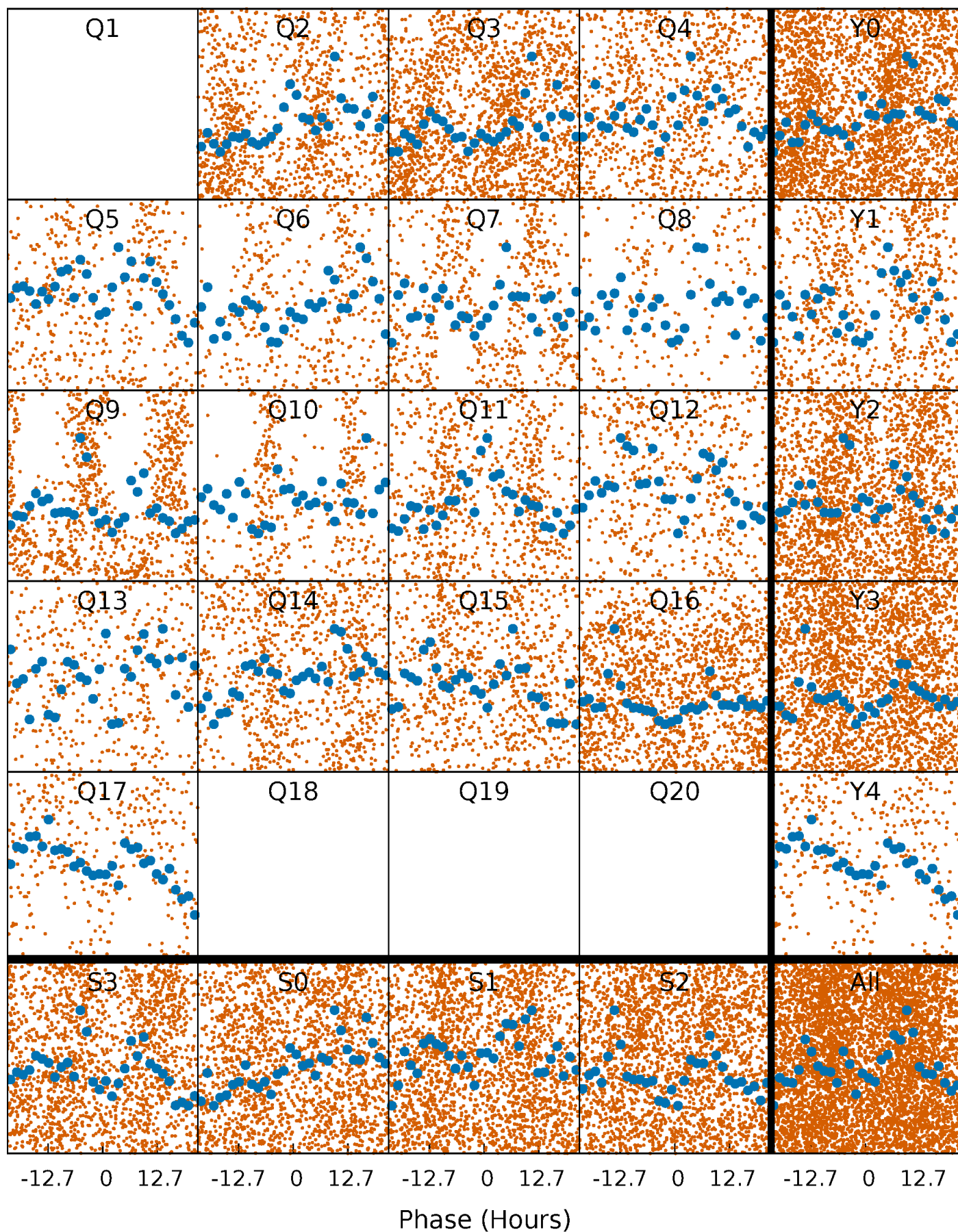


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

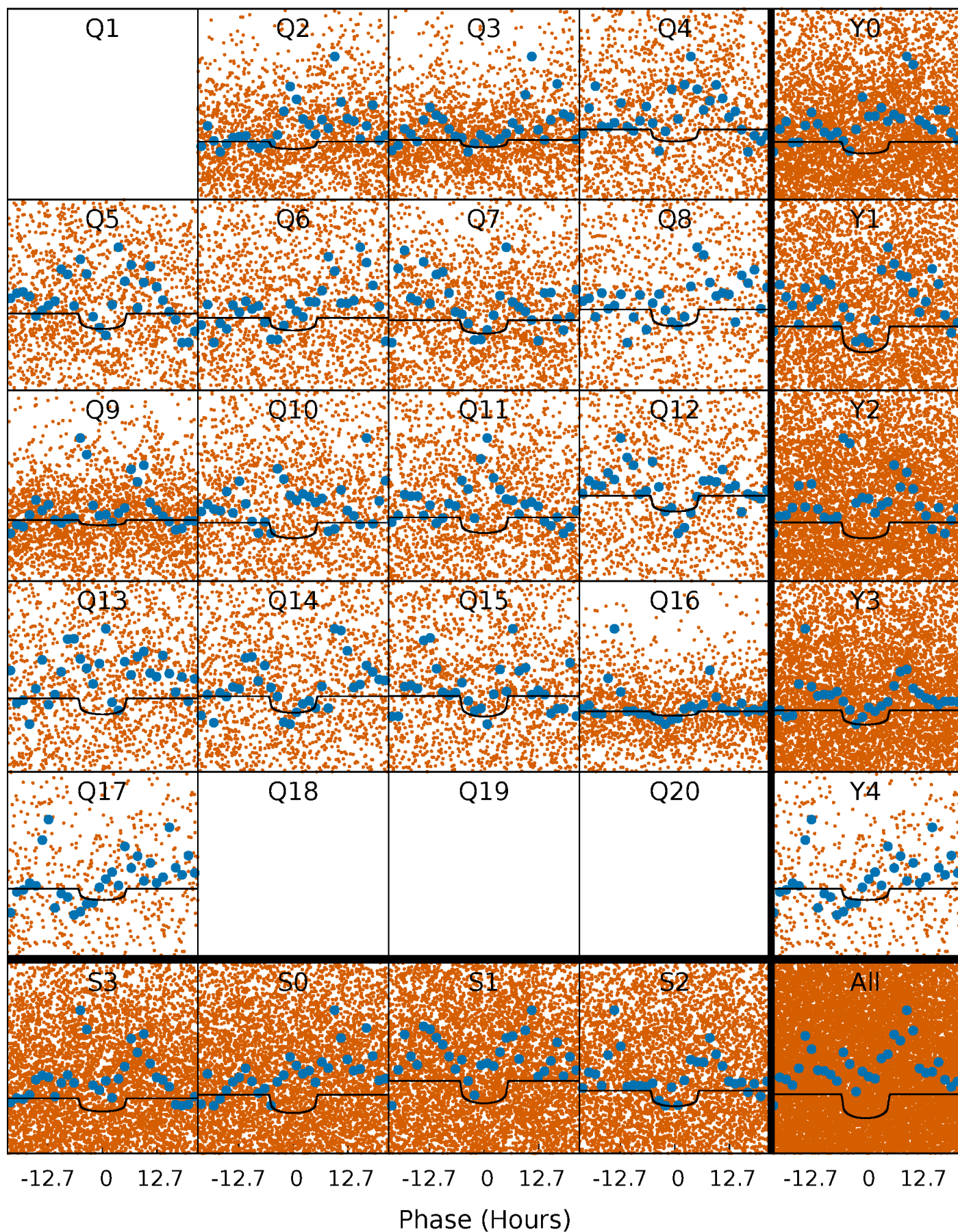
TCE 012453624-01 P= 3.322161 Days  $T_0=132.942957$  (BKJD)





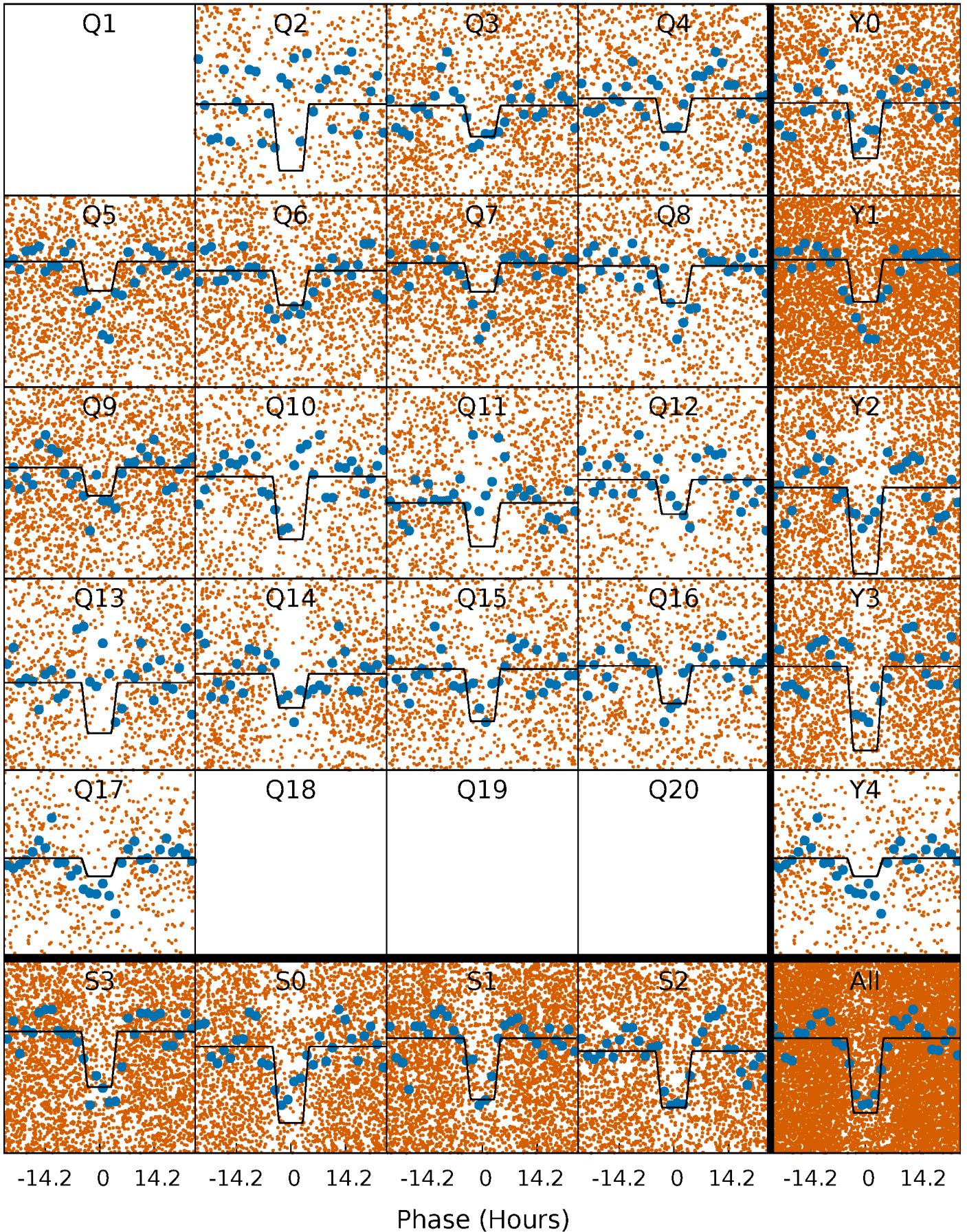
# DV Quarter-Phased Transit Curves

TCE 012453624-01 P= 3.322161 Days  $T_0=132.942957$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 012453624-01 P= 3.322227 Days  $T_0=132.875530$  (BKJD)

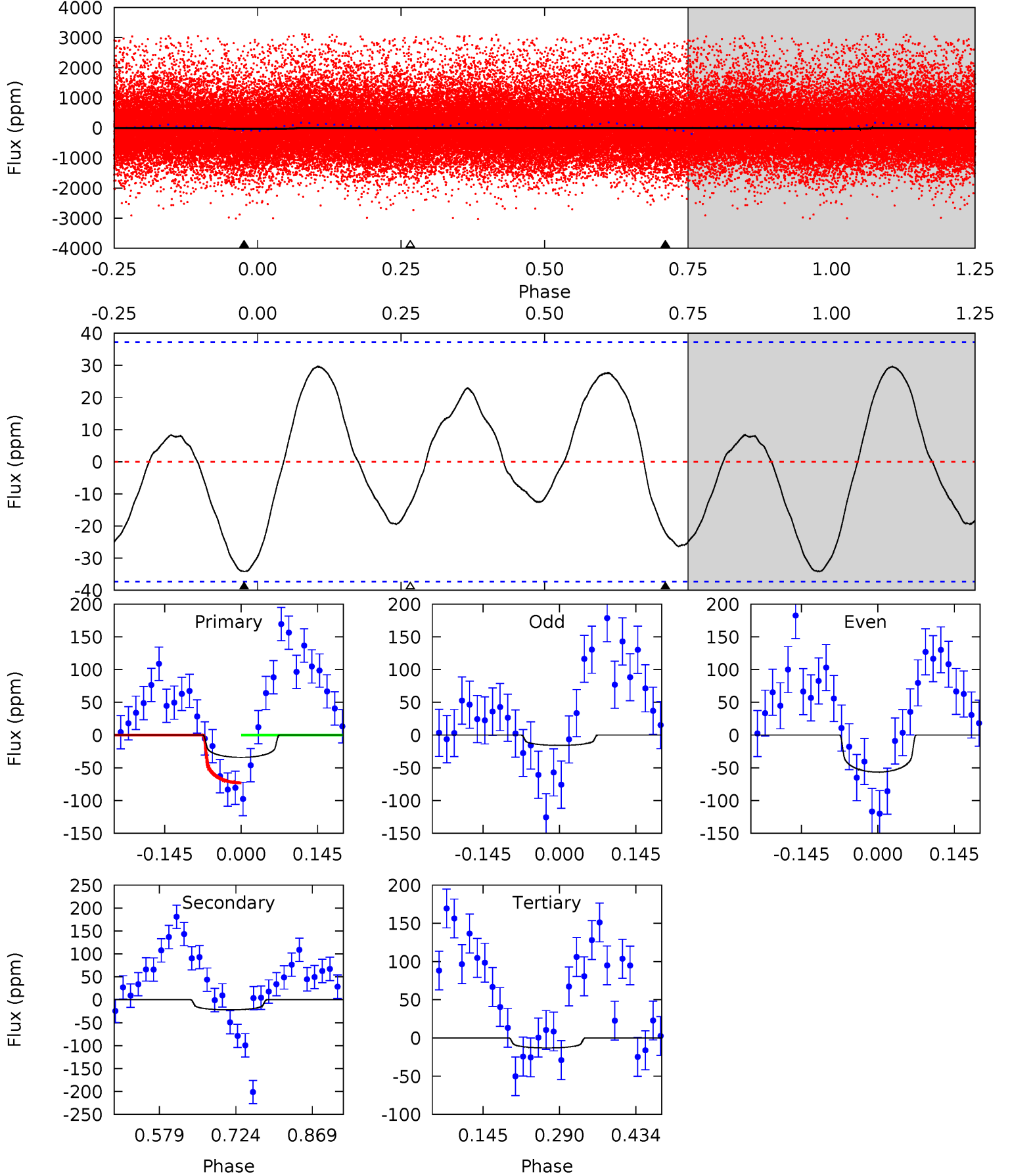




# DV Model-Shift Uniqueness Test

012453624-01, P = 3.322161 Days, E = 132.942957 Days

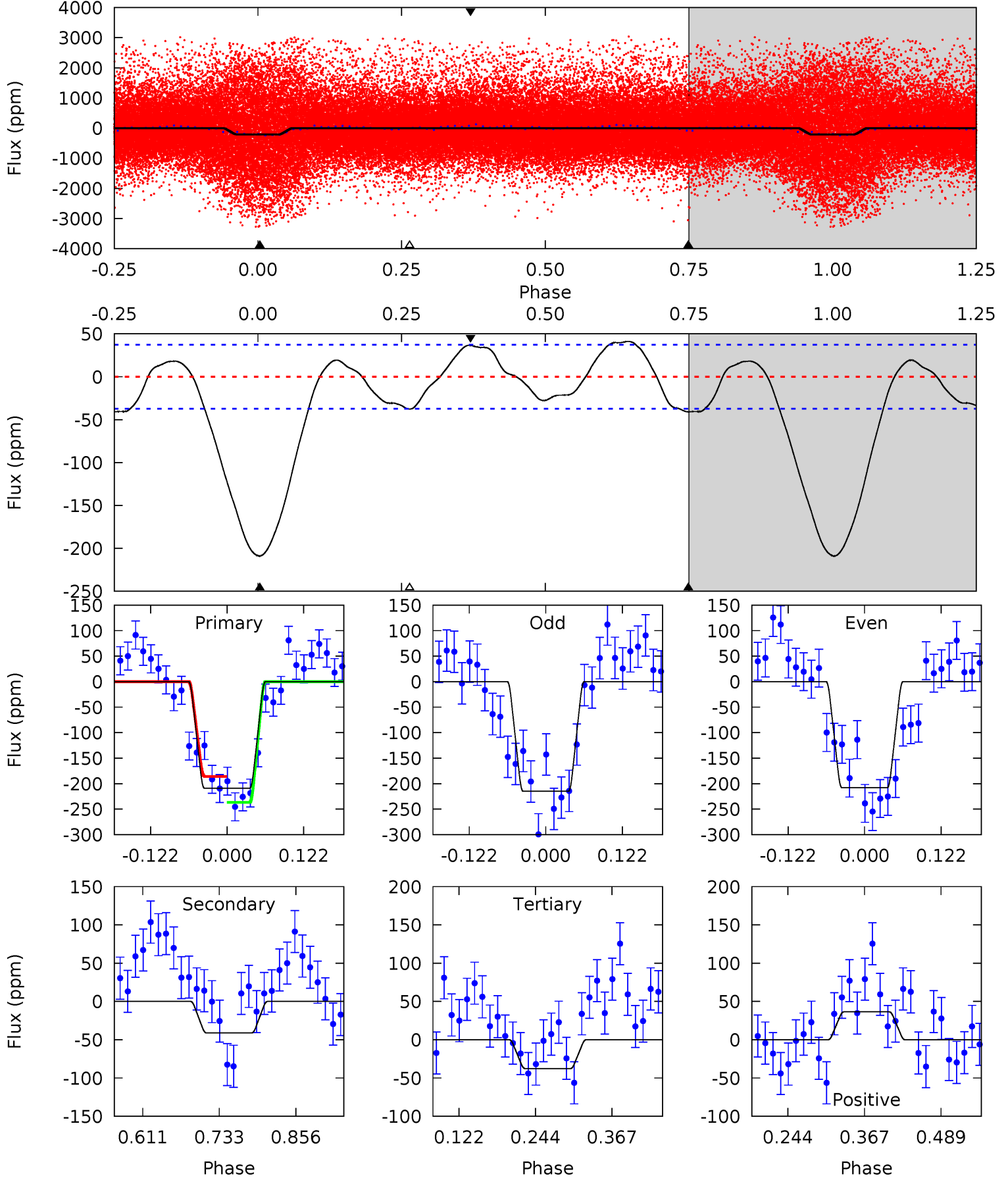
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
4.11	2.65	1.58	0	4.49	1.46	1.56	2.53	4.11	1.08	2.65	2.48	-69.6	0.46	4.46



# Alt Model-Shift Uniqueness Test

012453624-01, P = 3.322227 Days, E = 132.875530 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
25.3	4.97	4.57	4.42	4.52	1.55	2.81	20.7	20.9	0.41	0.56	0.42	0.98	0.16	3.09





### Stellar Parameters For KIC 012453624

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$3776^{+75}_{-75}$	$4.747^{+0.039}_{-0.025}$	$-0.100^{+0.100}_{-0.100}$	$0.500^{+0.029}_{-0.035}$	$0.511^{+0.031}_{-0.031}$	$5.740^{+0.947}_{-0.604}$
	+2%/-2%	+1%/-1%	+100%/-100%	+6%/-7%	+6%/-6%	+16%/-11%
Source	PHO2	PHO2	PHO2	DSEP		

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology  
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

### Secondary Eclipse Parameters for KIC 012453624-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-22 \pm 8$	$0.57^{+0.26}_{-0.25}$	$880^{+21}_{-22}$	$2924^{+588}_{-313}$	$42^{+95}_{-24}$
Alt.	$-41 \pm 8$	$0.73^{+0.27}_{-0.25}$	$880^{+21}_{-22}$	$2998^{+394}_{-260}$	$51^{+63}_{-25}$

$T_{max}$  = 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

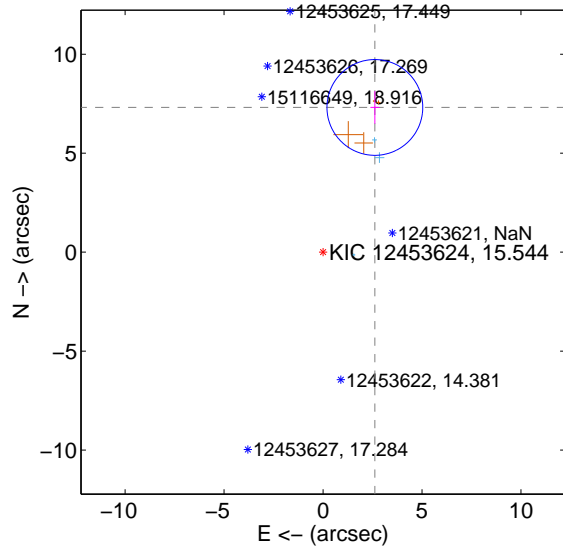
Supplemental centroid analysis for 012453624-01. Kepler magnitude: 15.54. Transit SNR 7.23

There are 7 quarters with good PRF difference image offsets

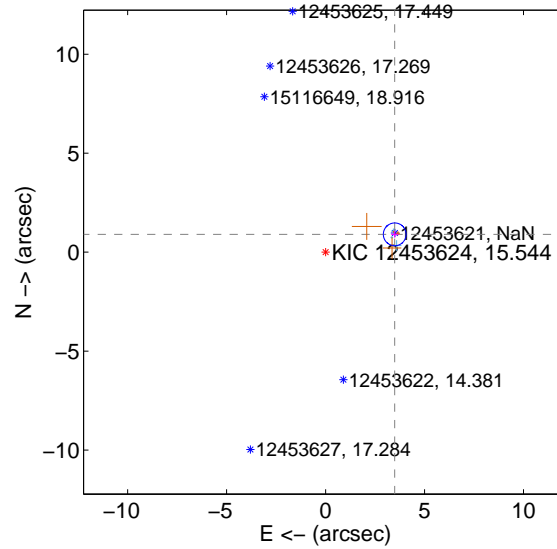
The OOT PRF centroid is offset from the target star catalog position by about 5.47 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$7.768 \pm 0.807$	9.63	$-2.619 \pm 0.229$	$7.313 \pm 0.826$
PRF-fit source offset from KIC position	$3.608 \pm 0.192$	18.82	$-3.494 \pm 0.181$	$0.901 \pm 0.164$
photometric centroid source offset	$2.71 \pm 0.53$	5.09	$-2.71 \pm 0.53$	$-0.12 \pm 0.80$

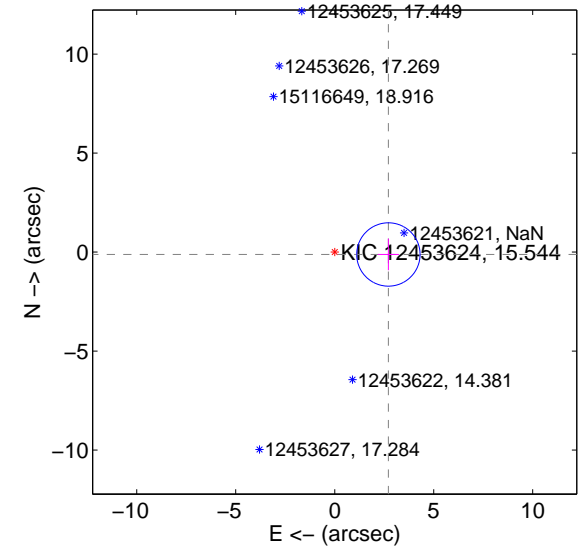
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

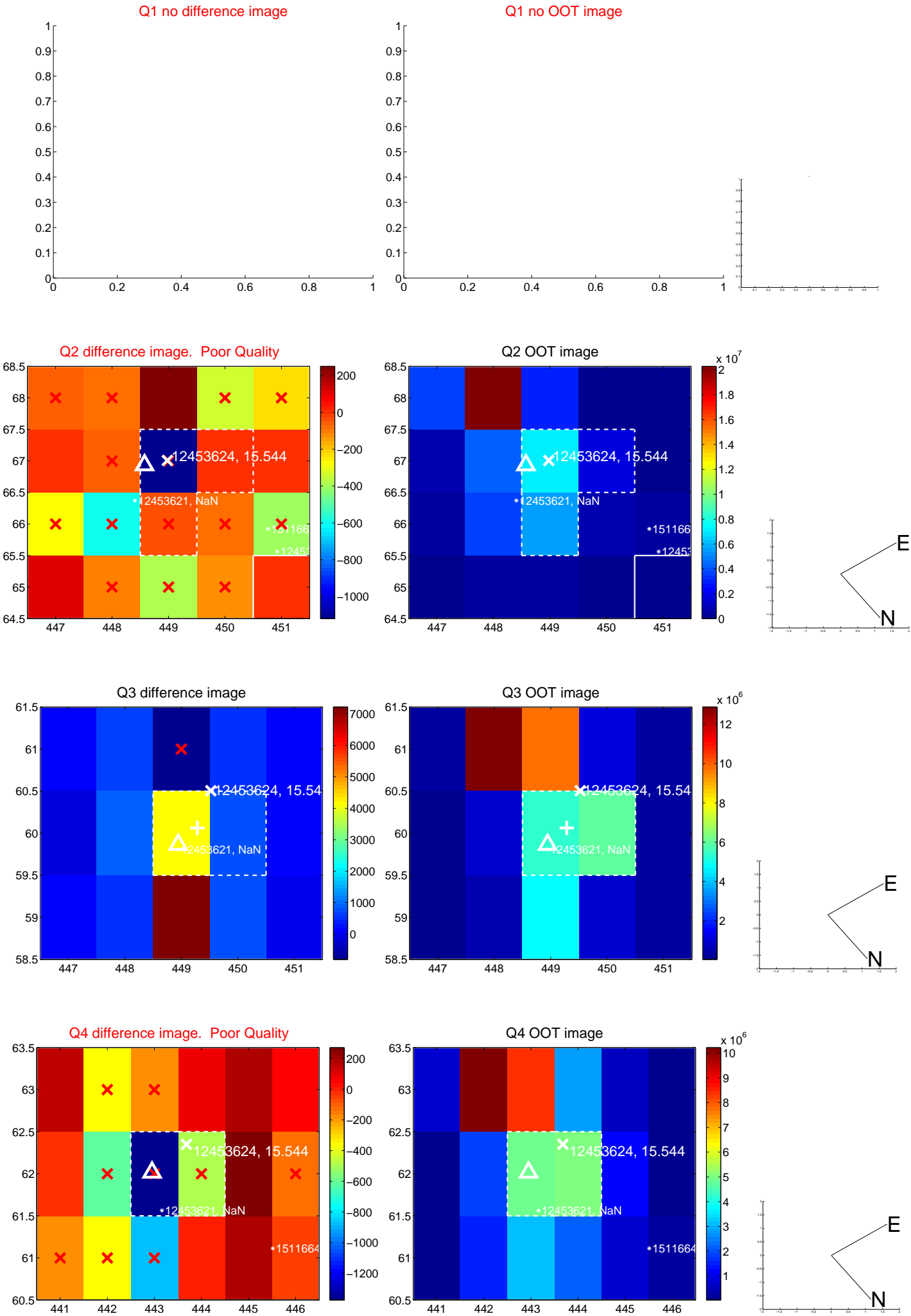


offset from photometric centroids

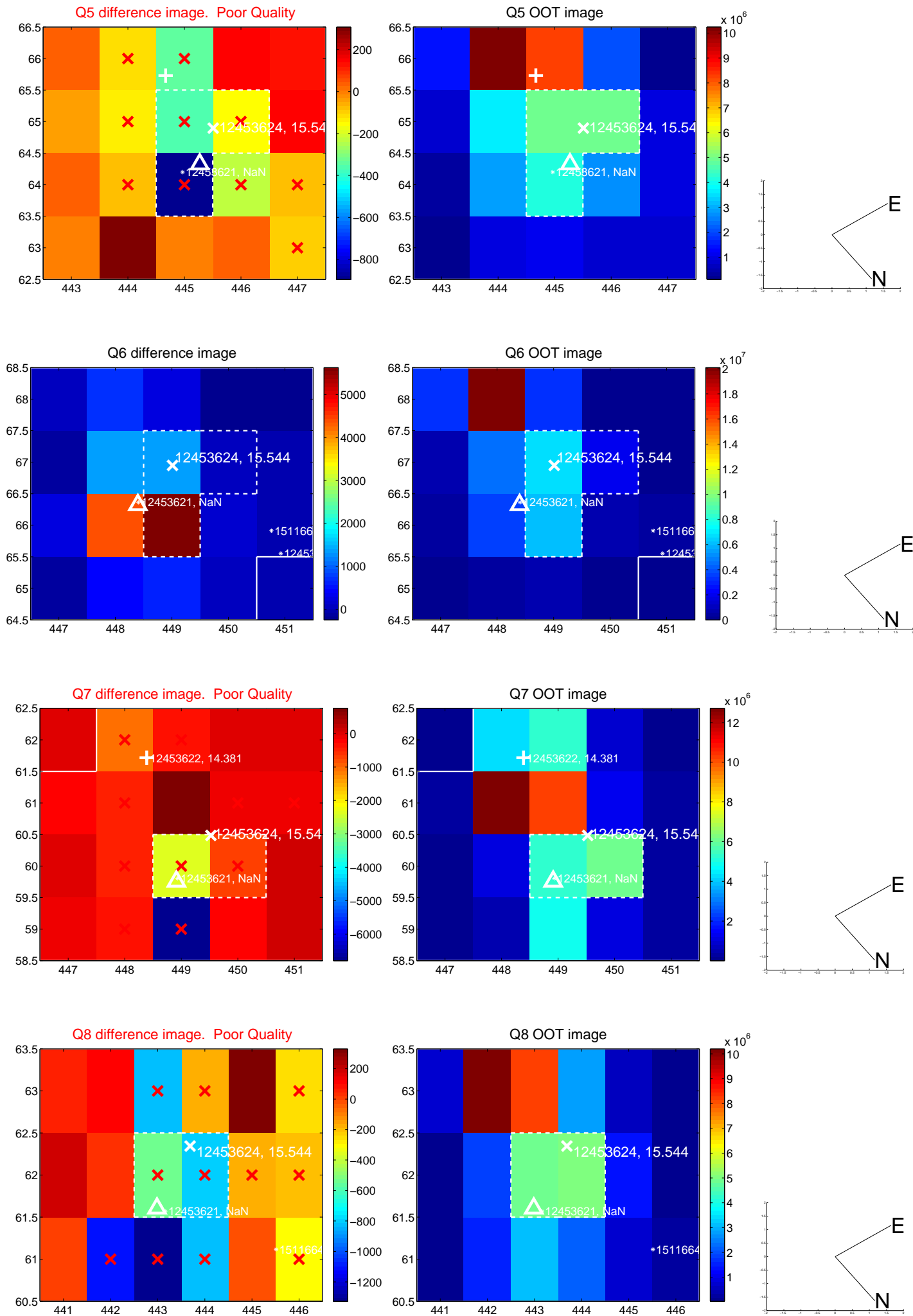


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

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

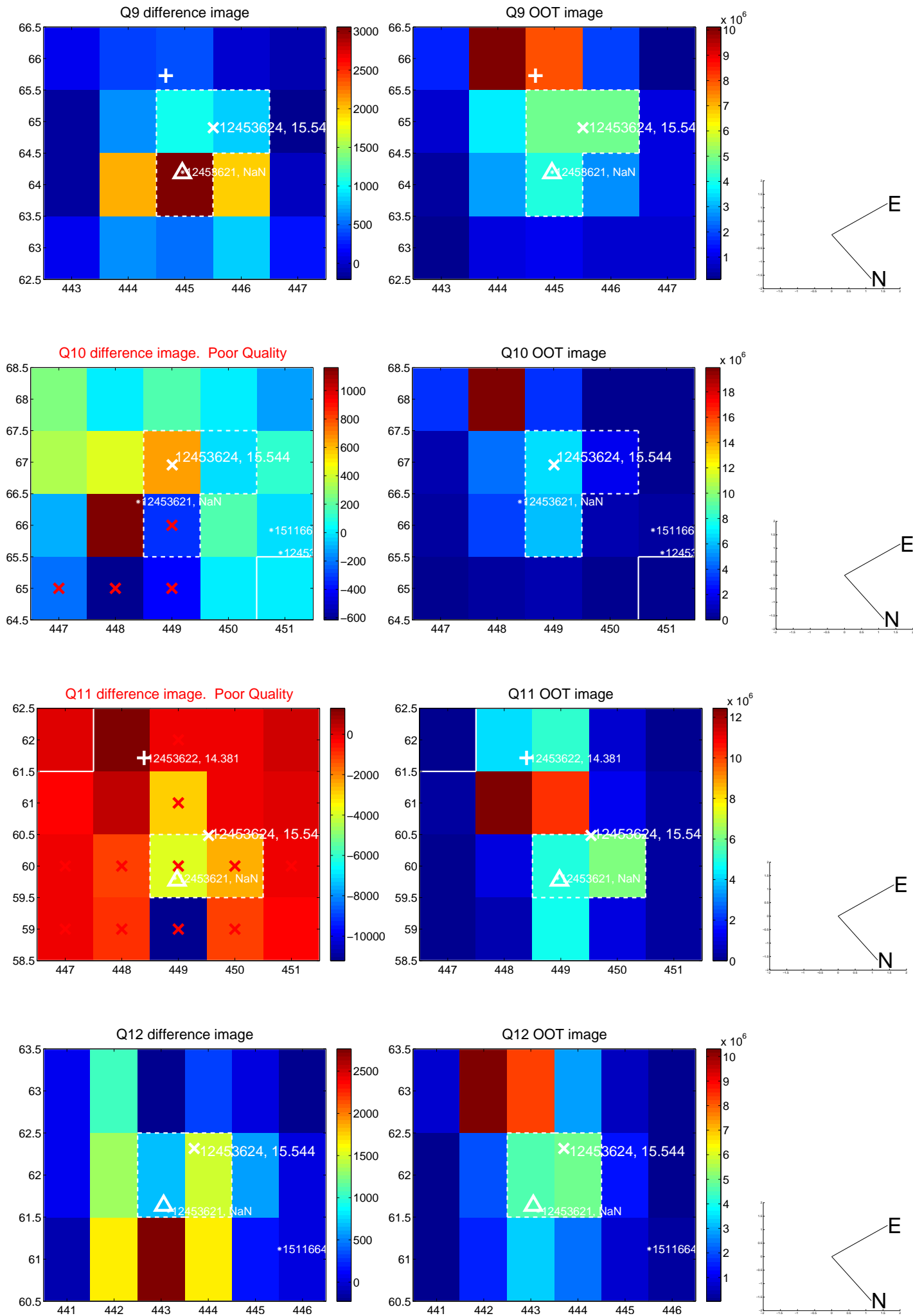


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

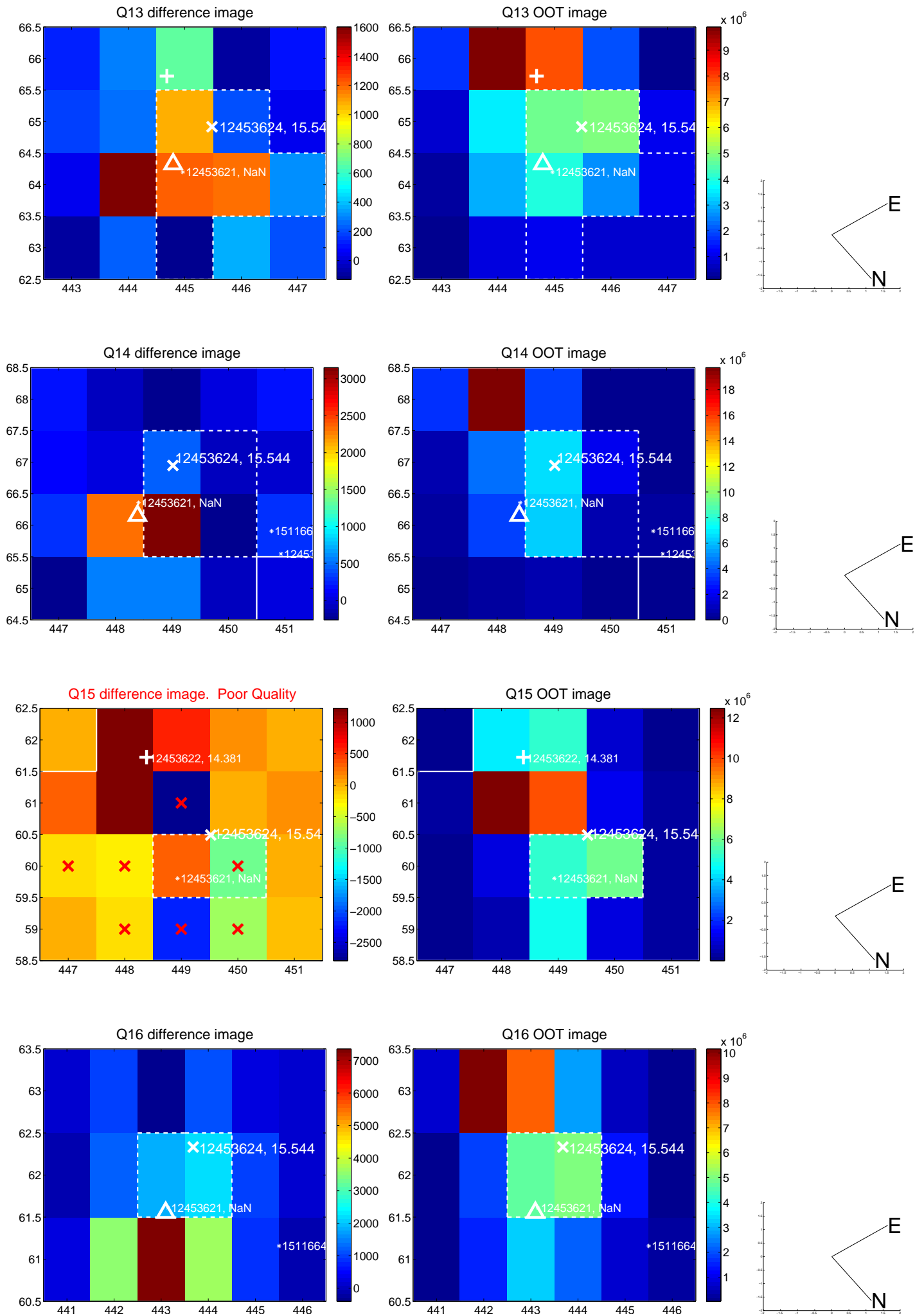




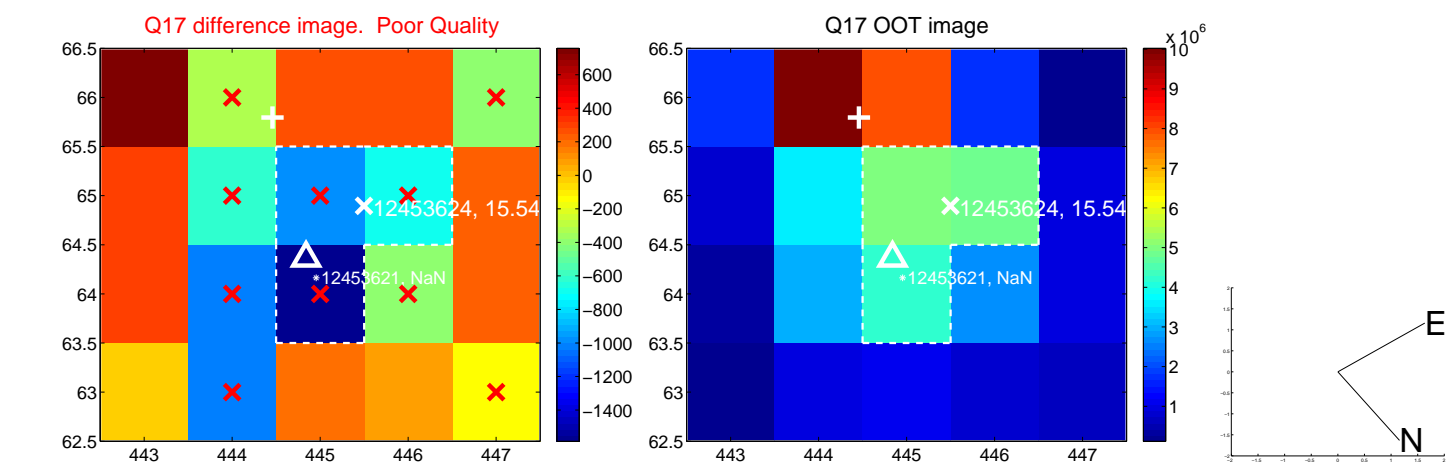
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



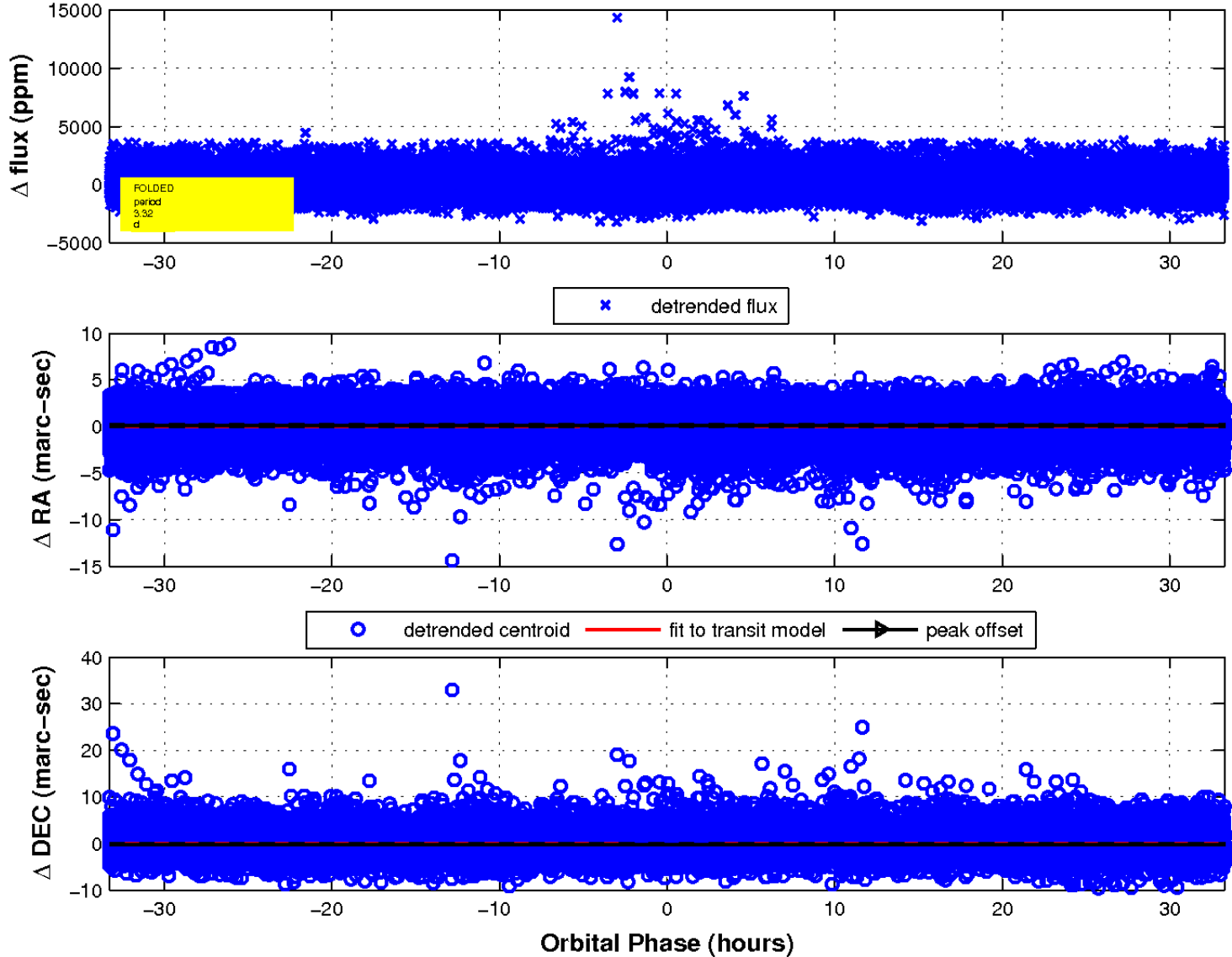
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



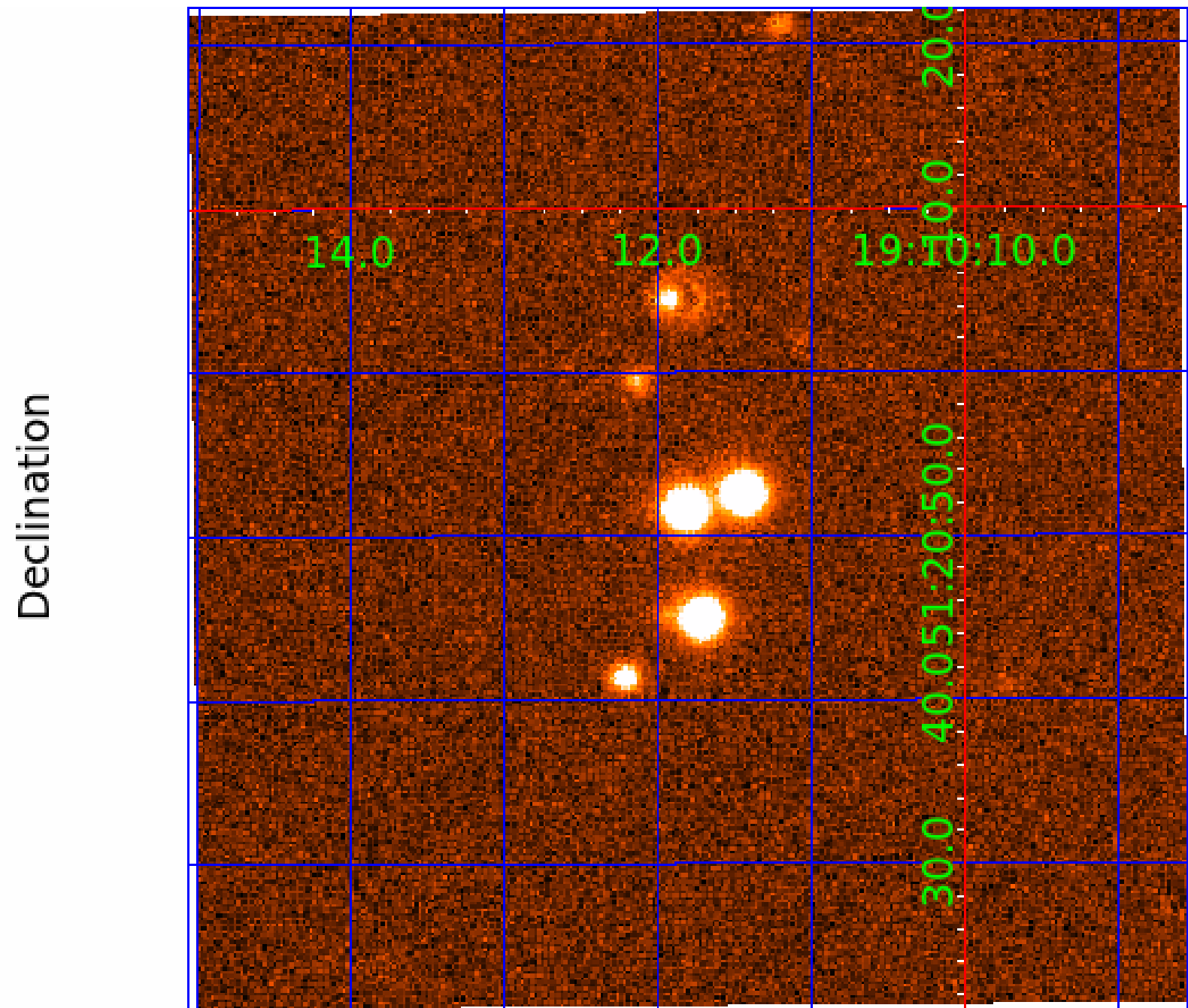
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



fluxWeightedCentroids, Planet 1 of 2



UKIRT Image





# KIC 012453624

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012453624-01	OBS	No	3.322161	132.942957	113.4	11.096	8.6	7.2	0.50	3776	0.59	37.59
012453624-02	OBS	No	175.767110	137.750287	897.5	11.095	8.4	5.9	0.50	3776	1.58	0.19

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012453624-01	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV—CENT_KIC_POS
012453624-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—TRANS_GAPPED—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_KIC_POS

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

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

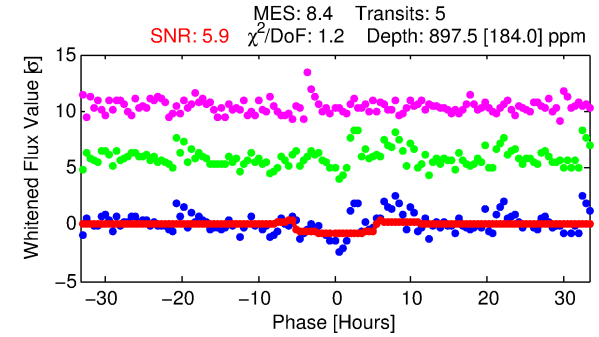
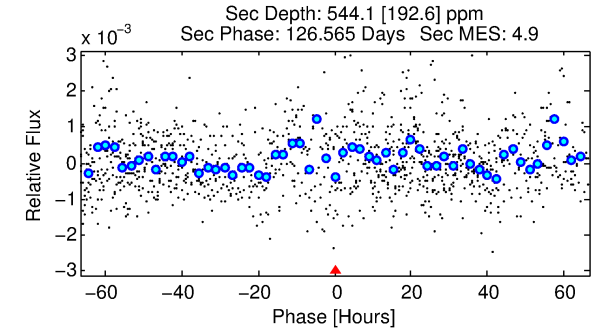
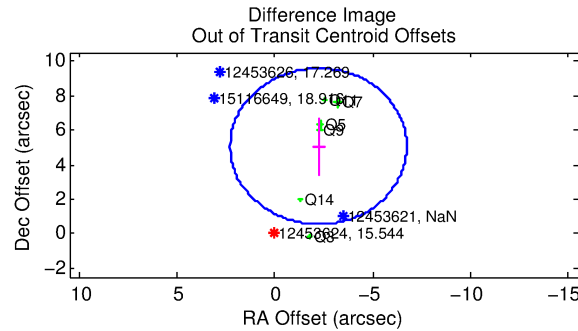
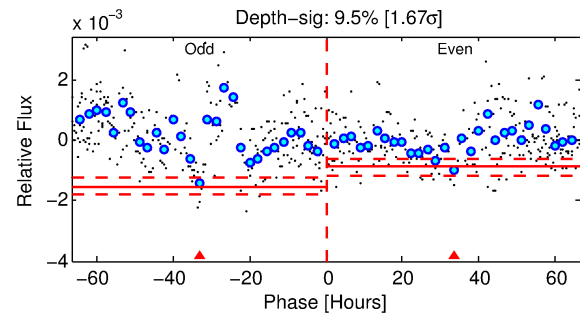
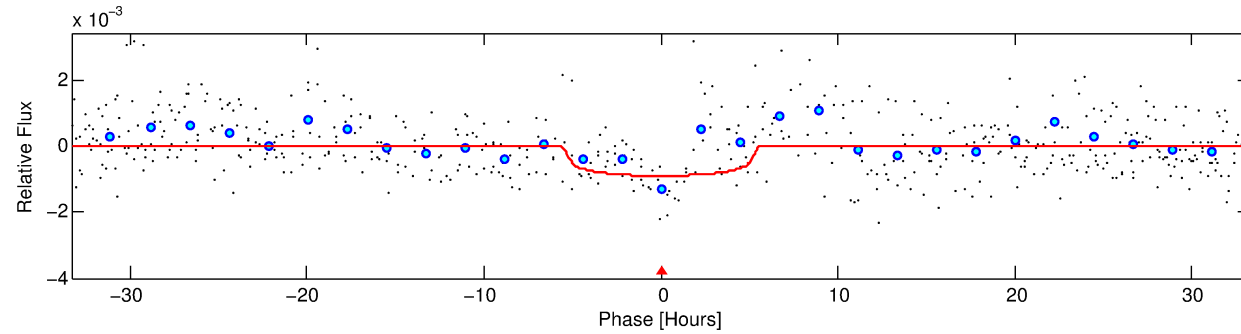
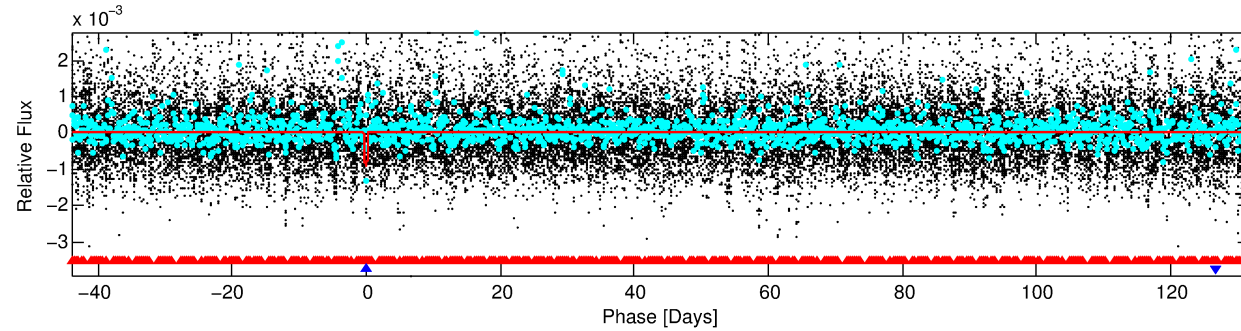
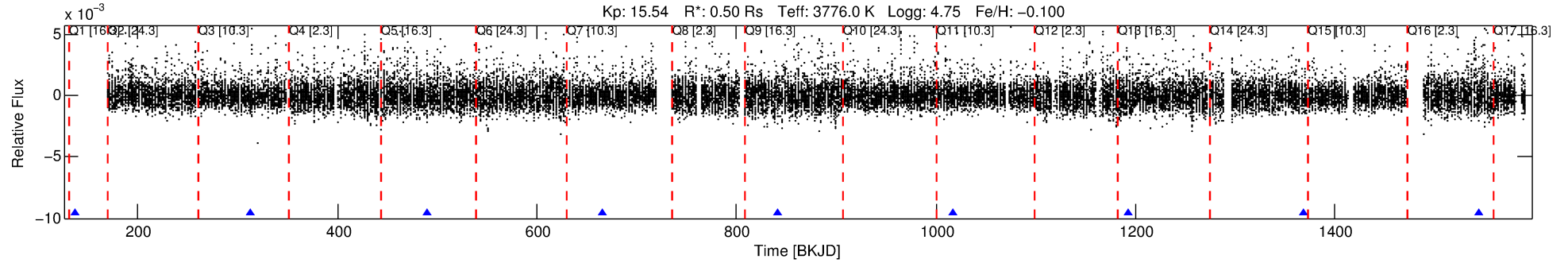
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 012453624-02

No Significant Match Found

# DV One-Page Summary

KIC: 12453624 Candidate: 2 of 2 Period: 175.767 d



## DV Fit Results:

Period = 175.76711 [0.00400] d  
Epoch = 137.7503 [0.0206] BKJD  
Rp/R\* = 0.0289 [0.0109]  
a/R\* = 95.46 [150.84]  
b = 0.66 [1.35]  
Seff = 0.19 [0.02]  
Teq = 168 [5] K  
Rp = 1.58 [0.61] Re  
a = 0.4905 [0.0272] AU  
Ag = 28873.77 [24207.39] [1.19 $\sigma$ ]  
Teffp = 3390 [711] K [4.53 $\sigma$ ]

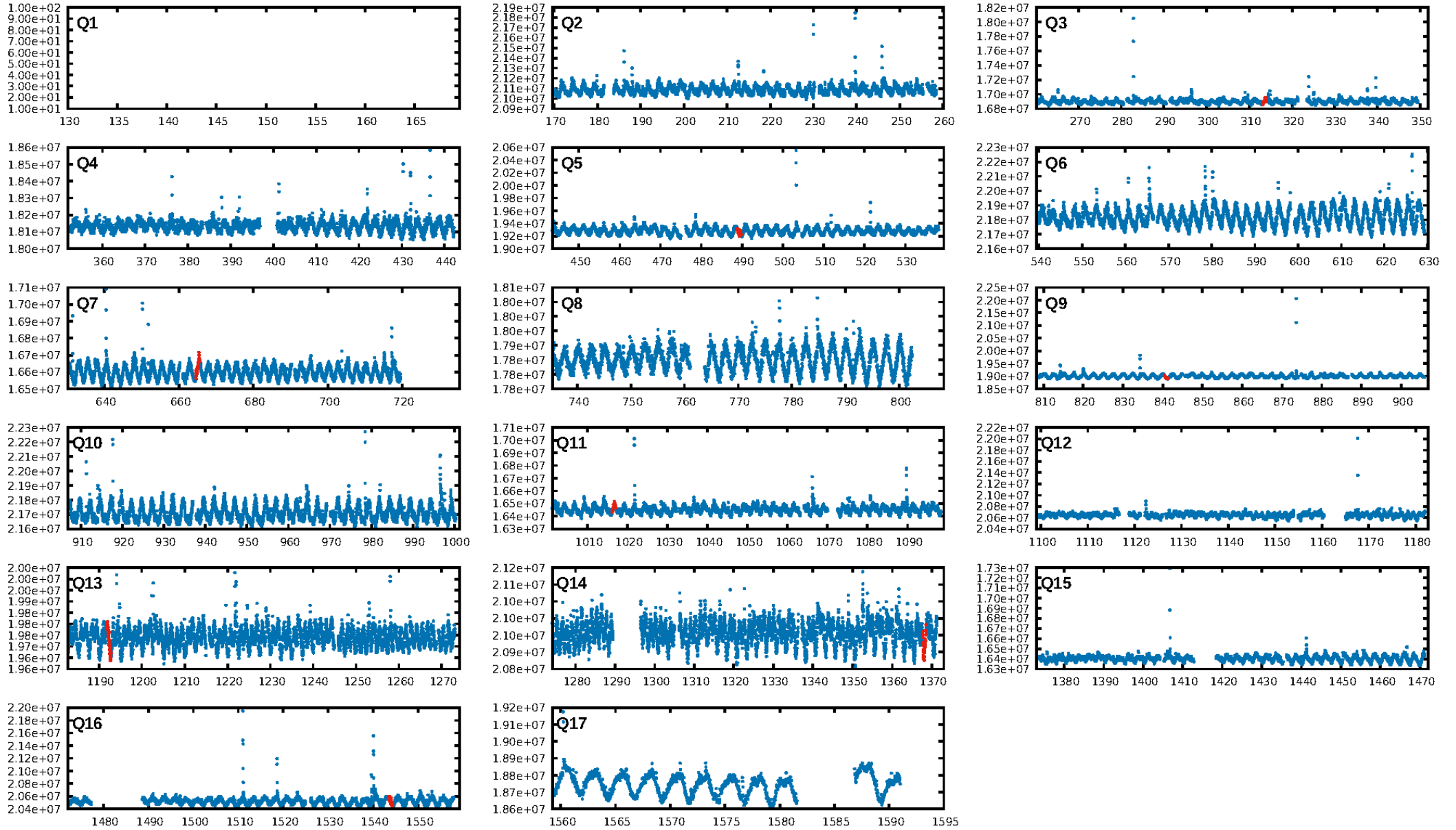
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [263.76 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 86.3%  
ModelChiSquareGof-sig: 100.0%  
**Bootstrap-pfa: 5.00e-10**  
RollingBand-fgt: 1.00 [5/5]  
GhostDiagnostic-chr: 2.852  
Centroid-sig: 48.3%  
**Centroid-so: 2.373 arcsec [3.86 $\sigma$ ]**  
**OotOffset-rm: 5.524 arcsec [3.68 $\sigma$ ]**  
**KicOffset-rm: 3.613 arcsec [34.18 $\sigma$ ]**  
OotOffset-st: 1/3/0/2 [6]  
KicOffset-st: 1/3/0/2 [6]  
DiffImageQuality-fgm: 0.50 [3/6]  
DiffImageOverlap-fno: 0.14 [1/7]

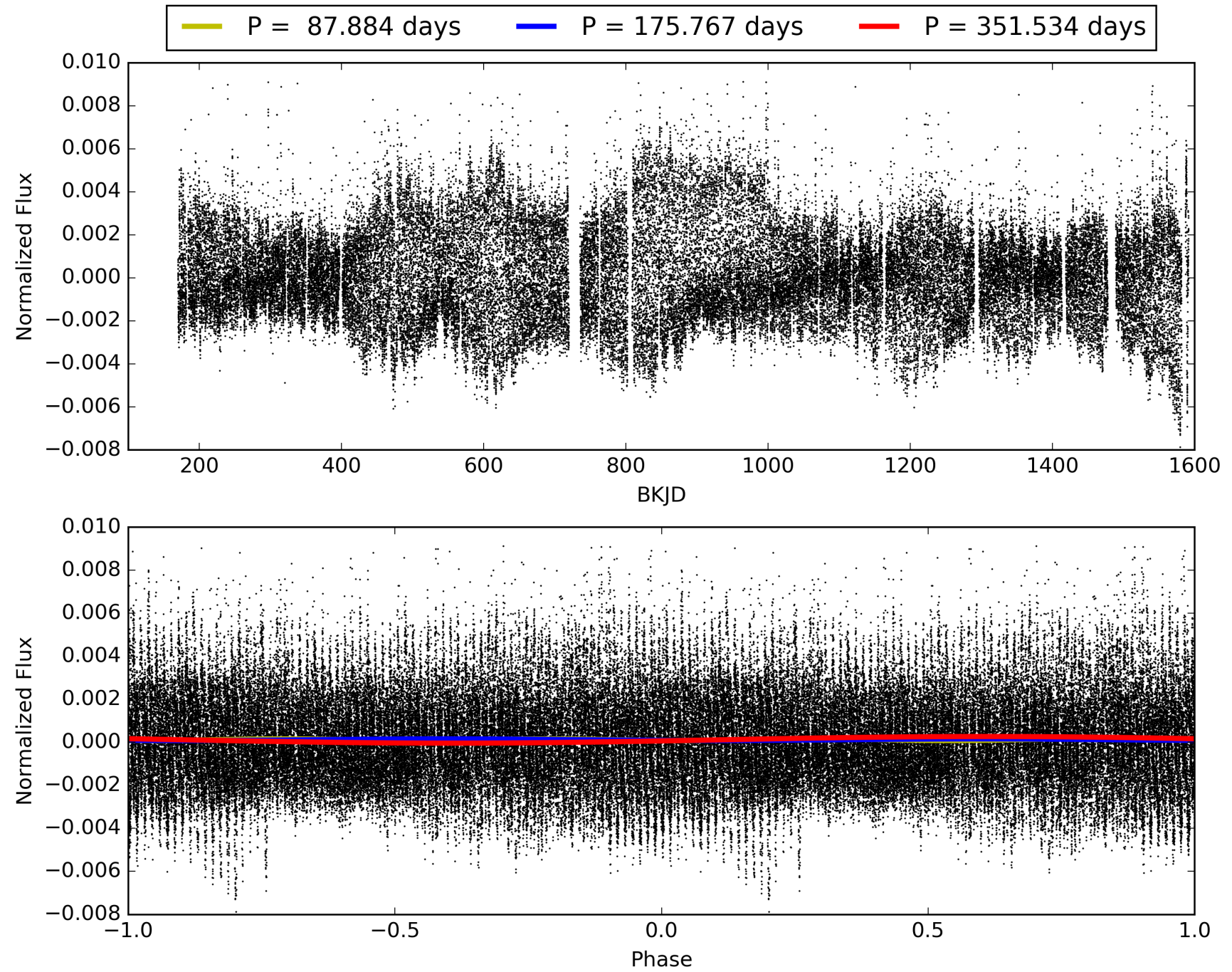
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 09:25:28 Z

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

# TCE 012453624-02, PDC Light Curves



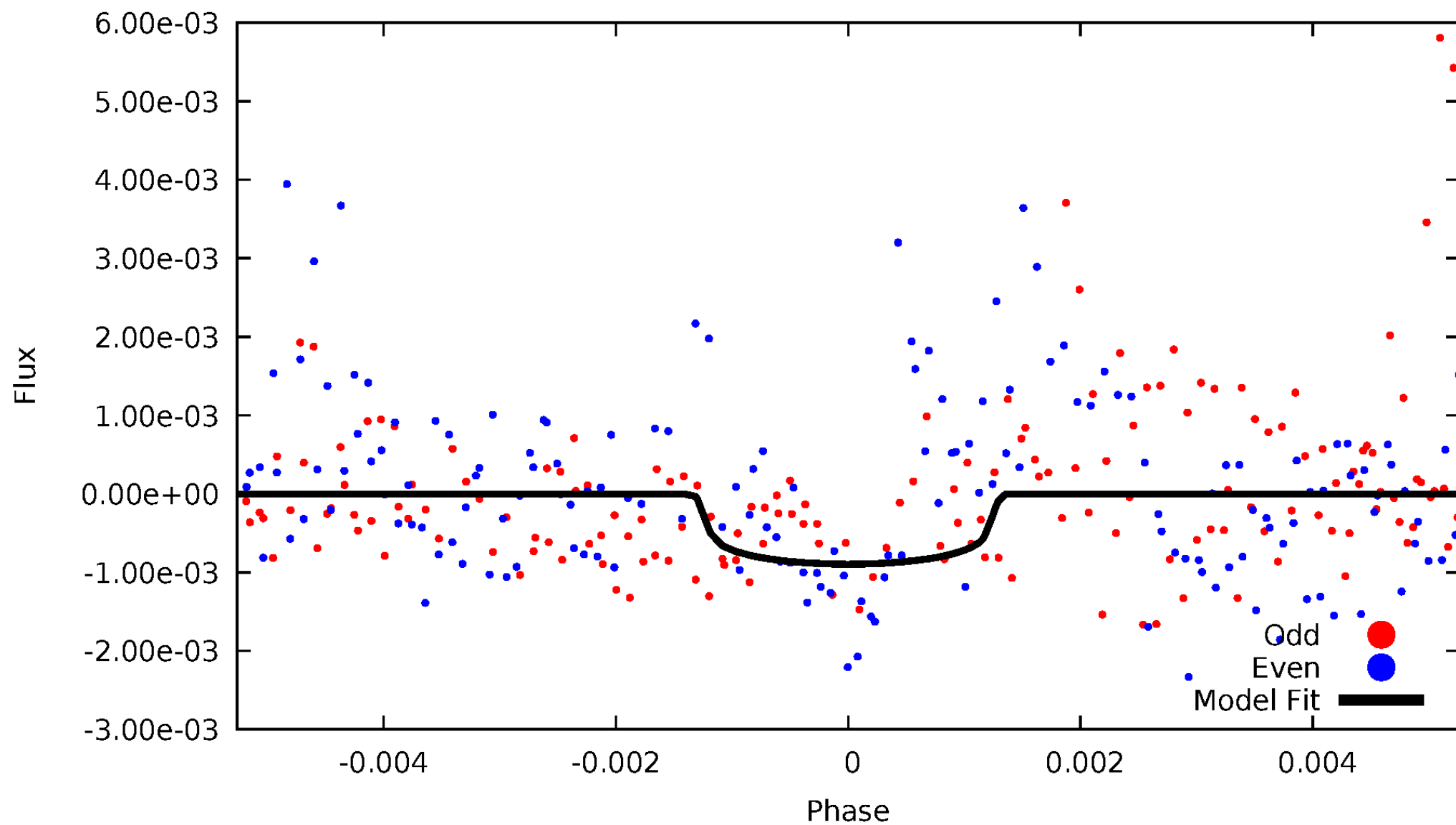
# TCE 012453624-02





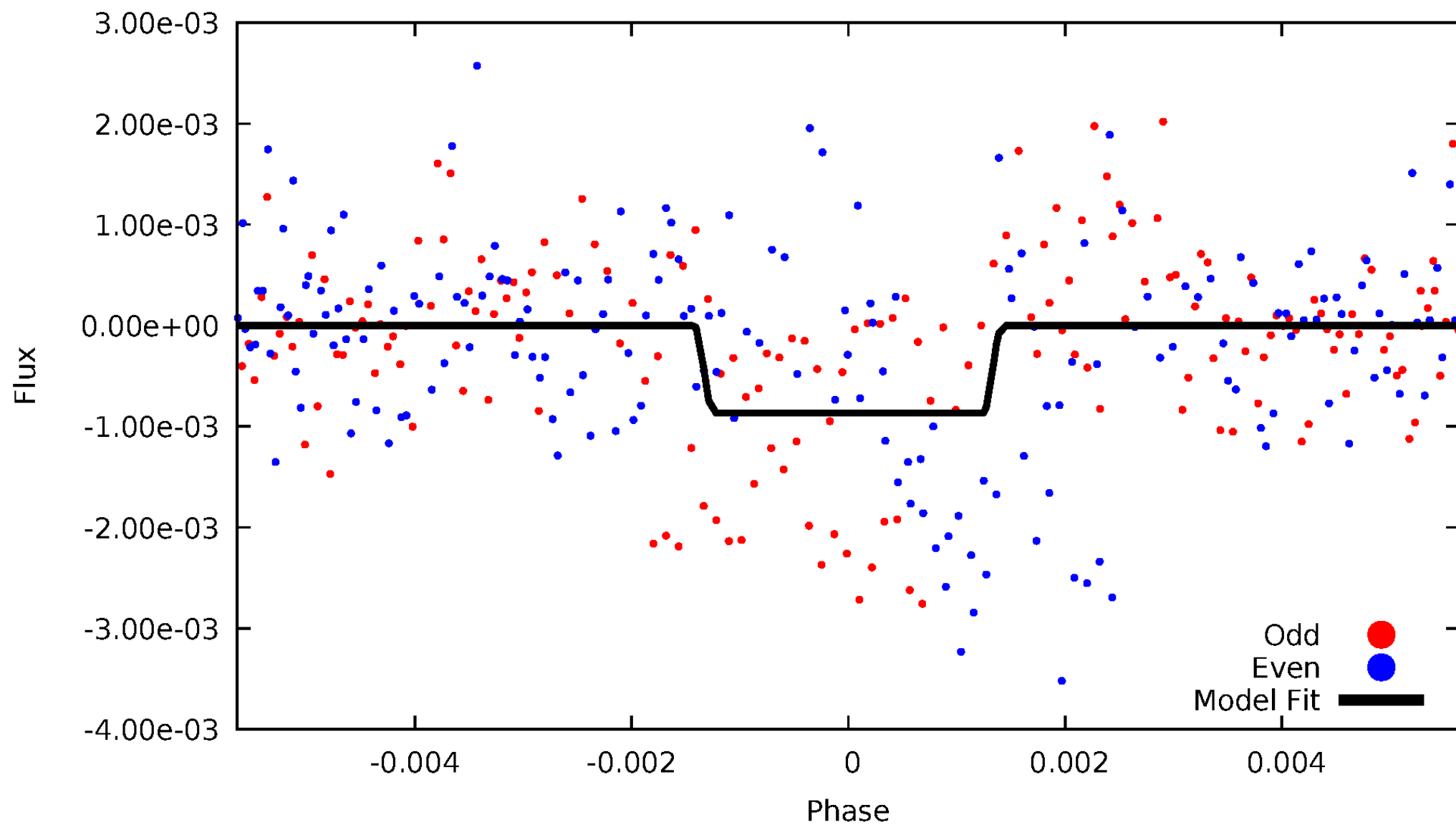
# DV Odd/Even

TCE 012453624-02



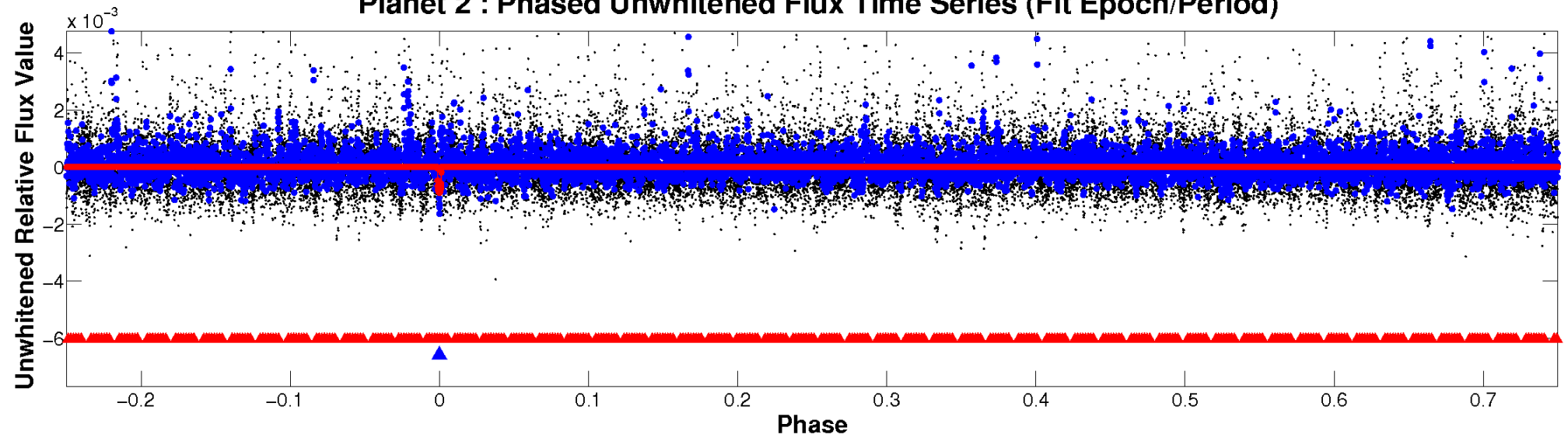
# ALT Odd/Even

TCE 012453624-02

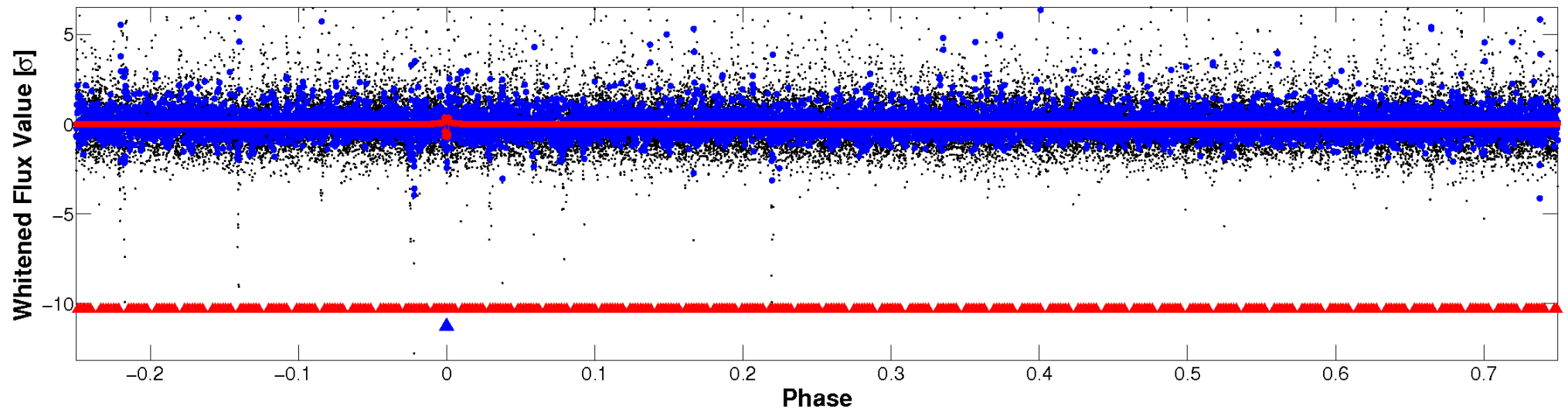


# Non-Whitened Vs. Whitened Light Curve

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

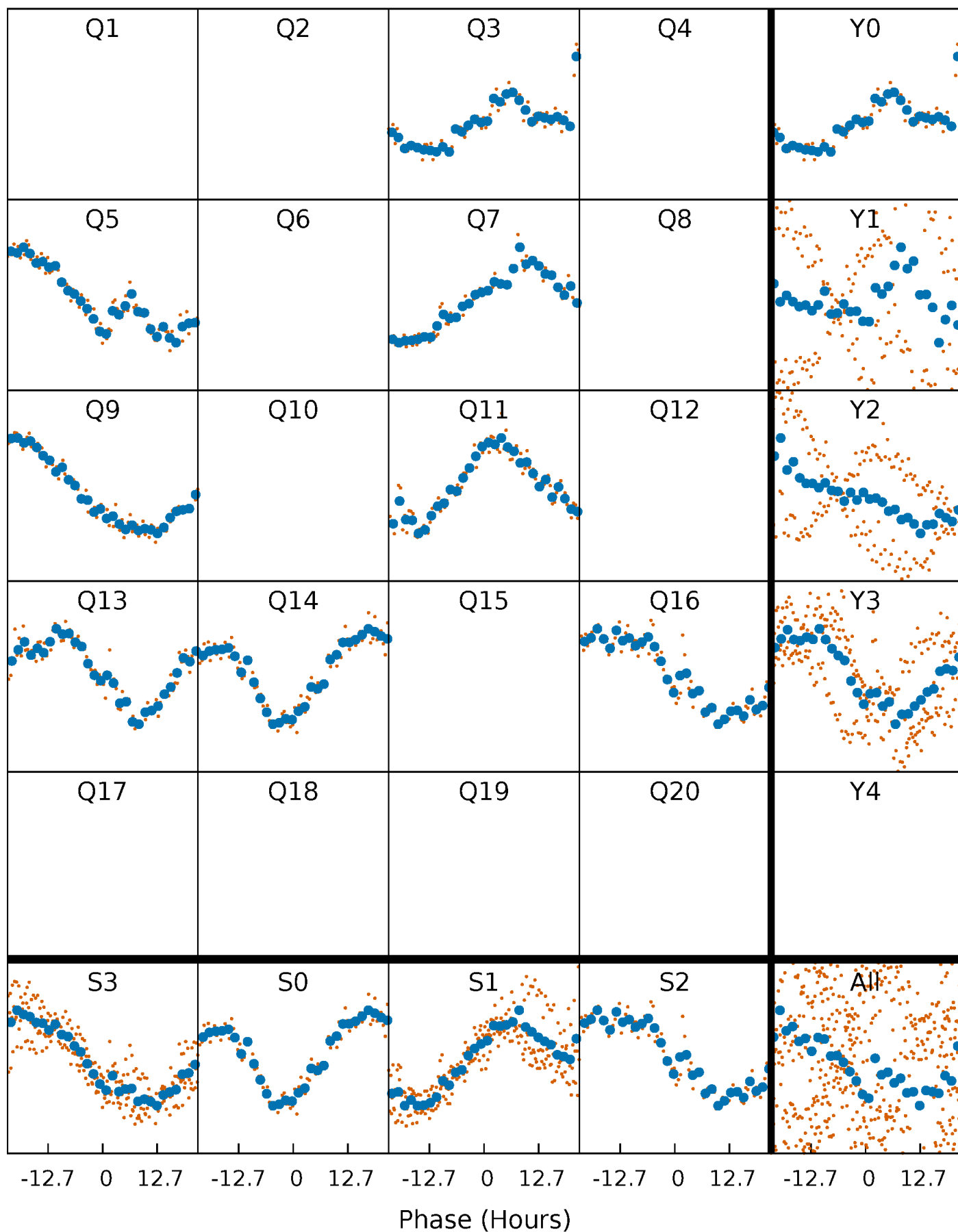


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



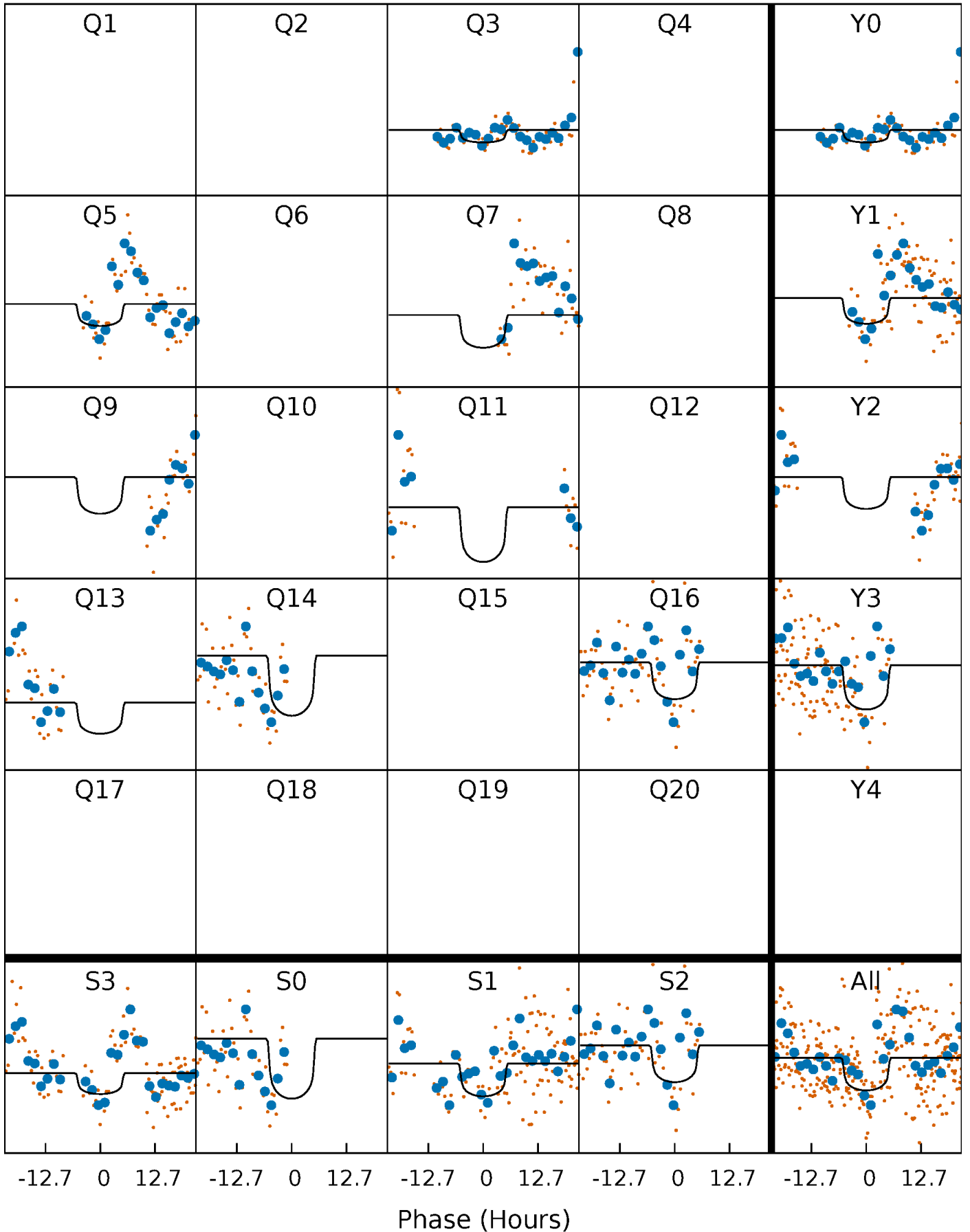
# PDC Quarter-Phased Transit Curves

TCE 012453624-02   P=175.767110 Days    $T_0=137.750287$  (BKJD)



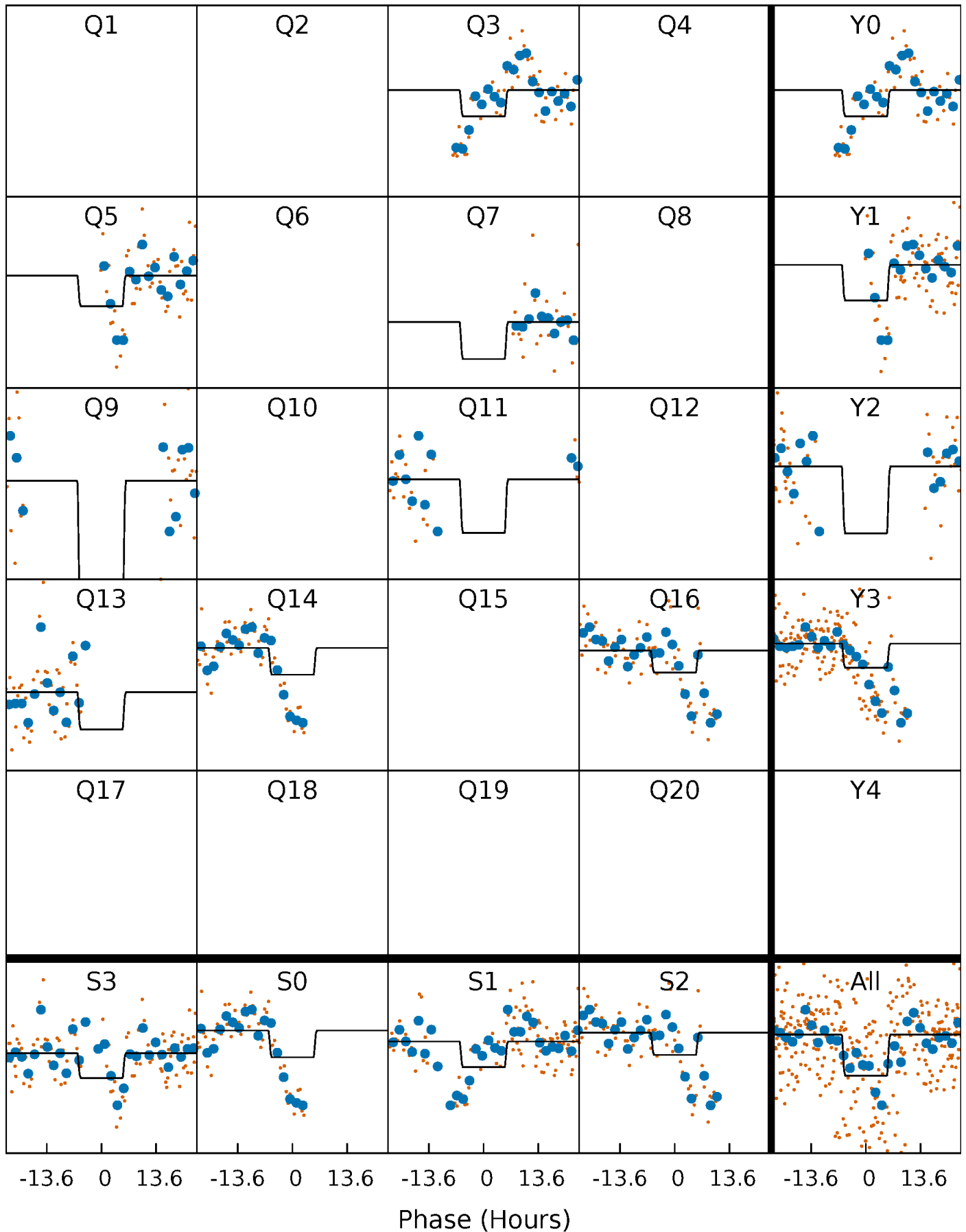
# DV Quarter-Phased Transit Curves

TCE 012453624-02   P=175.767110 Days    $T_0=137.750287$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 012453624-02     $P=175.765492$  Days     $T_0=137.594353$  (BKJD)

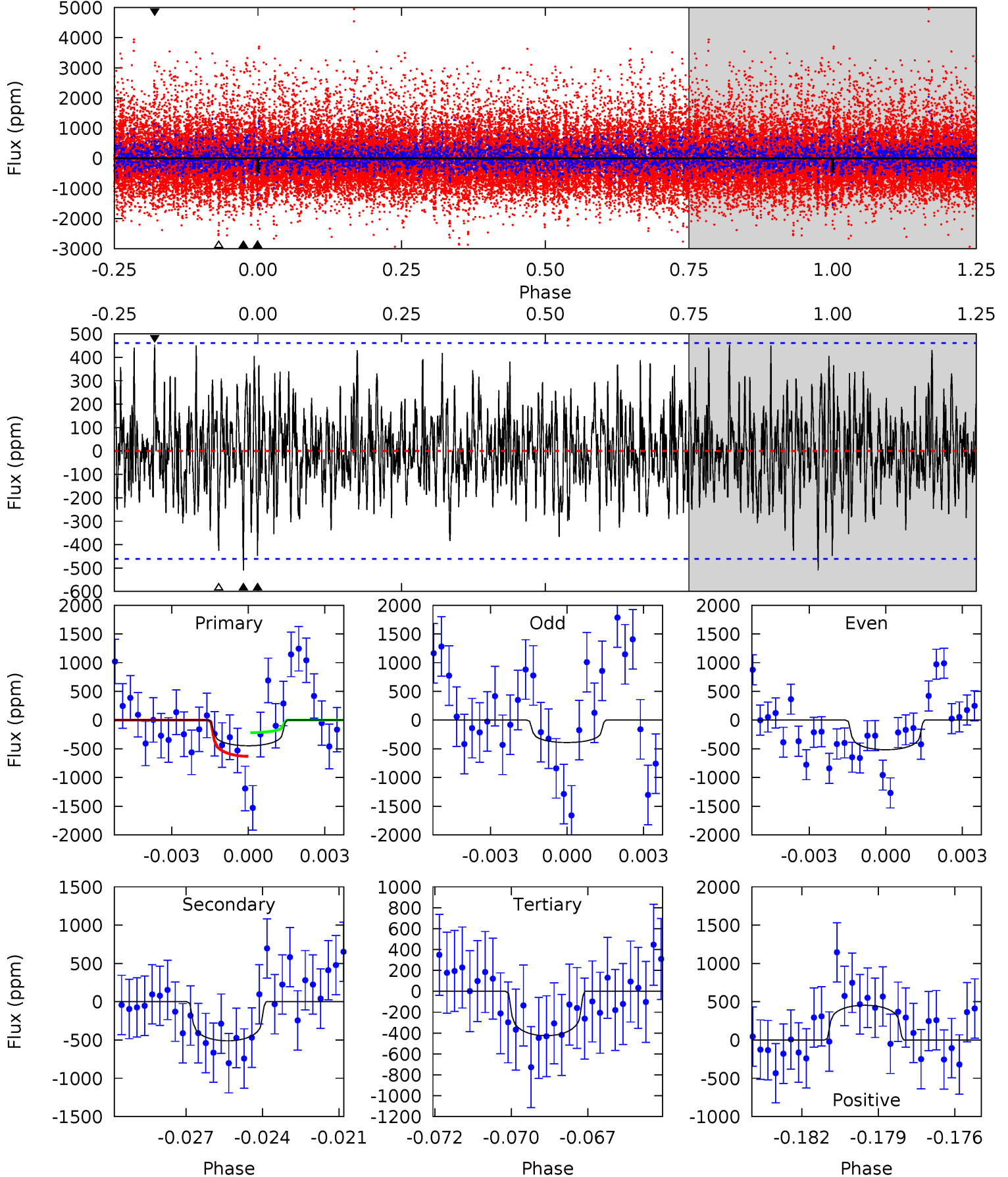




# DV Model-Shift Uniqueness Test

012453624-02,  $P = 175.767110$  Days,  $E = 137.750287$  Days

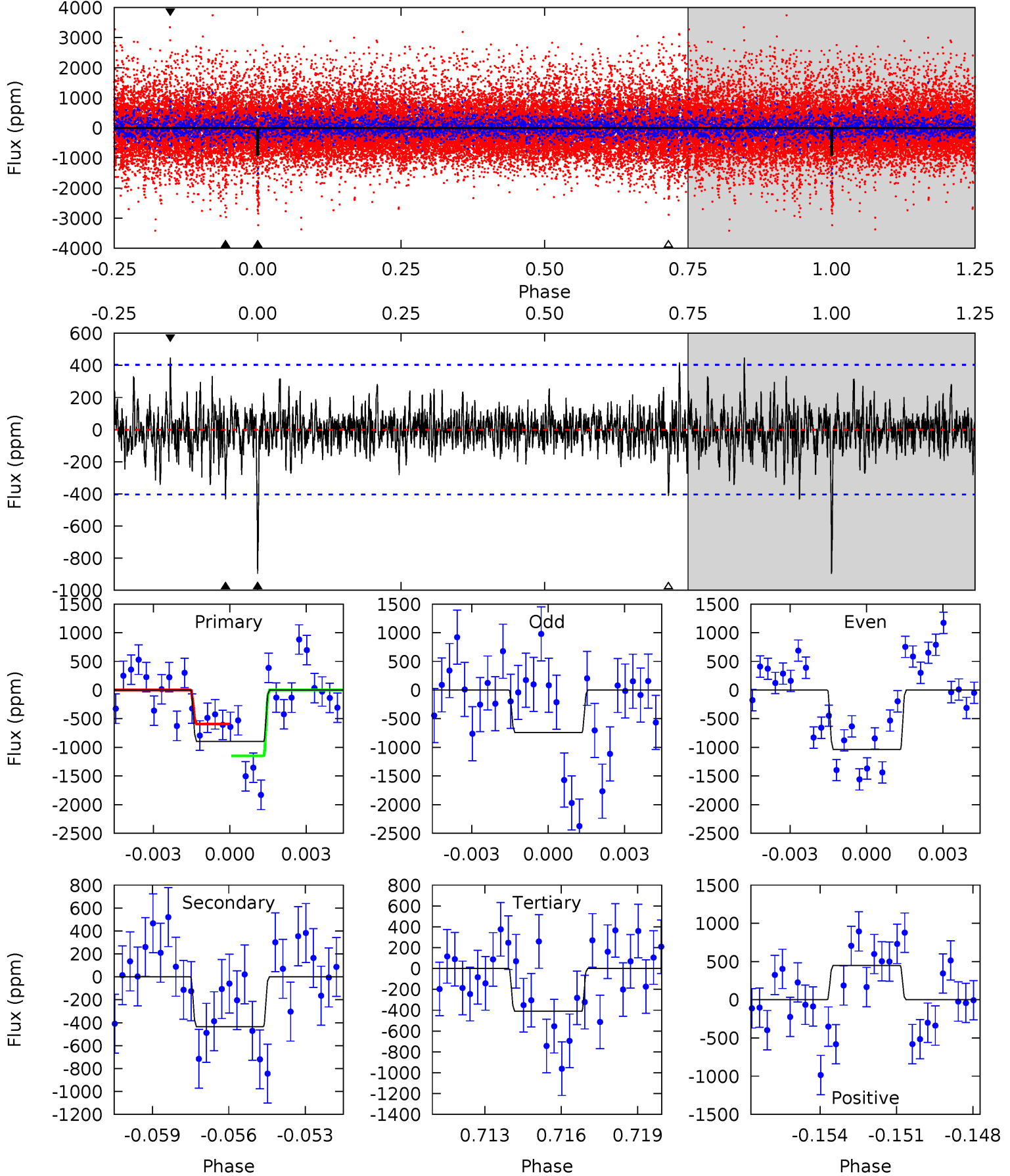
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
5.12	5.84	4.87	5.19	5.27	3.00	1.57	0.25	-0.07	0.97	0.65	0.68	1.17	0.47	2.37



# Alt Model-Shift Uniqueness Test

012453624-02, P = 175.765492 Days, E = 137.594353 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.7	5.67	5.37	5.85	5.27	2.99	1.22	6.34	5.86	0.30	-0.18	1.88	0.98	0.33	3.62



### Stellar Parameters For KIC 012453624

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$3776^{+75}_{-75}$	$4.747^{+0.039}_{-0.025}$	$-0.100^{+0.100}_{-0.100}$	$0.500^{+0.029}_{-0.035}$	$0.511^{+0.031}_{-0.031}$	$5.740^{+0.947}_{-0.604}$
	+2%/-2%	+1%/-1%	+100%/-100%	+6%/-7%	+6%/-6%	+16%/-11%
Source	PHO2	PHO2	PHO2	DSEP		

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology  
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

### Secondary Eclipse Parameters for KIC 012453624-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-510 \pm 87$	$1.59^{+0.60}_{-0.56}$	$234^{+6}_{-6}$	$3466^{+572}_{-335}$	$26703^{+39620}_{-13081}$
Alt.	$-434 \pm 77$	$1.61^{+0.62}_{-0.61}$	$234^{+5}_{-6}$	$3361^{+582}_{-333}$	$22113^{+35436}_{-10911}$

$T_{\text{max}}$  = 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

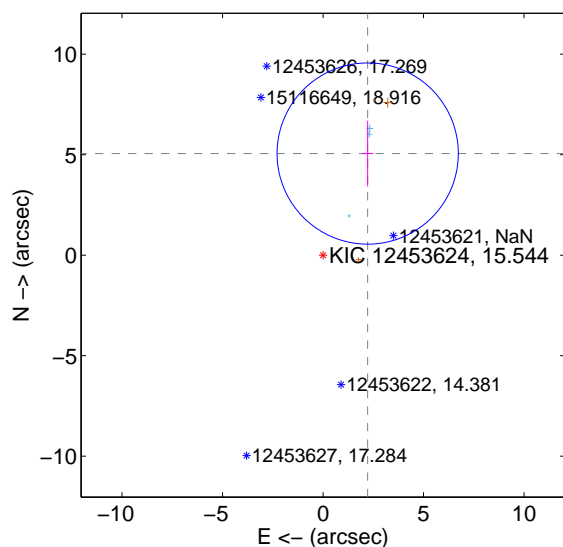
Supplemental centroid analysis for 012453624-02. Kepler magnitude: 15.54. Transit SNR 5.87

There are 3 quarters with good PRF difference image offsets

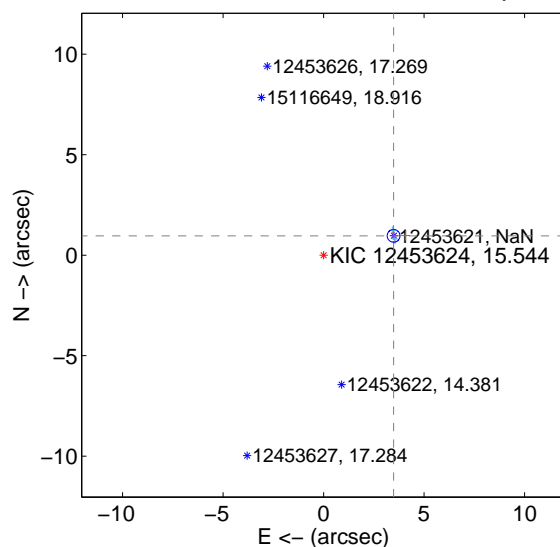
The OOT PRF centroid is offset from the target star catalog position by about 2.46 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$5.524 \pm 1.503$	3.68	$-2.222 \pm 0.281$	$5.057 \pm 1.637$
PRF-fit source offset from KIC position	$3.613 \pm 0.106$	34.18	$-3.483 \pm 0.103$	$0.962 \pm 0.104$
photometric centroid source offset	$2.37 \pm 0.62$	3.86	$-2.08 \pm 0.53$	$-1.15 \pm 0.82$

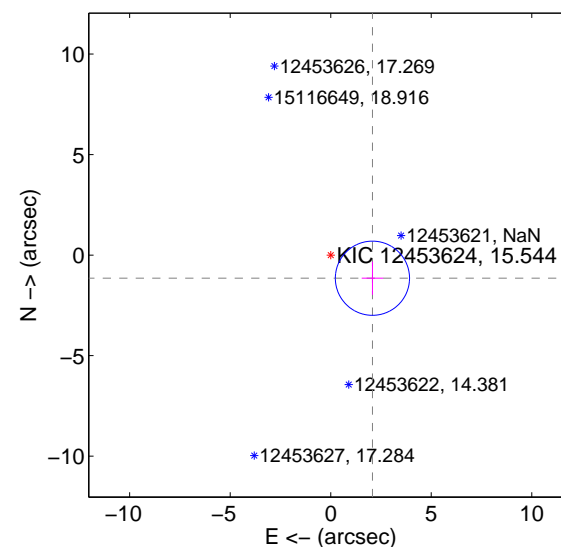
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

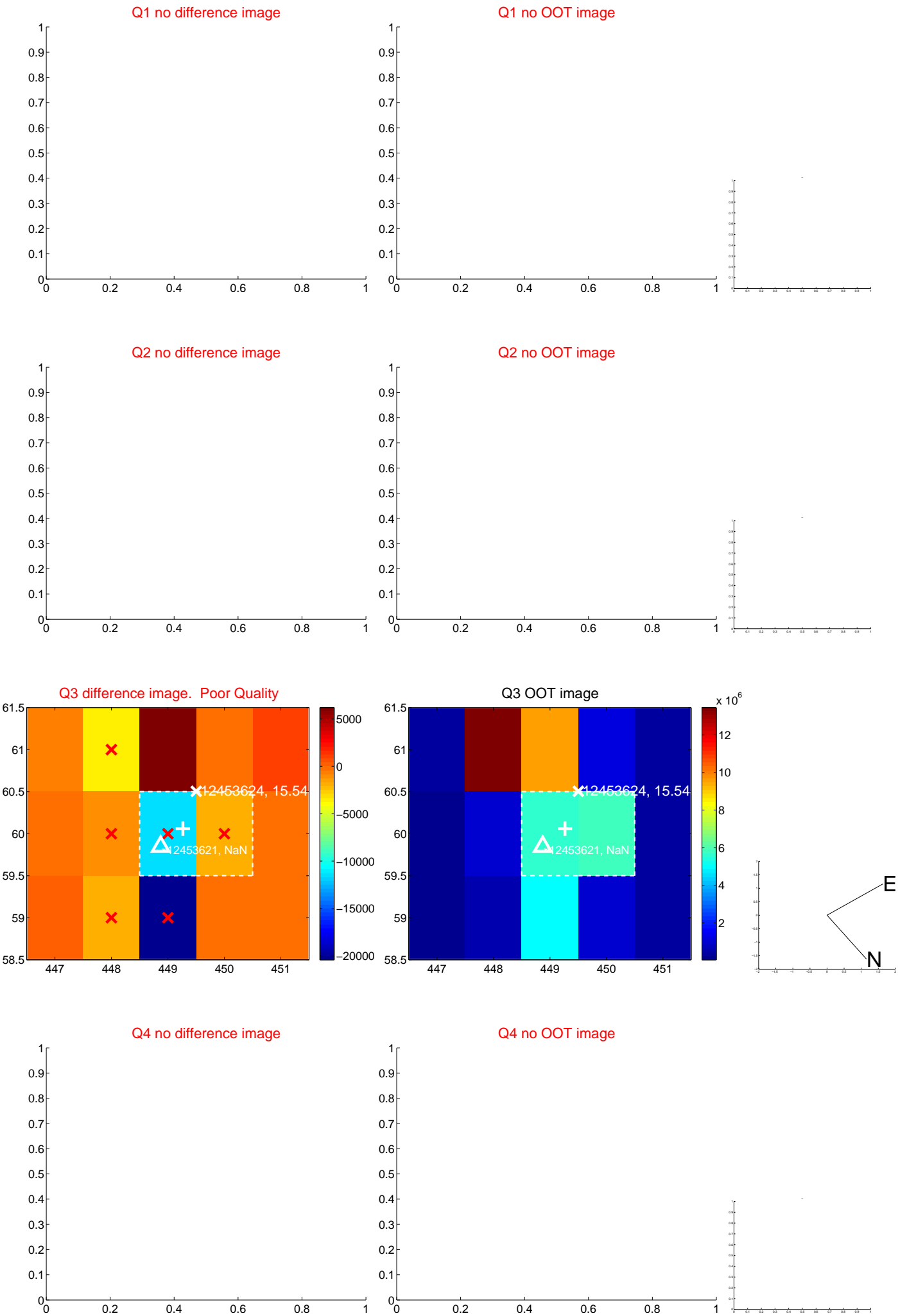


offset from photometric centroids

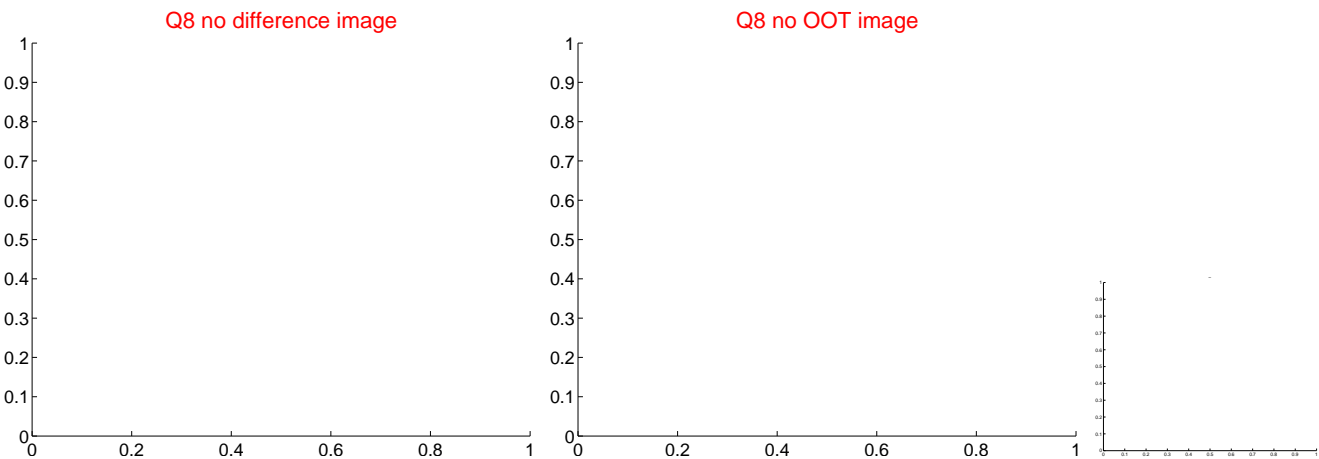
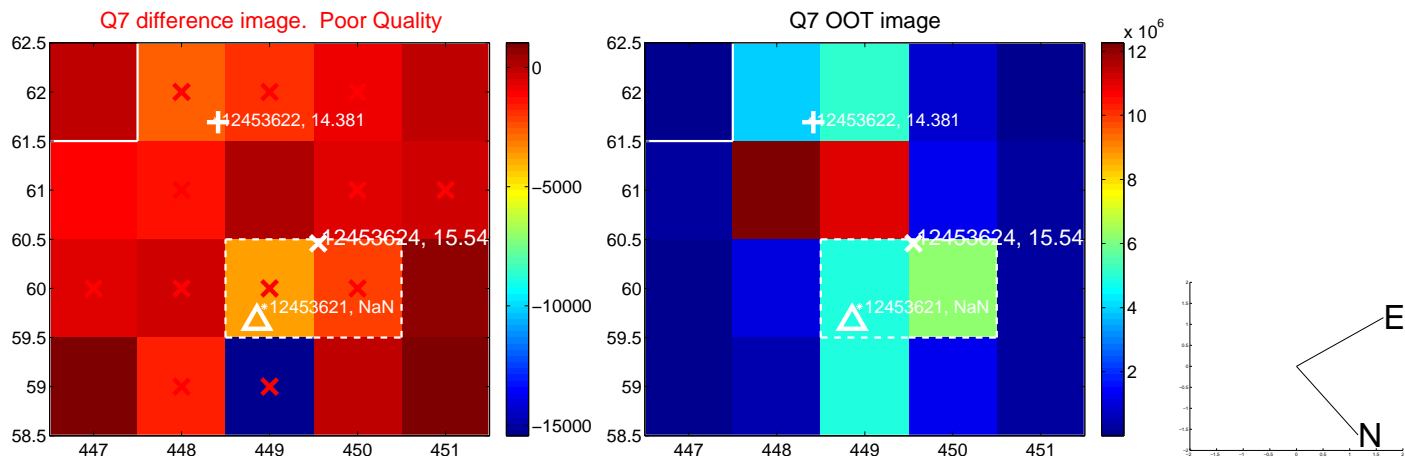
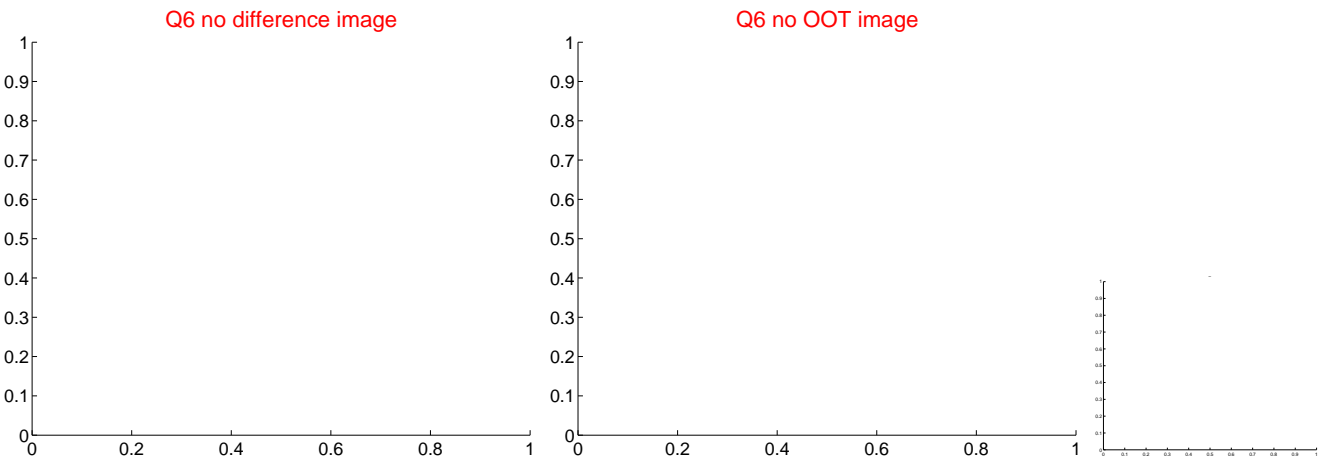
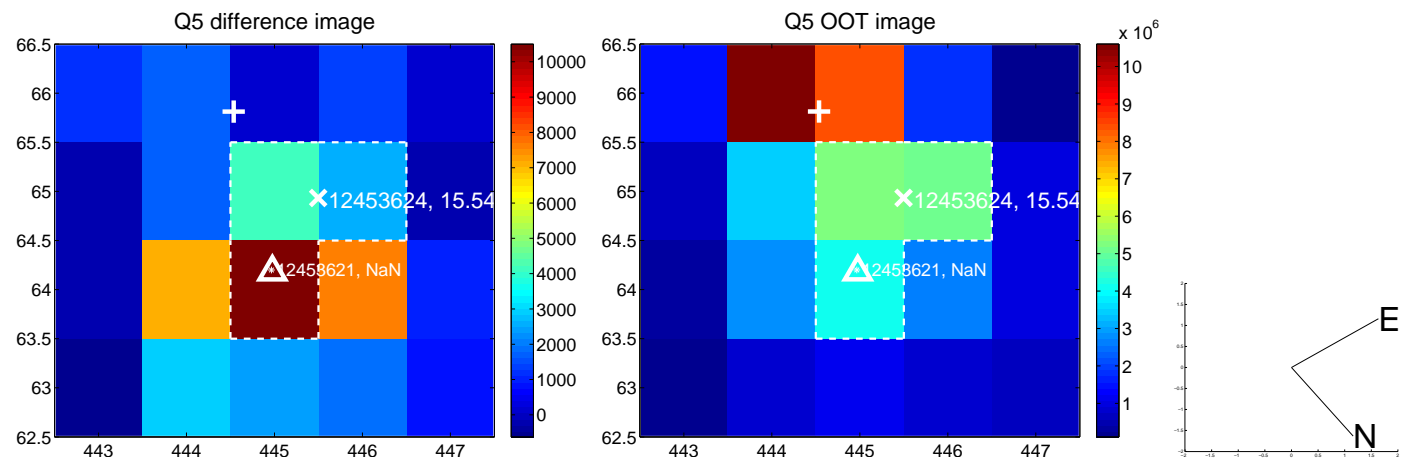


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

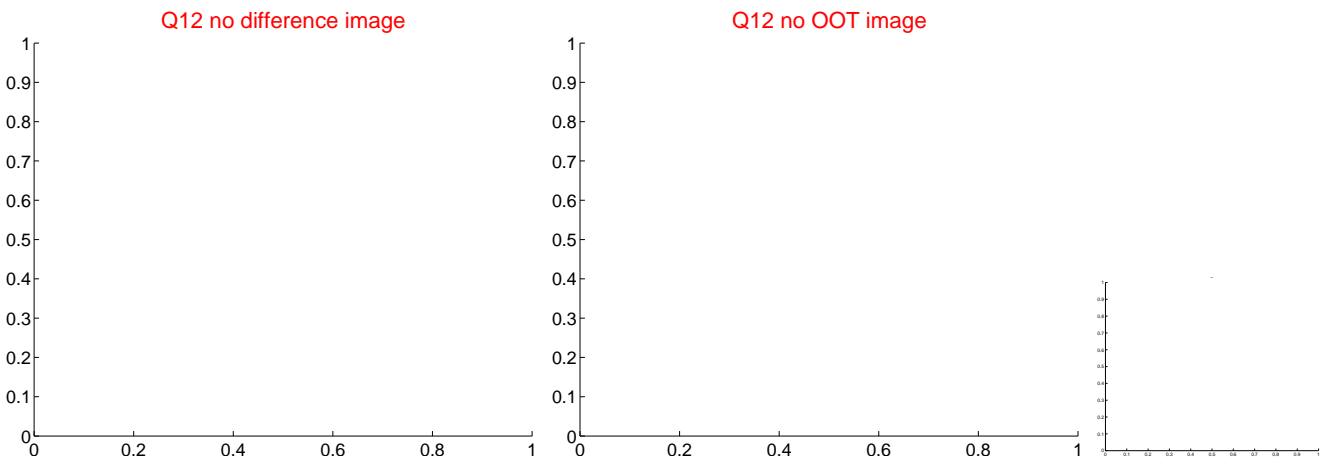
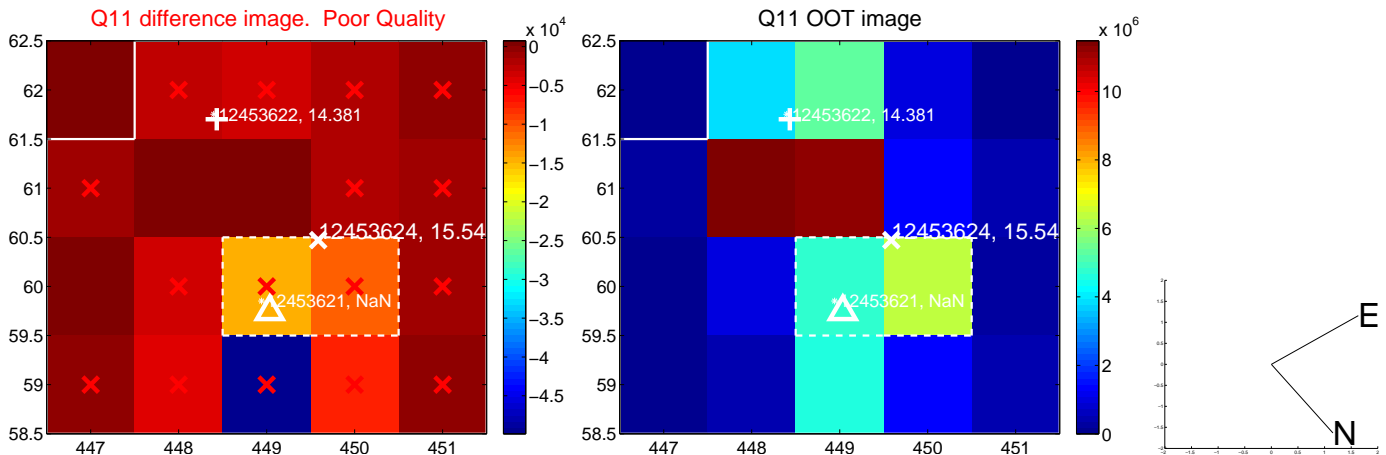
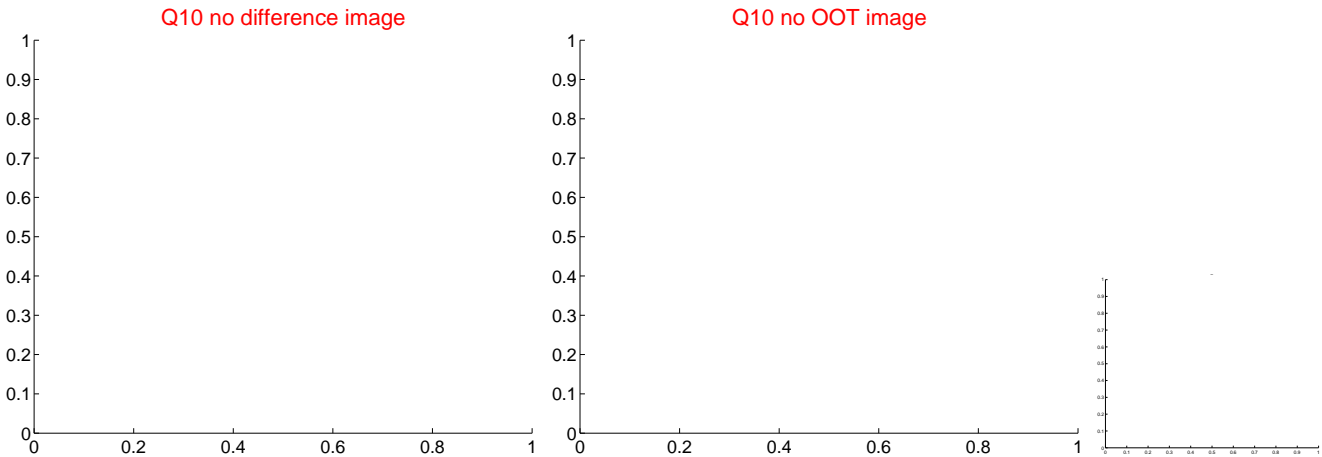
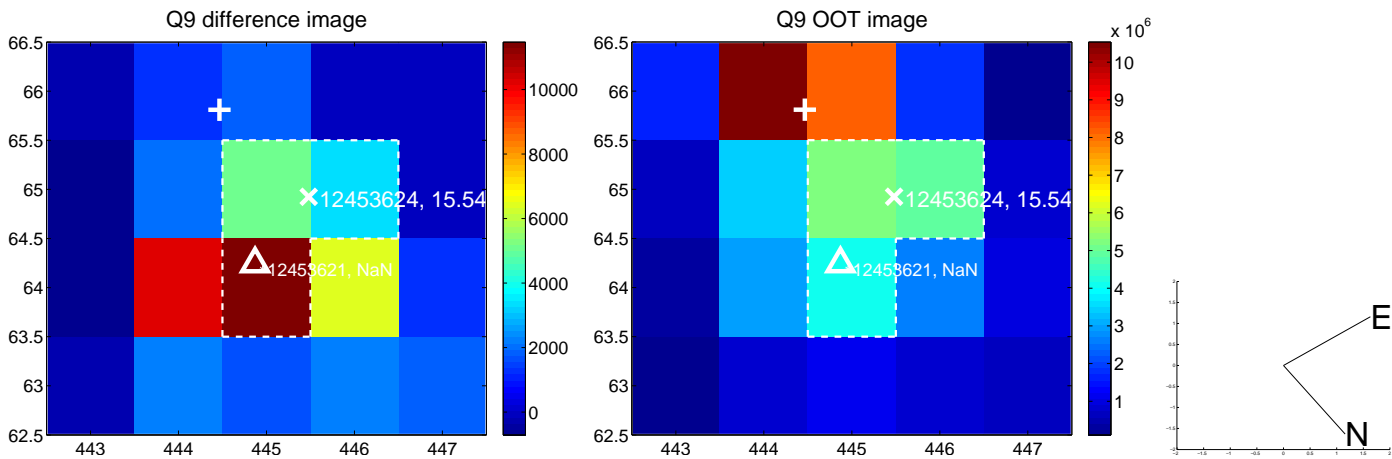
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\Delta$ : difference centroid. red  $\times$ : large negative pixel value.



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



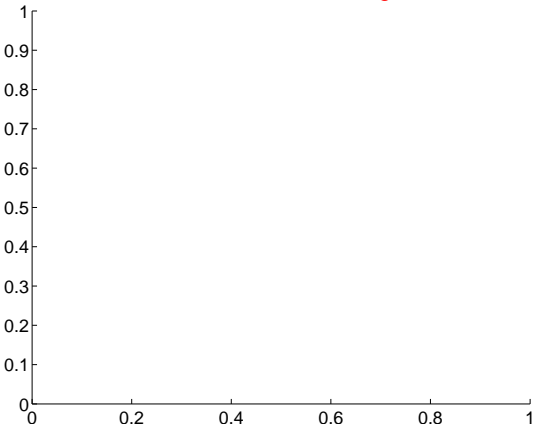
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



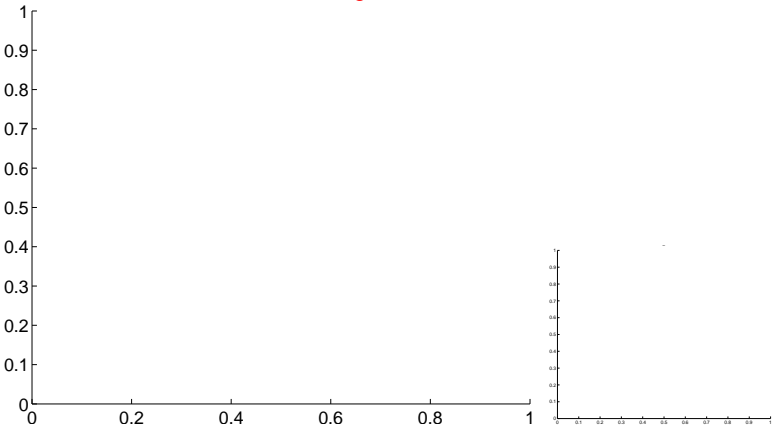


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

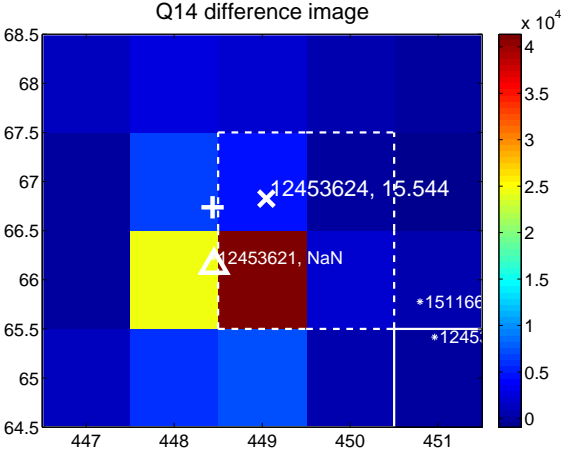
Q13 no difference image



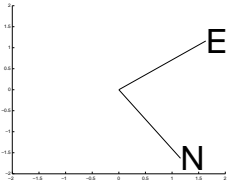
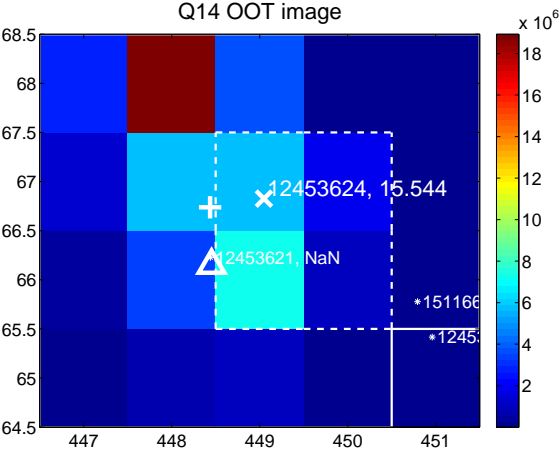
Q13 no OOT image



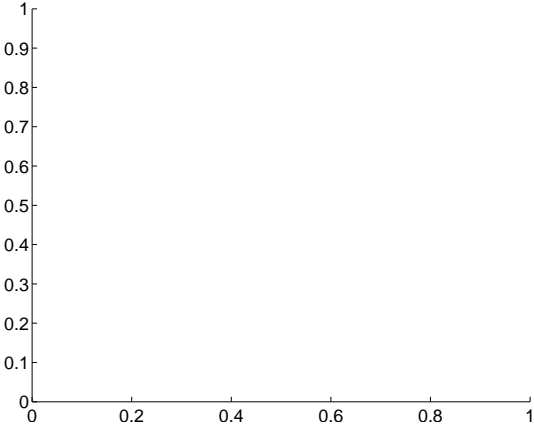
Q14 difference image



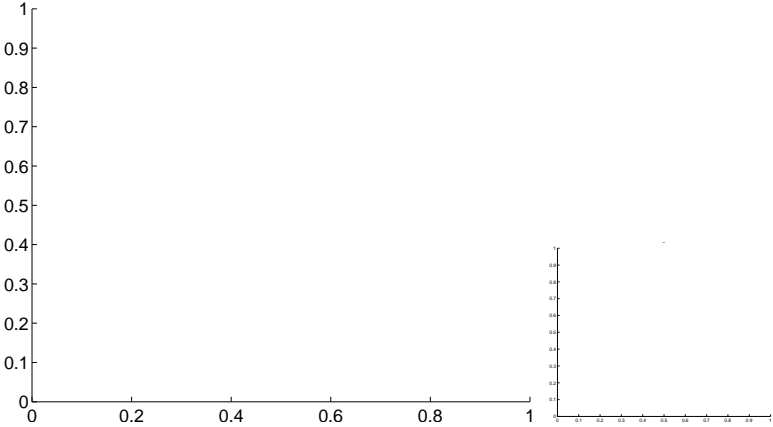
Q14 OOT image



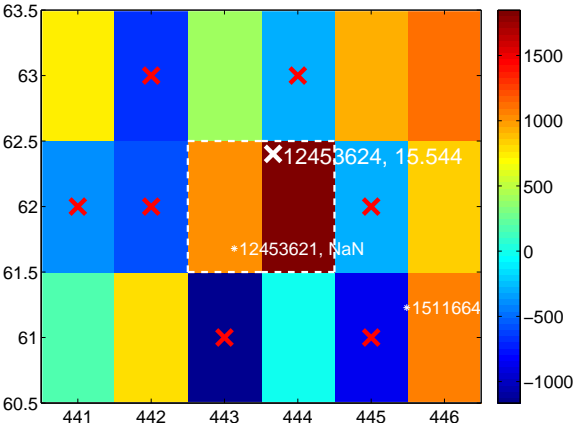
Q15 no difference image



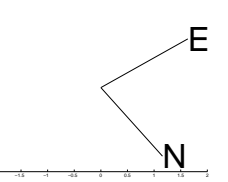
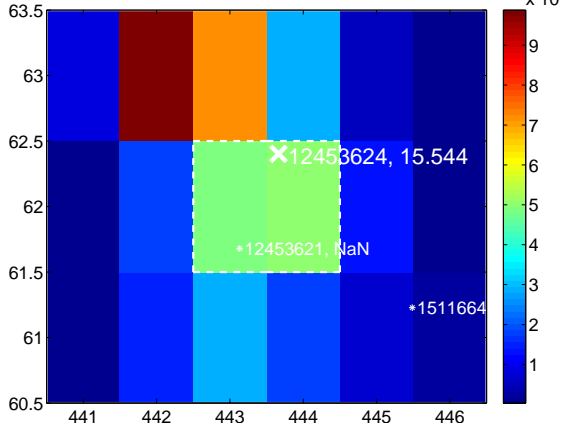
Q15 no OOT image



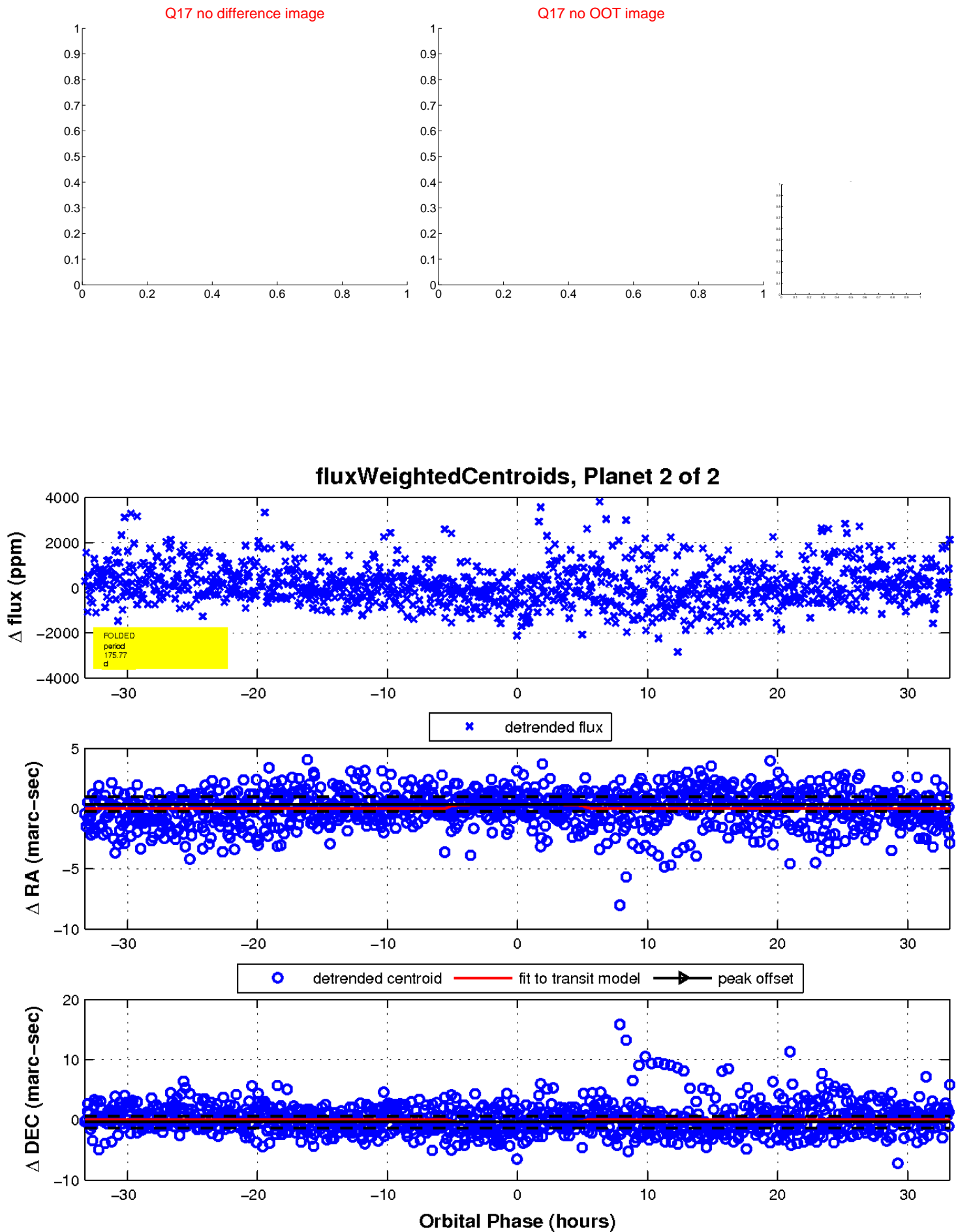
Q16 difference image. Poor Quality



Q16 OOT image



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



UKIRT Image

Declination

