

# KIC 002156089

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
002156089-01	OBS	No	427.410340	149.402655	316.9	9.740	7.4	7.4	1.86	5653	3.63	2.27

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
002156089-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

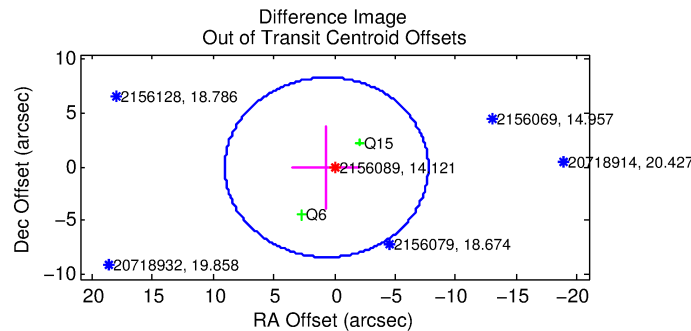
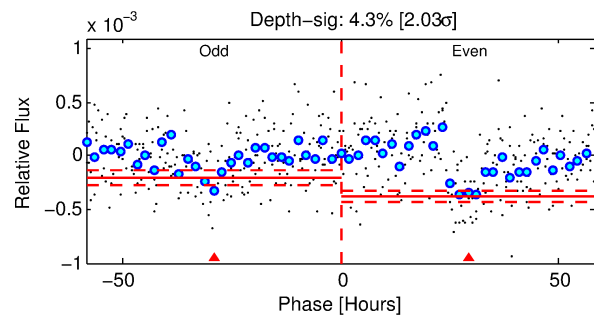
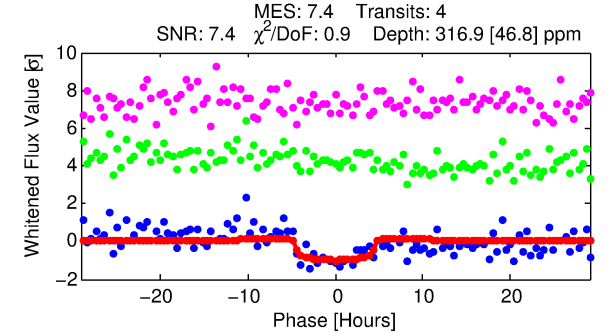
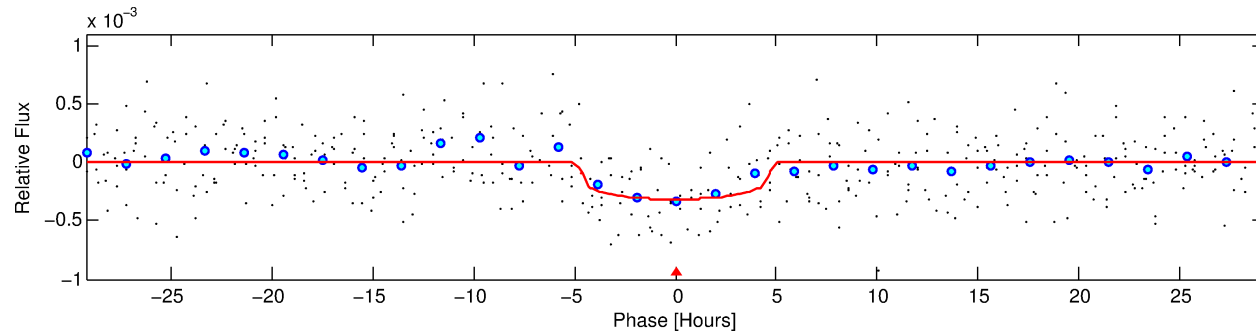
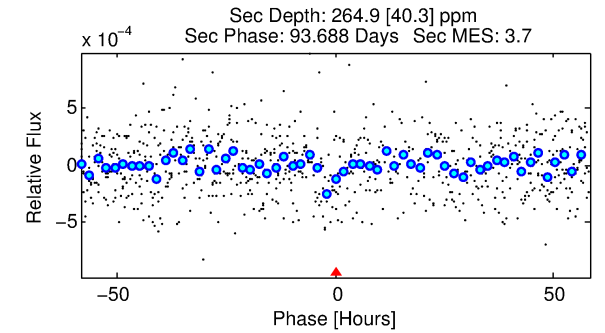
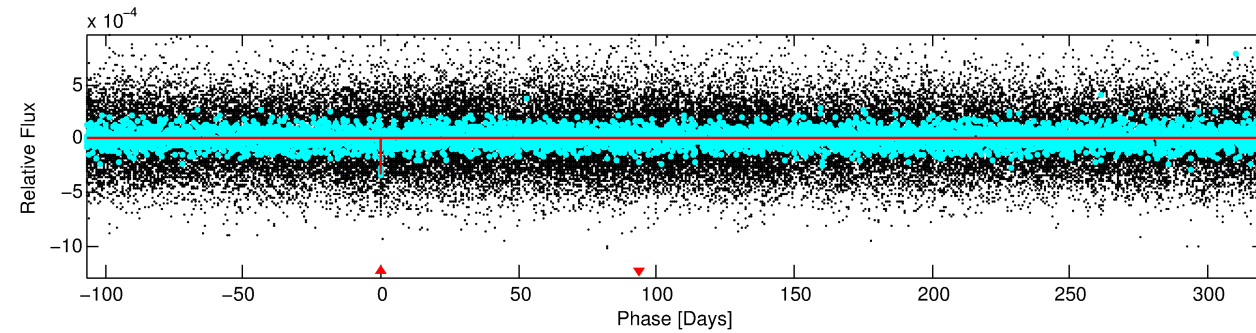
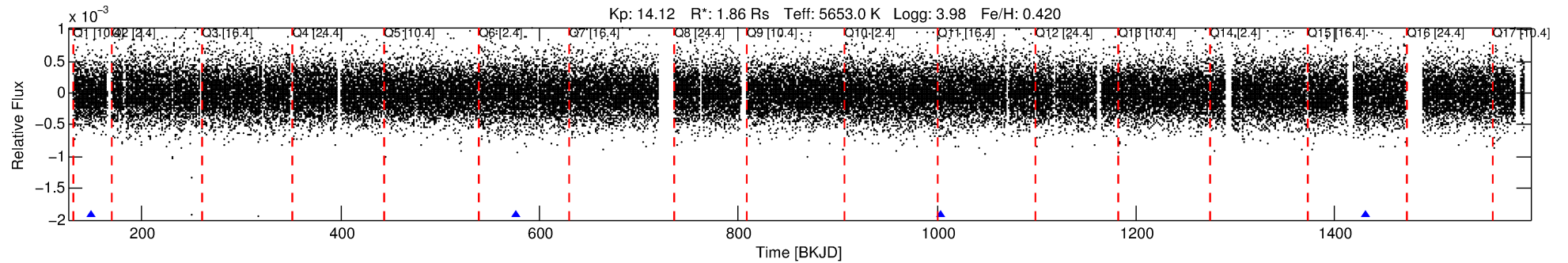
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 002156089-01

No Significant Match Found

# DV One-Page Summary

KIC: 2156089 Candidate: 1 of 1 Period: 427.410 d



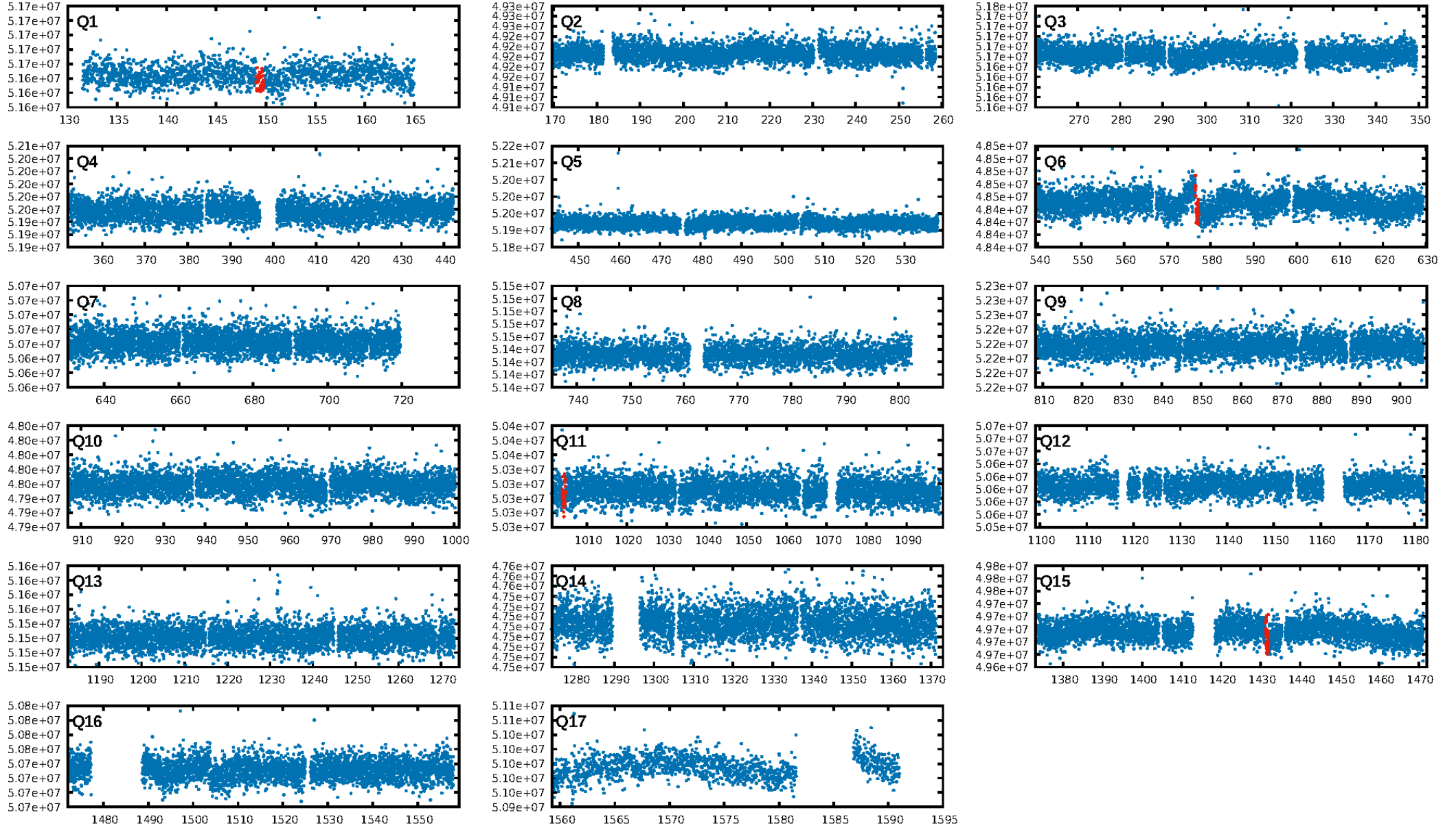
## DV Fit Results:

Period = 427.41034 [0.00967] d  
Epoch = 149.4027 [0.0169] BKJD  
Rp/R\* = 0.0179 [0.0220]  
a/R\* = 223.35 [1142.18]  
b = 0.77 [2.75]  
Seff = 2.27 [0.78]  
Teq = 313 [27] K  
Rp = 3.63 [4.55] Re  
a = 1.1815 [0.2580] AU  
Ag = 15418.72 [38372.38] [0.40 $\sigma$ ]  
Teffp = 5393 [3325] K [1.53 $\sigma$ ]

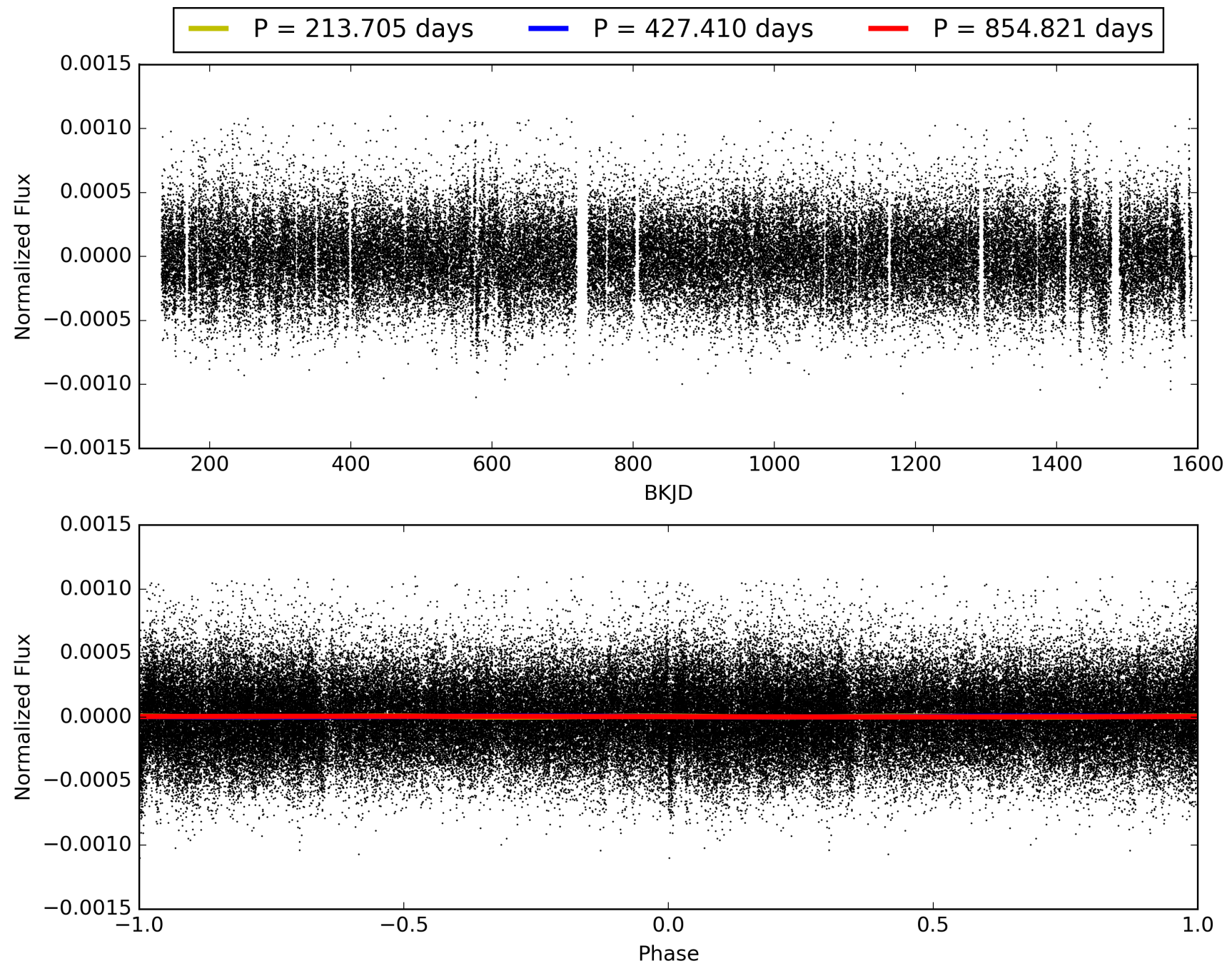
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 30.9%  
ModelChiSquareGof-sig: 100.0%  
**Bootstrap-pfa: 2.87e-11**  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -14.17  
Centroid-sig: 24.2%  
Centroid-so: 0.796 arcsec [0.44 $\sigma$ ]  
OotOffset-rm: 0.651 arcsec [0.23 $\sigma$ ]  
KicOffset-rm: 0.369 arcsec [0.13 $\sigma$ ]  
OotOffset-st: 1/1/0/0 [2]  
KicOffset-st: 1/1/0/0 [2]  
DiffImageQuality-fgm: 1.00 [2/2]  
DiffImageOverlap-fno: 1.00 [3/3]

# TCE 002156089-01, PDC Light Curves

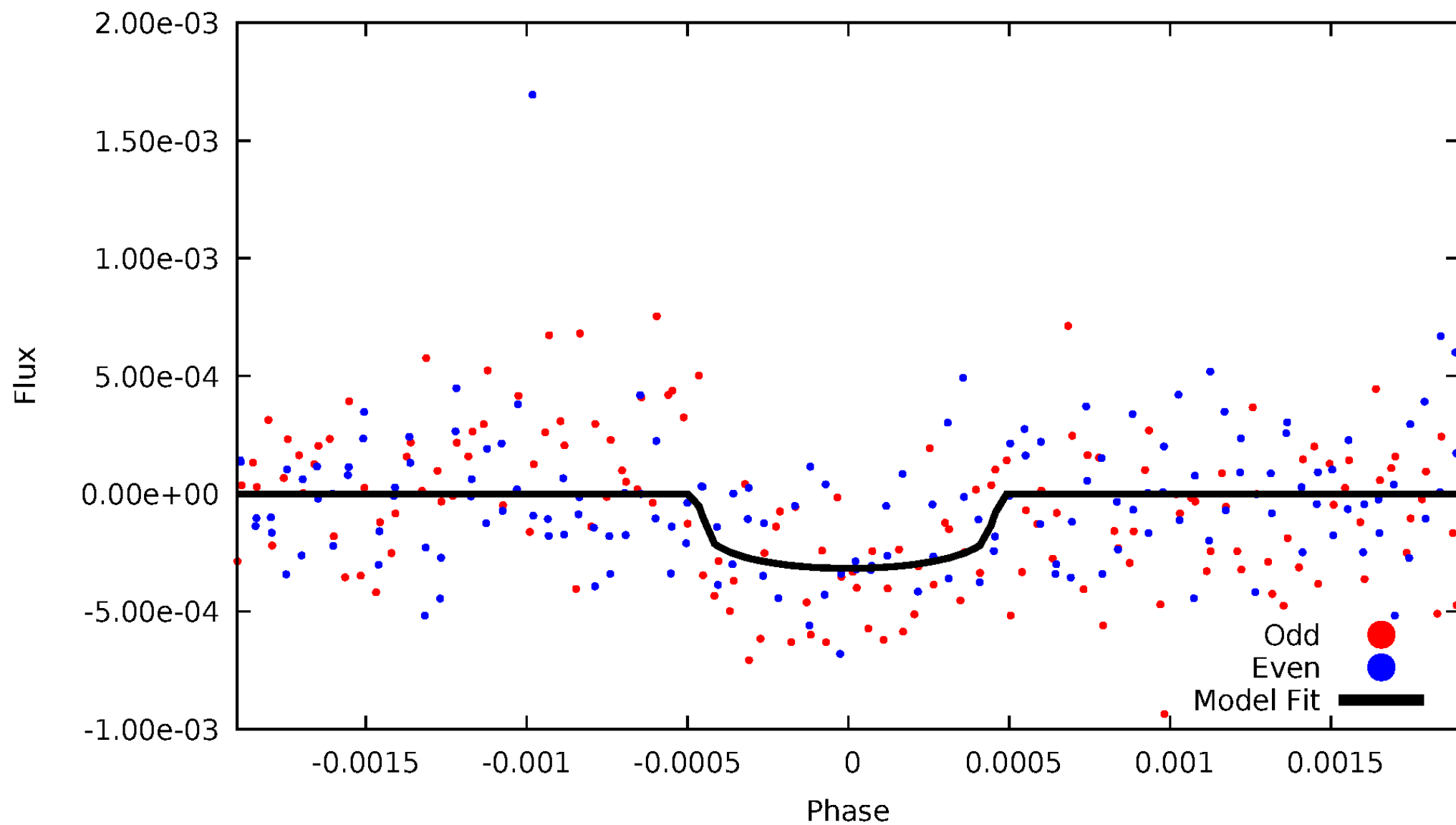


TCE 002156089-01



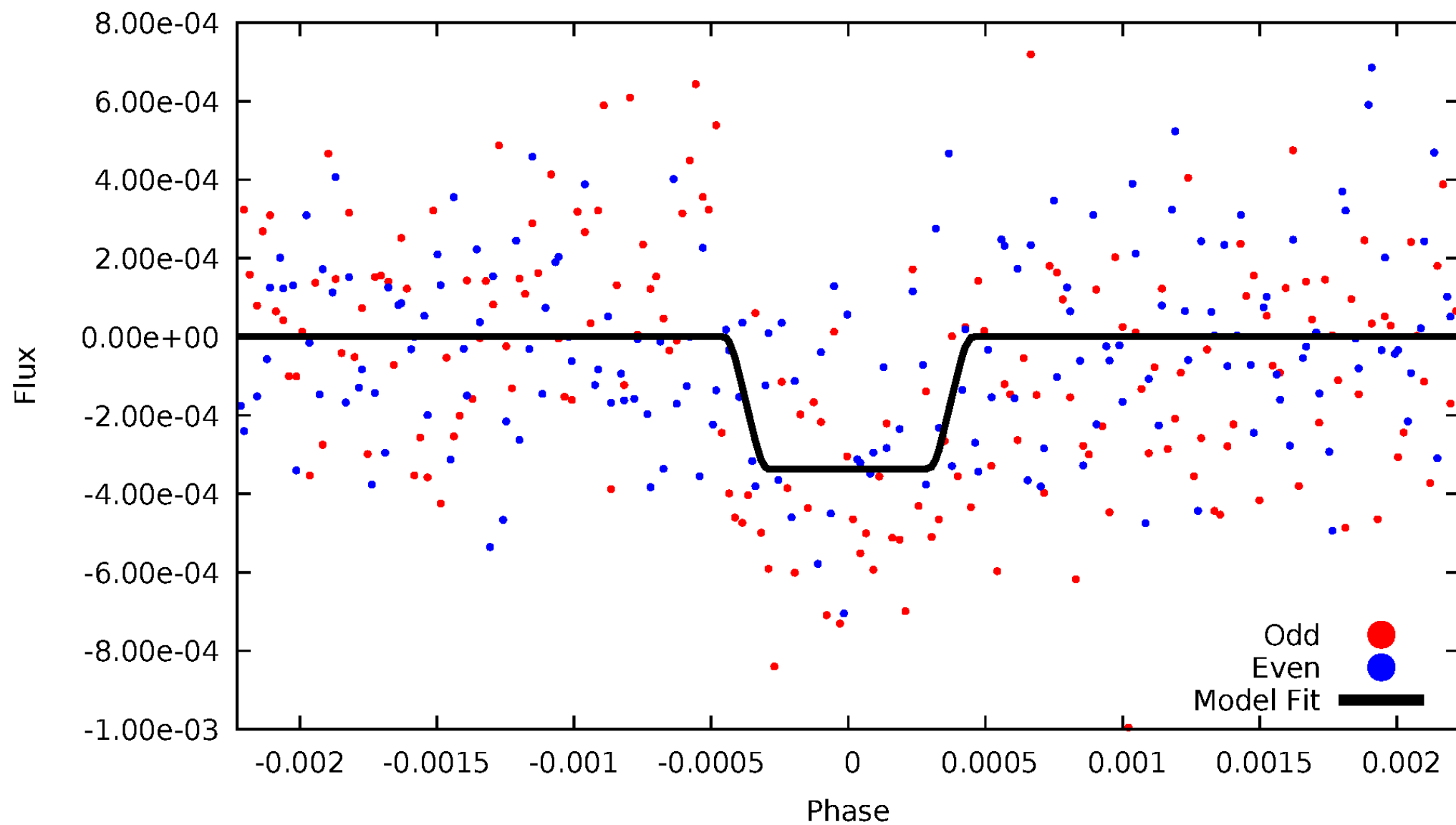
# DV Odd/Even

TCE 002156089-01



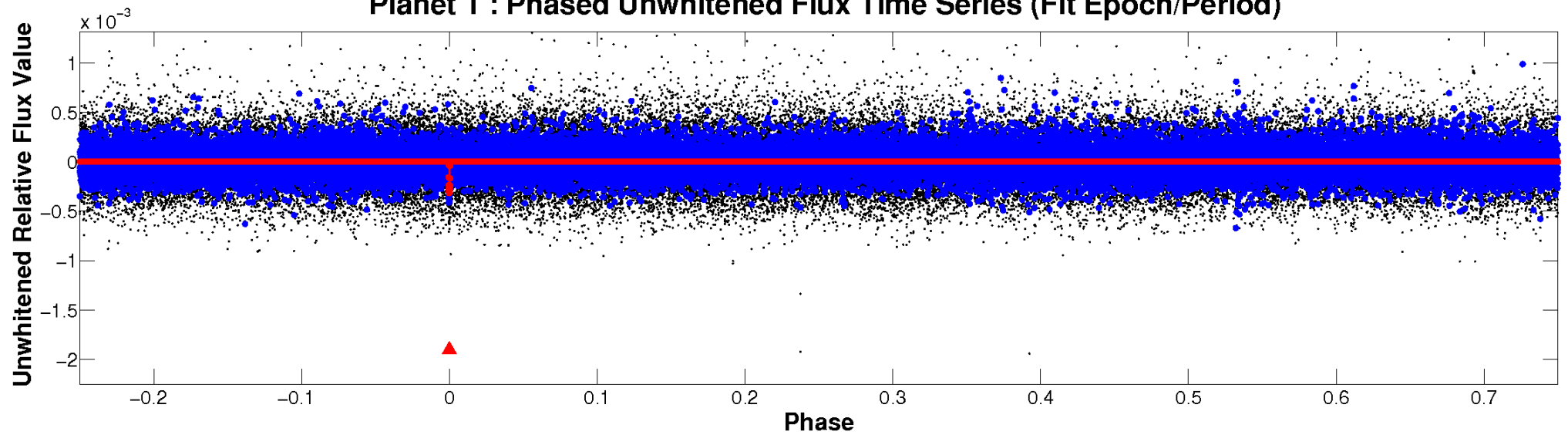
# ALT Odd/Even

TCE 002156089-01

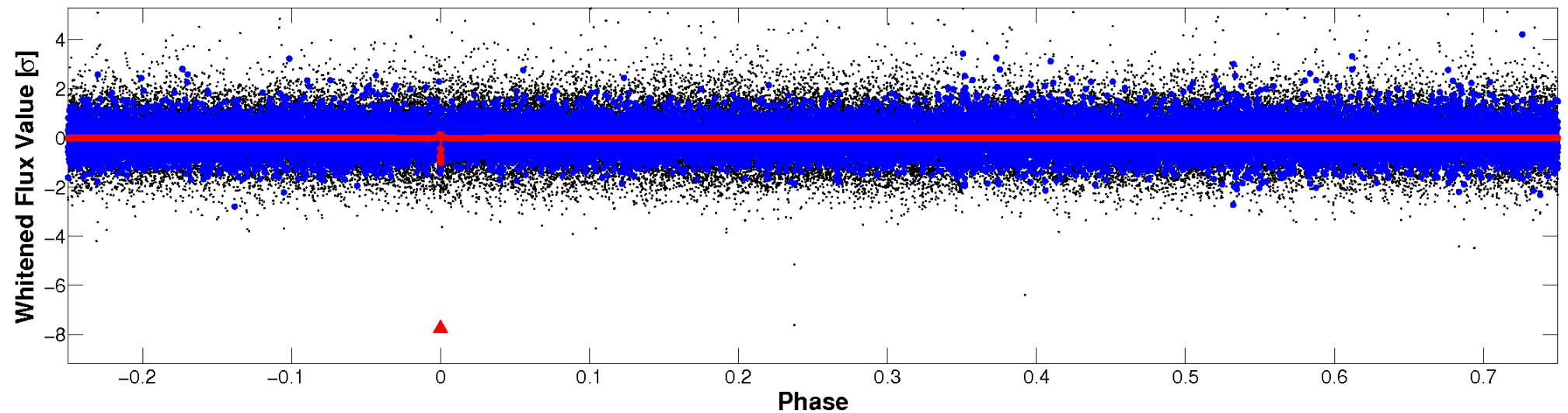


# Non-Whitened Vs. Whitened Light Curve

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



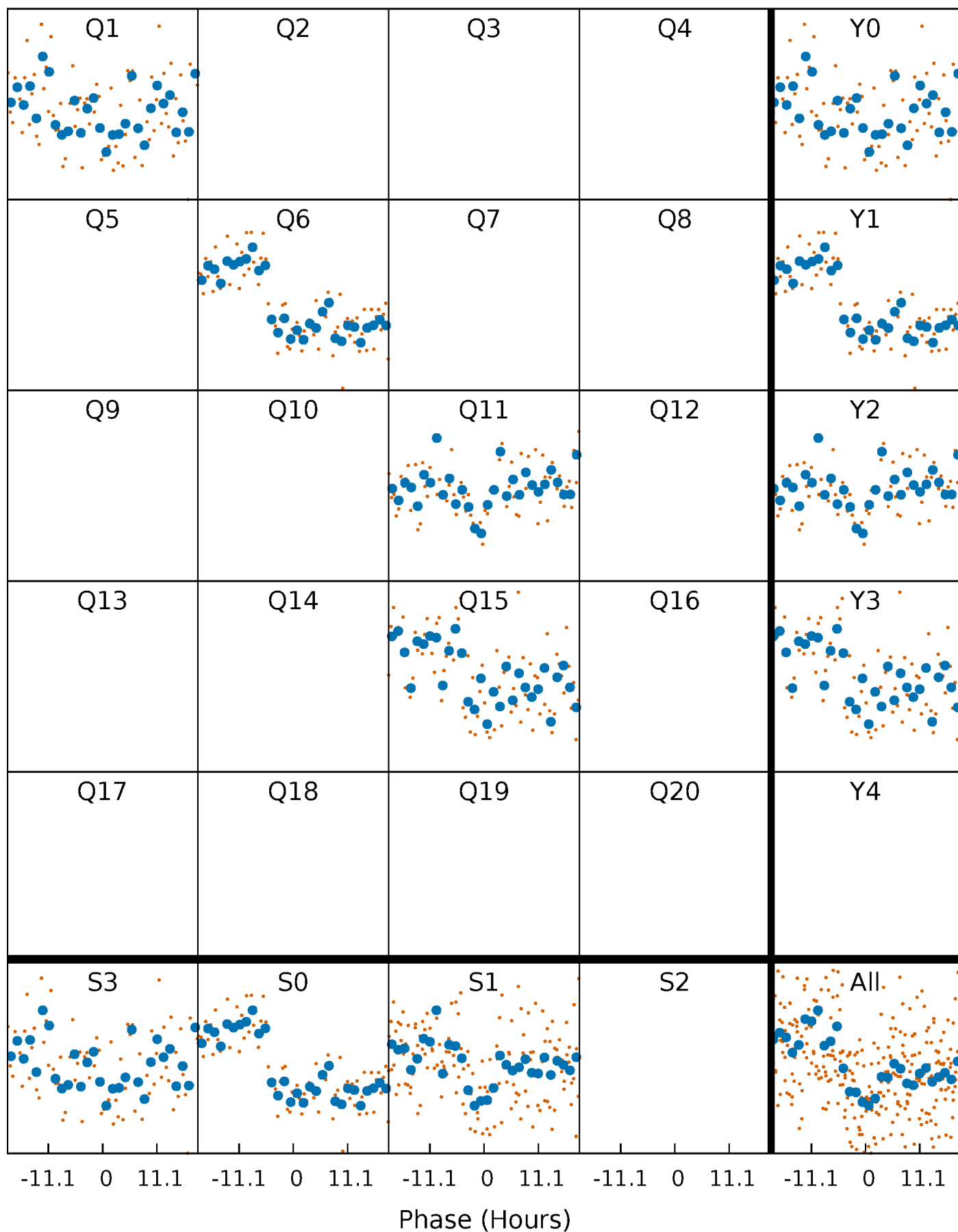
**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**





# PDC Quarter-Phased Transit Curves

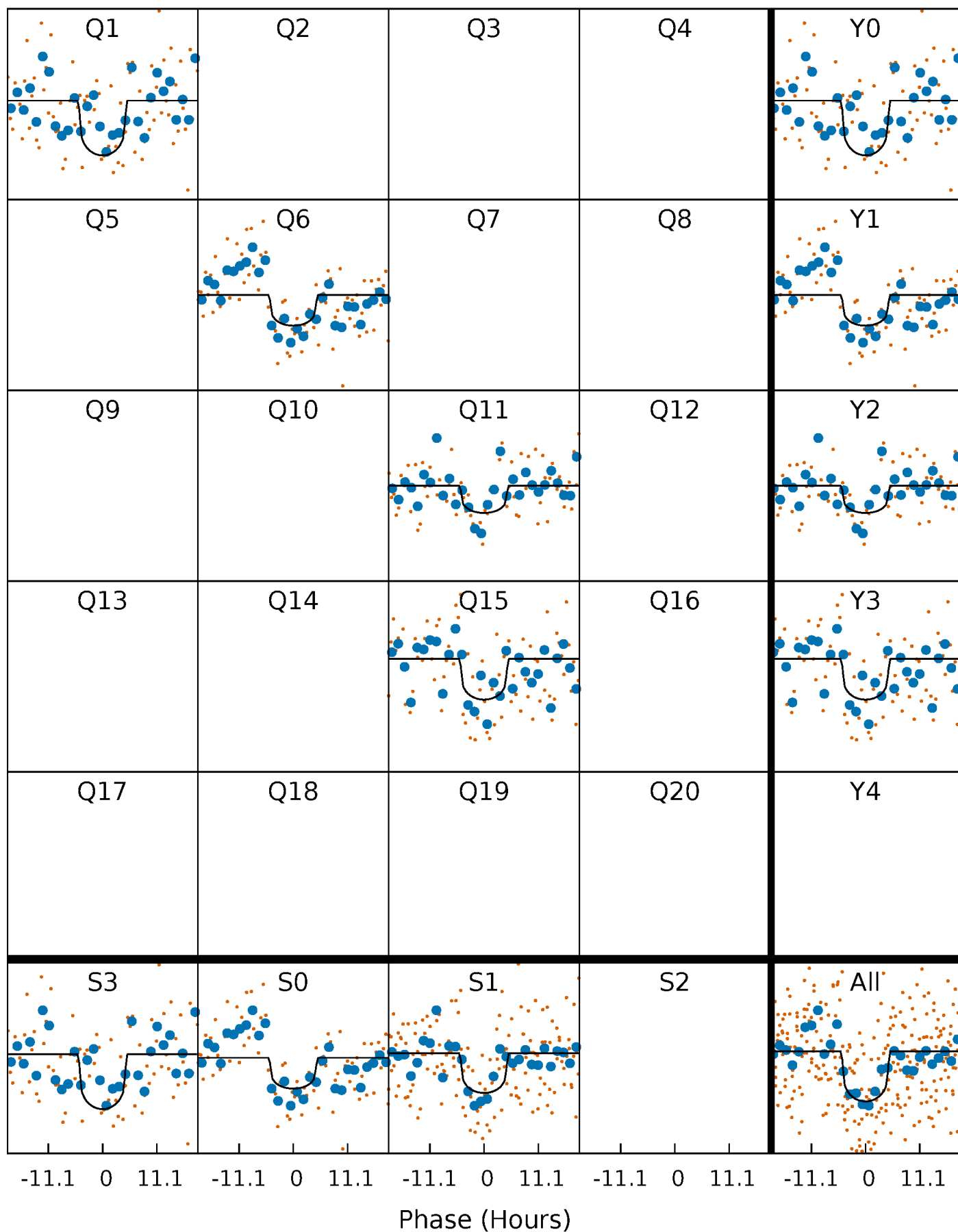
TCE 002156089-01 P=427.410340 Days  $T_0=149.402655$  (BKJD)





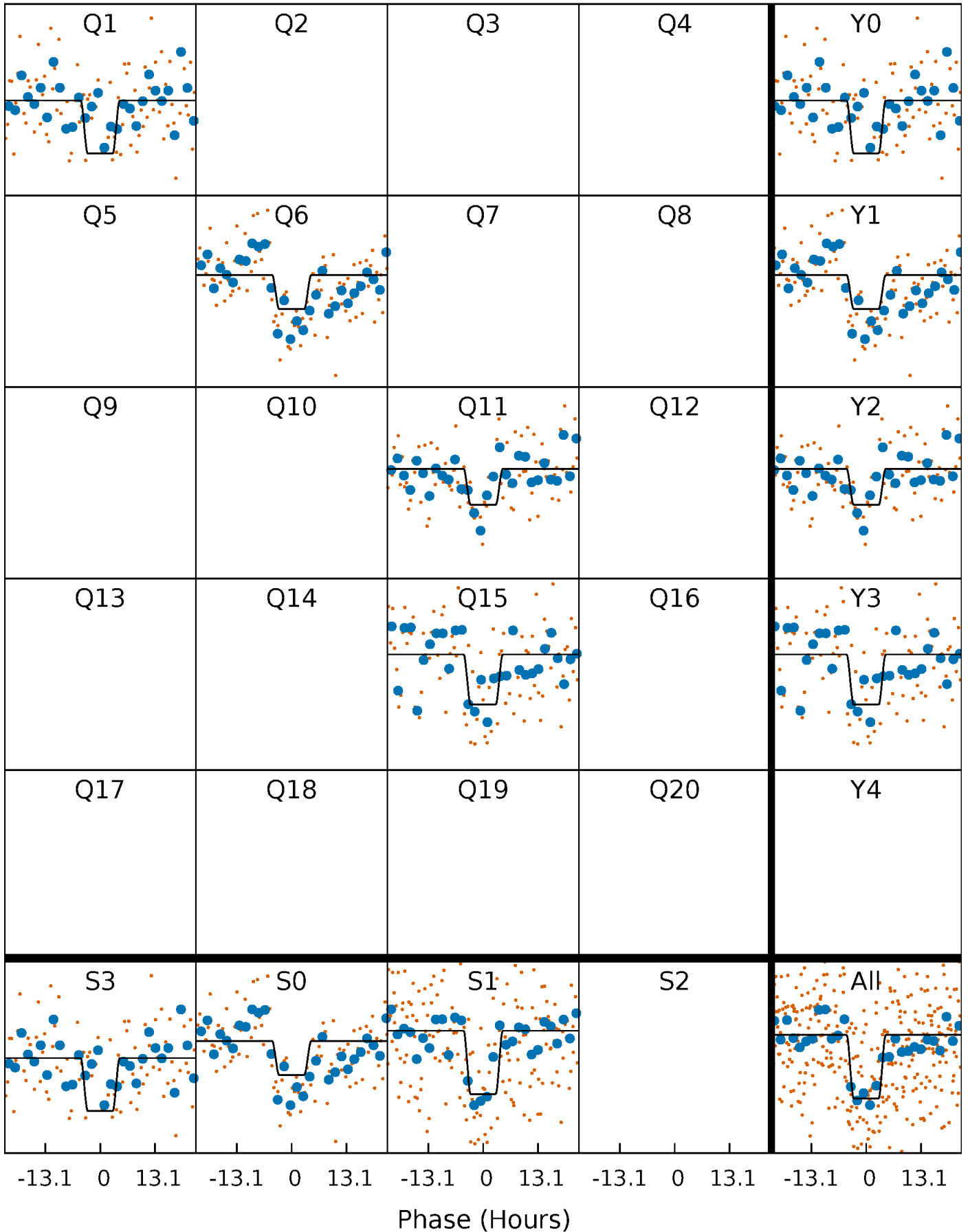
# DV Quarter-Phased Transit Curves

TCE 002156089-01 P=427.410340 Days  $T_0=149.402655$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

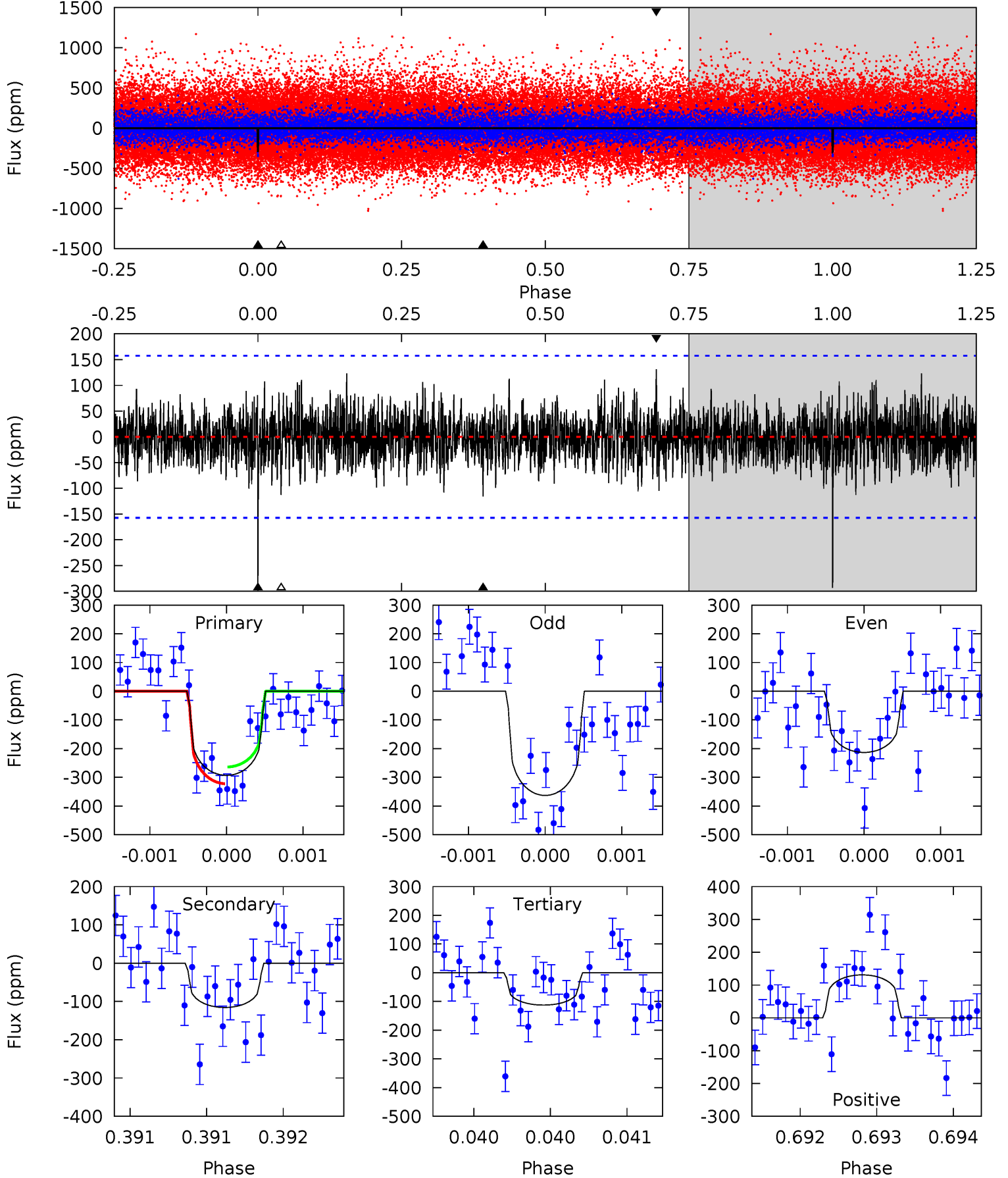
TCE 002156089-01 P=427.422397 Days  $T_0=149.374277$  (BKJD)



# DV Model-Shift Uniqueness Test

002156089-01, P = 427.410340 Days, E = 149.402655 Days

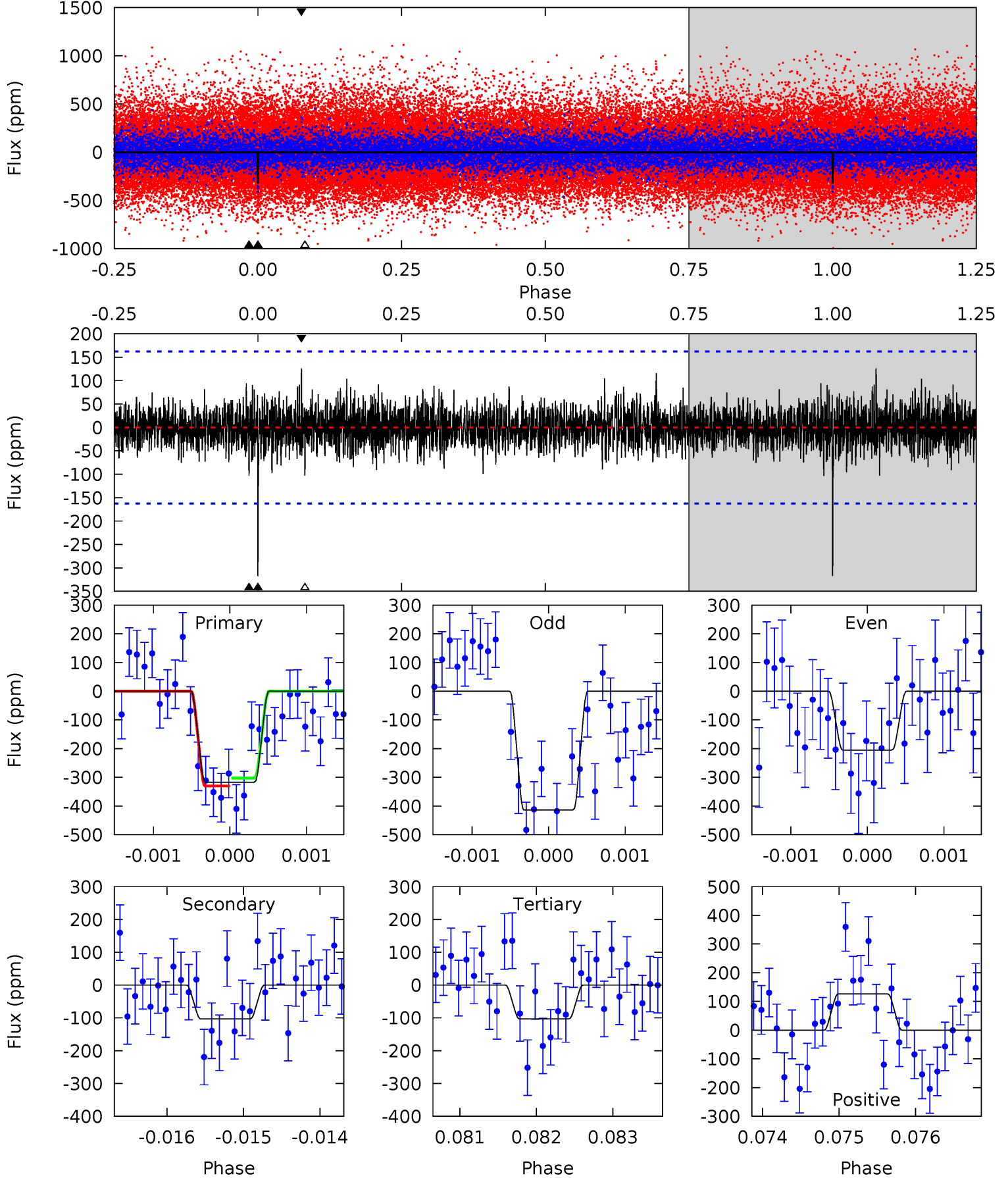
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
10.2	4.02	3.91	4.55	5.46	3.30	1.20	6.27	5.63	0.11	-0.53	2.61	1.00	0.31	1.02



# Alt Model-Shift Uniqueness Test

002156089-01, P = 427.422397 Days, E = 149.374277 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
10.7	3.48	3.47	4.26	5.47	3.32	0.99	7.21	6.42	0.01	-0.77	3.54	1.05	0.28	0.47



### Stellar Parameters For KIC 002156089

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5653^{+76}_{-76}$	$3.979^{+0.195}_{-0.065}$	$0.420^{+0.050}_{-0.100}$	$1.861^{+0.190}_{-0.444}$	$1.201^{+0.113}_{-0.135}$	$0.263^{+0.283}_{-0.057}$
	+1%/-1%	+5%/-2%	+12%/-24%	+10%/-24%	+9%/-11%	+108%/-22%
Source	SPE68	SPE68	SPE68	DSEP		

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

### Secondary Eclipse Parameters for KIC 002156089-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-116 \pm 29$	$4.59^{+4.12}_{-2.99}$	$433^{+15}_{-25}$	$4086^{+2298}_{-791}$	$4200^{+29014}_{-3105}$
Alt.	$-103 \pm 30$	$4.81^{+4.05}_{-3.08}$	$432^{+16}_{-25}$	$3950^{+2030}_{-693}$	$3405^{+22734}_{-2393}$

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

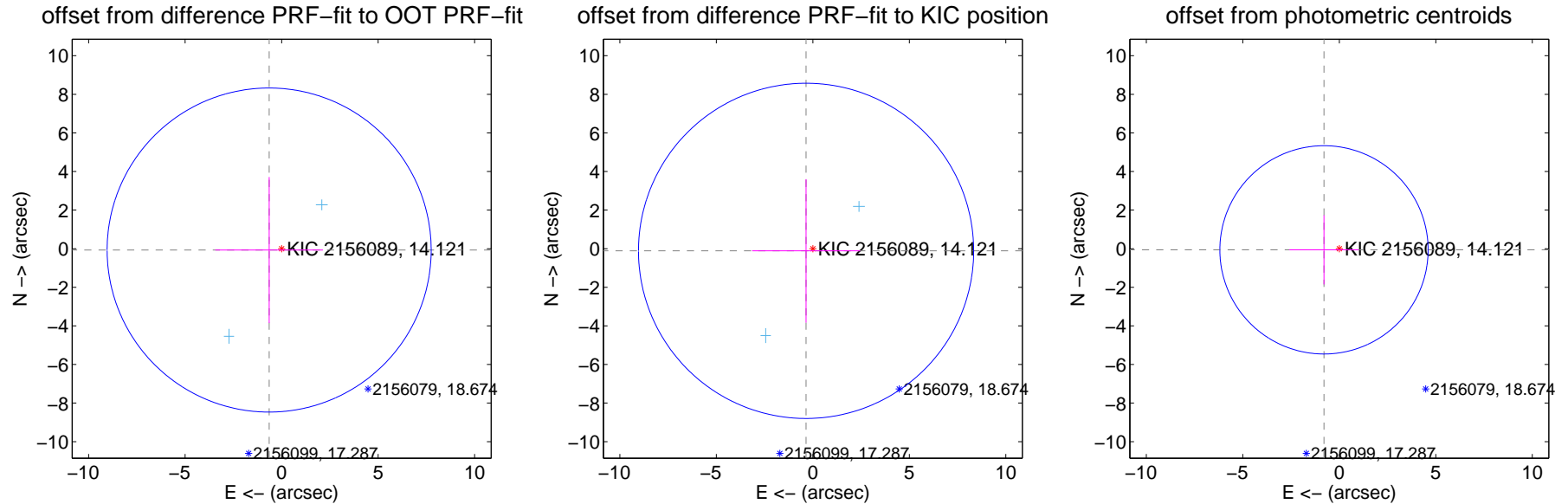
## DV Centroid Data

Supplemental centroid analysis for 002156089-01. Kepler magnitude: 14.12. Transit SNR 7.38

There are 2 quarters with good PRF difference image offsets

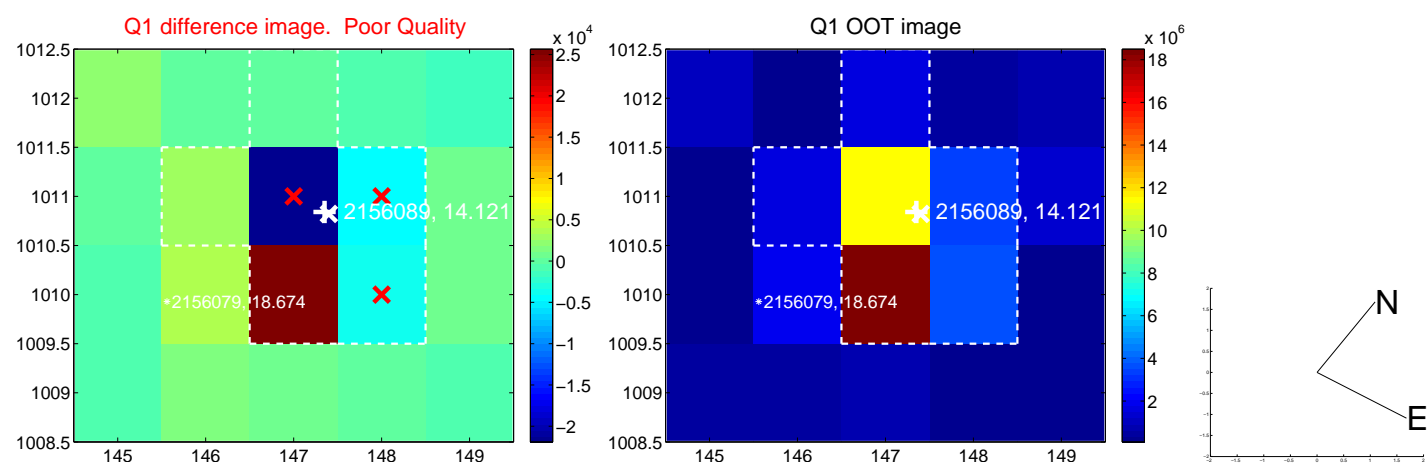
The direct PRF centroid is offset from the target star catalog position by about 0.32 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.651 \pm 2.799$	0.23	$0.647 \pm 2.785$	$-0.070 \pm 3.781$
PRF-fit source offset from KIC position	$0.369 \pm 2.895$	0.13	$0.351 \pm 2.798$	$-0.112 \pm 3.717$
photometric centroid source offset	$0.80 \pm 1.80$	0.44	$0.79 \pm 1.80$	$-0.06 \pm 1.79$



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





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

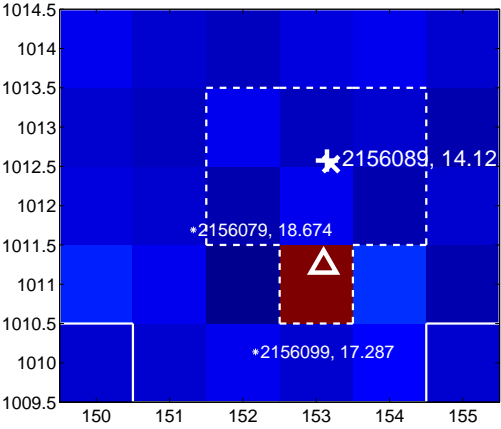
Q5 no difference image



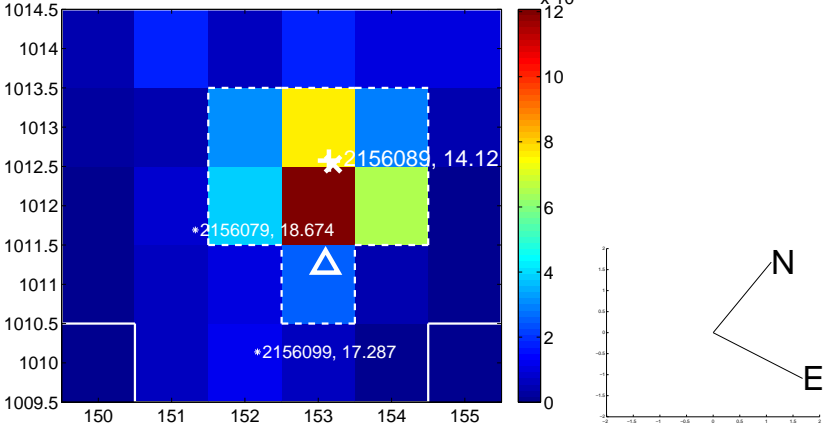
Q5 no OOT image



Q6 difference image



Q6 OOT image



Q7 no difference image



Q7 no OOT image



Q8 no difference image



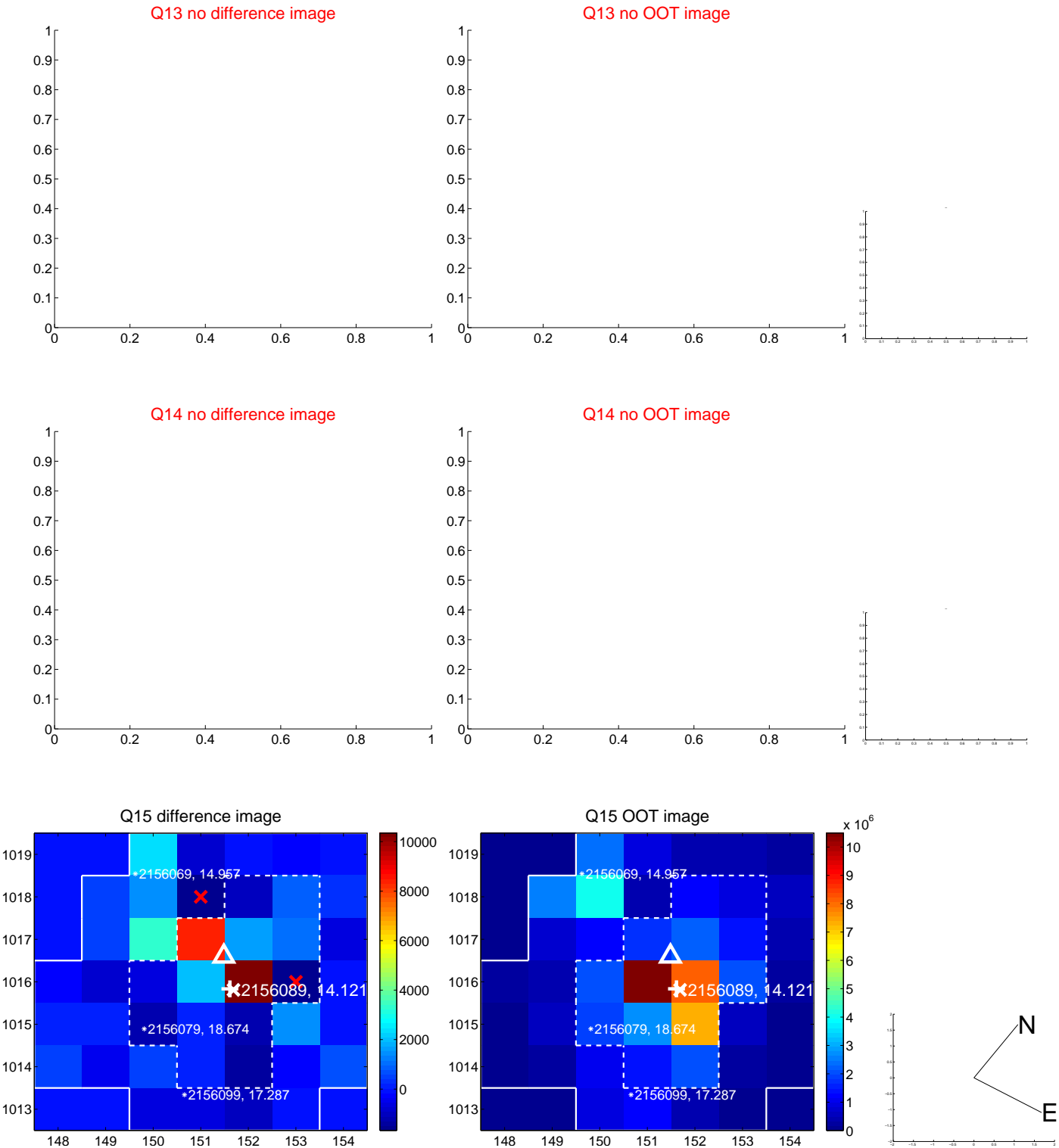
Q8 no OOT image



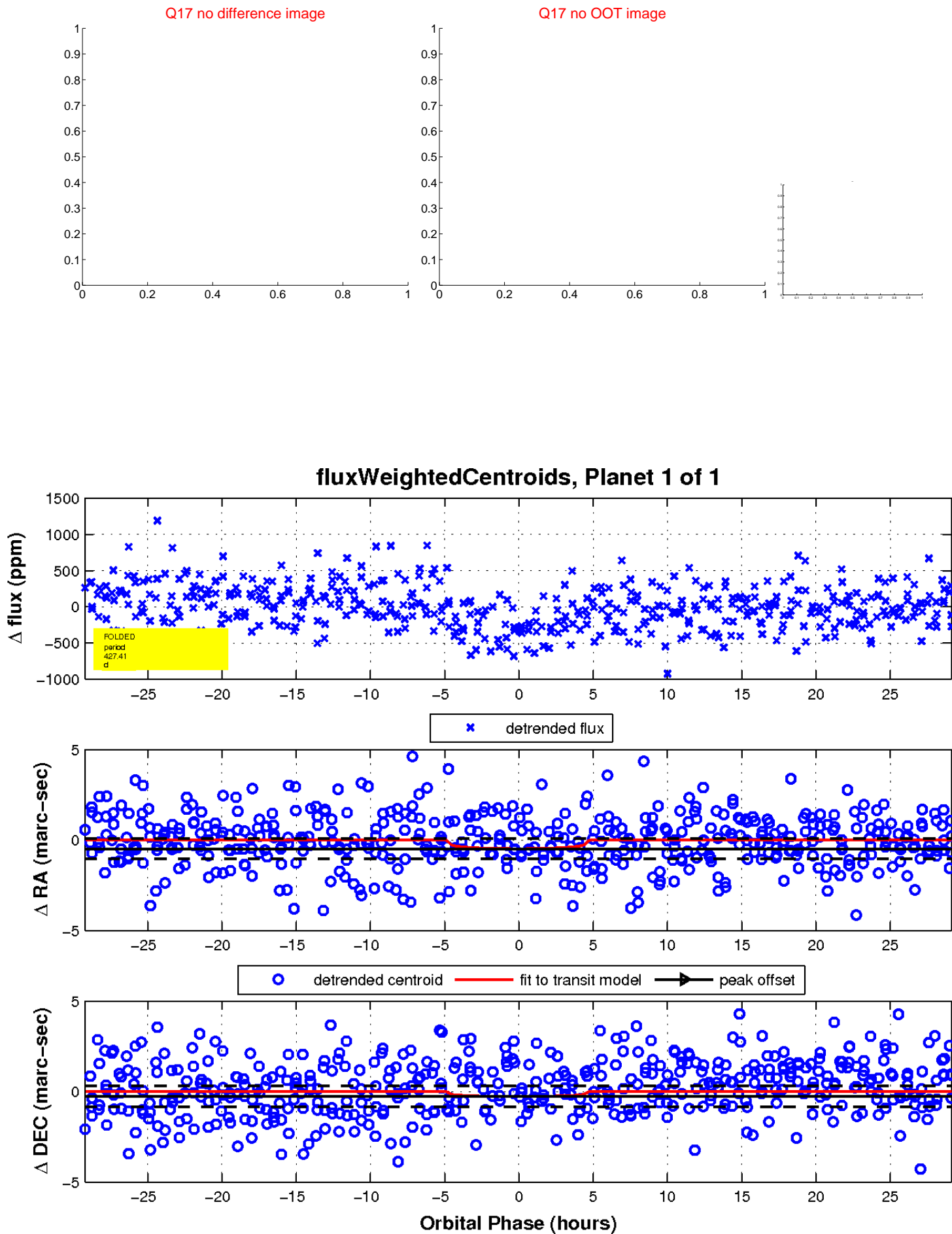
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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.



UKIRT Image

Declination

