

# KIC 010669516

## 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) | $R_p$ ( $R_{\oplus}$ ) | $S_p$ ( $S_{\oplus}$ ) |
|--------------|----------|------|---------------|--------------|-------------|------------------|------|------|-----------------------------|-----------------|------------------------|------------------------|
| 010669516-01 | OBS      | No   | 503.741192    | 491.660426   | 1526.1      | 8.510            | 18.3 | 2.3  | 2.03                        | 7204            | 8.37                   | 4.87                   |
| 010669516-02 | OBS      | No   | 395.355573    | 417.184315   | 12597.5     | 6.010            | 15.9 | 12.1 | 2.03                        | 7204            | 39.64                  | 6.72                   |

## Robovetter Results

| TCE          | Run Type | Disp | Score | N | S | C | E | Comments                                                                                                               |
|--------------|----------|------|-------|---|---|---|---|------------------------------------------------------------------------------------------------------------------------|
| 010669516-01 | OBS      | FP   | 0.00  | 1 | 0 | 0 | 0 | INDIV_TRANS_CHASES_ZUMA—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS |
| 010669516-02 | OBS      | FP   | 0.00  | 1 | 0 | 0 | 0 | INDIV_TRANS_CHASES—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS                                           |

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

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

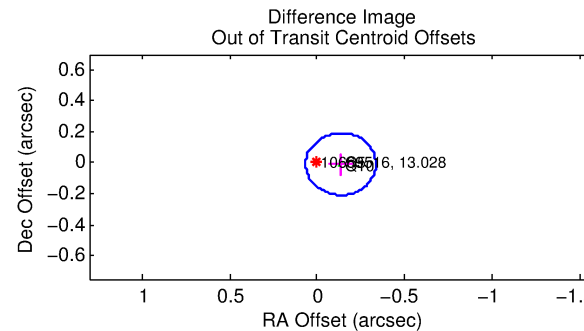
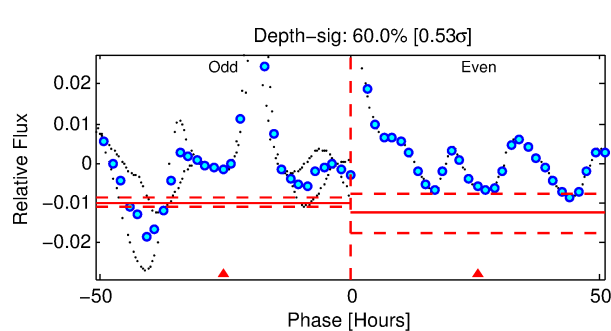
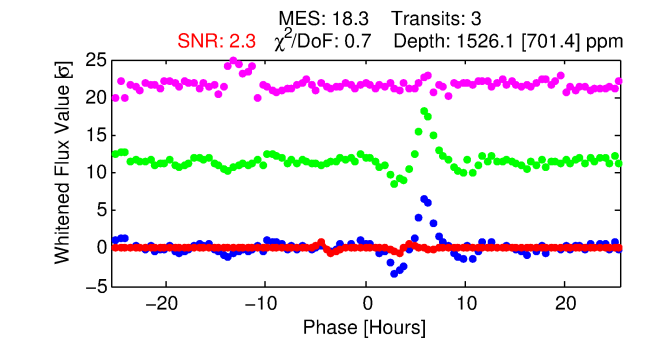
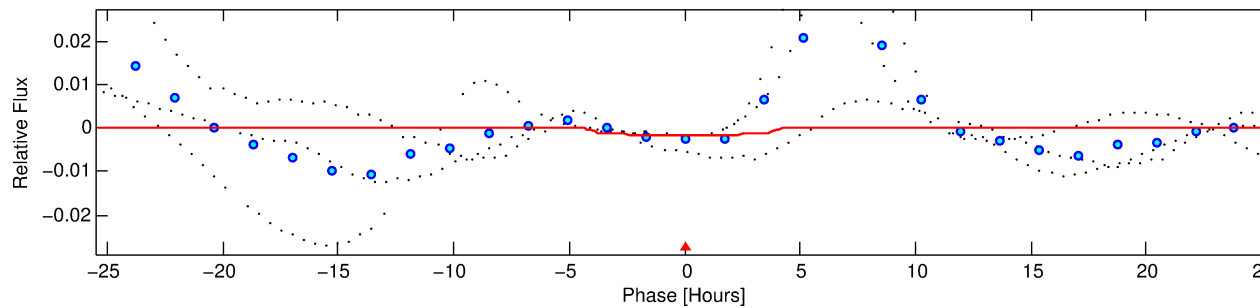
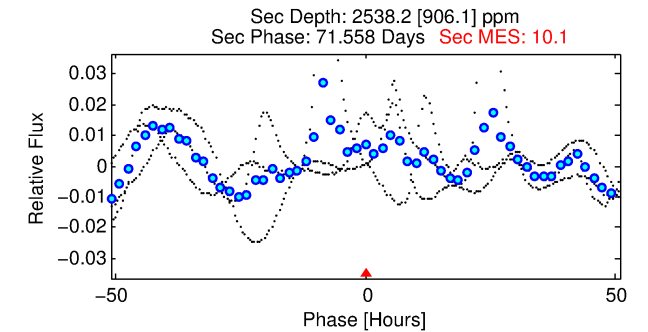
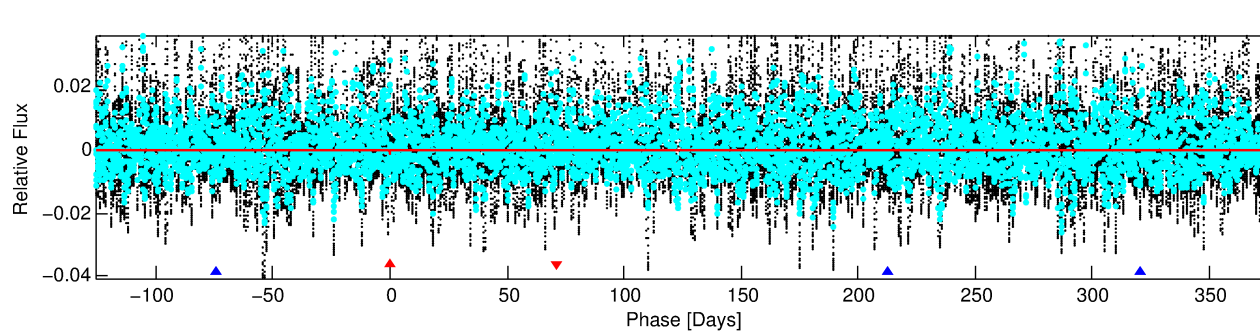
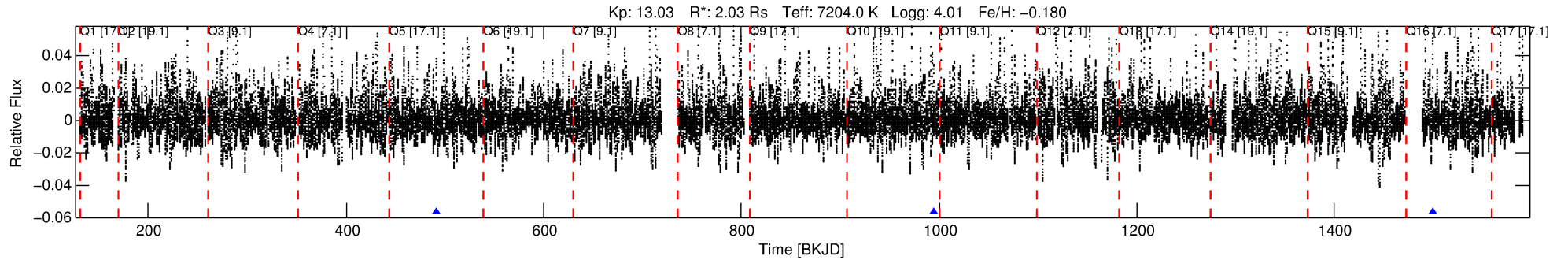
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 010669516-01

No Significant Match Found

# DV One-Page Summary

KIC: 10669516 Candidate: 1 of 2 Period: 503.741 d



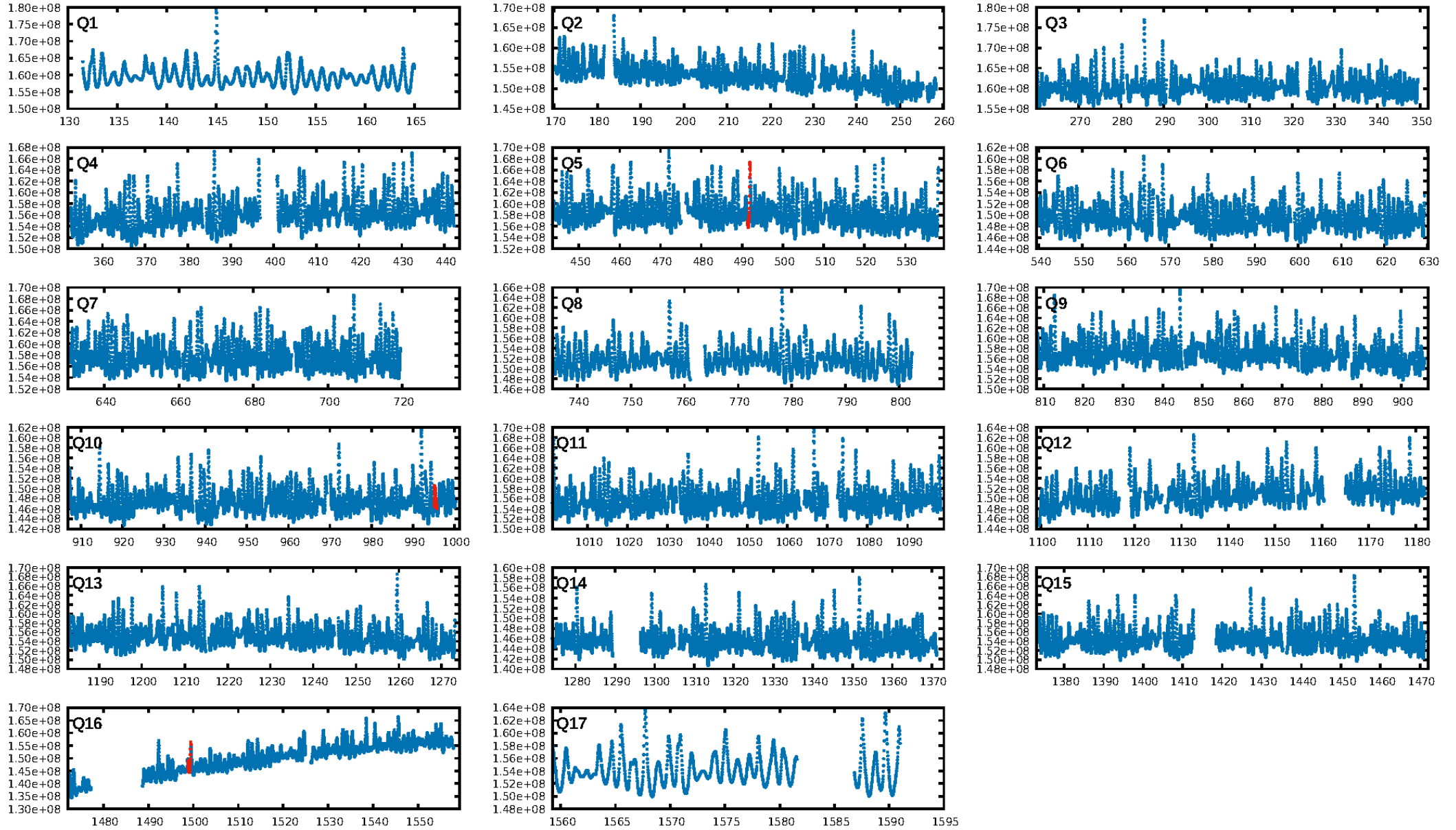
## DV Fit Results:

Period = 503.74119 [0.00896] d  
Epoch = 491.6604 [0.0088] BKJD  
Rp/R\* = 0.0378 [0.0127]  
a/R\* = 375.05 [343.24]  
b = 0.62 [0.90]  
Seff = 4.87 [2.23]  
Teq = 379 [43] K  
Rp = 8.37 [3.92] Re  
a = 1.4290 [0.4077] AU  
Ag = 40727.98 [35533.79] [1.15σ]  
**Teffp = 8318 [1618] K [4.90σ]**

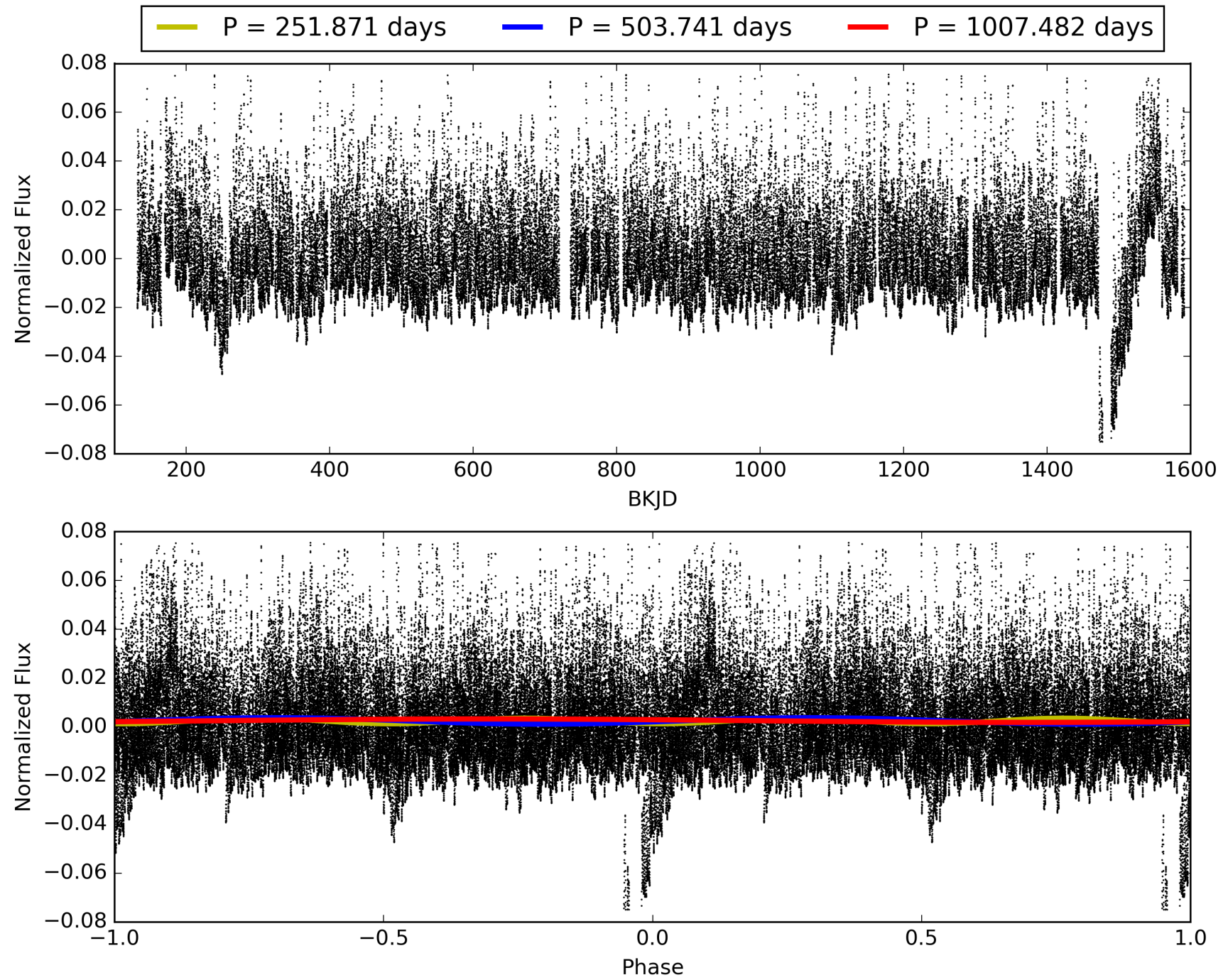
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [249.69σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 67.4%  
ModelChiSquareGof-sig: 100.0%  
**Bootstrap-pfa: 2.31e-09**  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 5.73  
Centroid-sig: N/A  
Centroid-so: 0.936 arcsec [1.60σ]  
OotOffset-rm: 0.134 arcsec [2.00σ]  
KicOffset-rm: 0.214 arcsec [1.61σ]  
OotOffset-st: 1/0/0/1 [2]  
KicOffset-st: 1/0/0/1 [2]  
DiffImageQuality-fgm: 0.50 [1/2]  
DiffImageOverlap-fno: 1.00 [2/2]

# TCE 010669516-01, PDC Light Curves

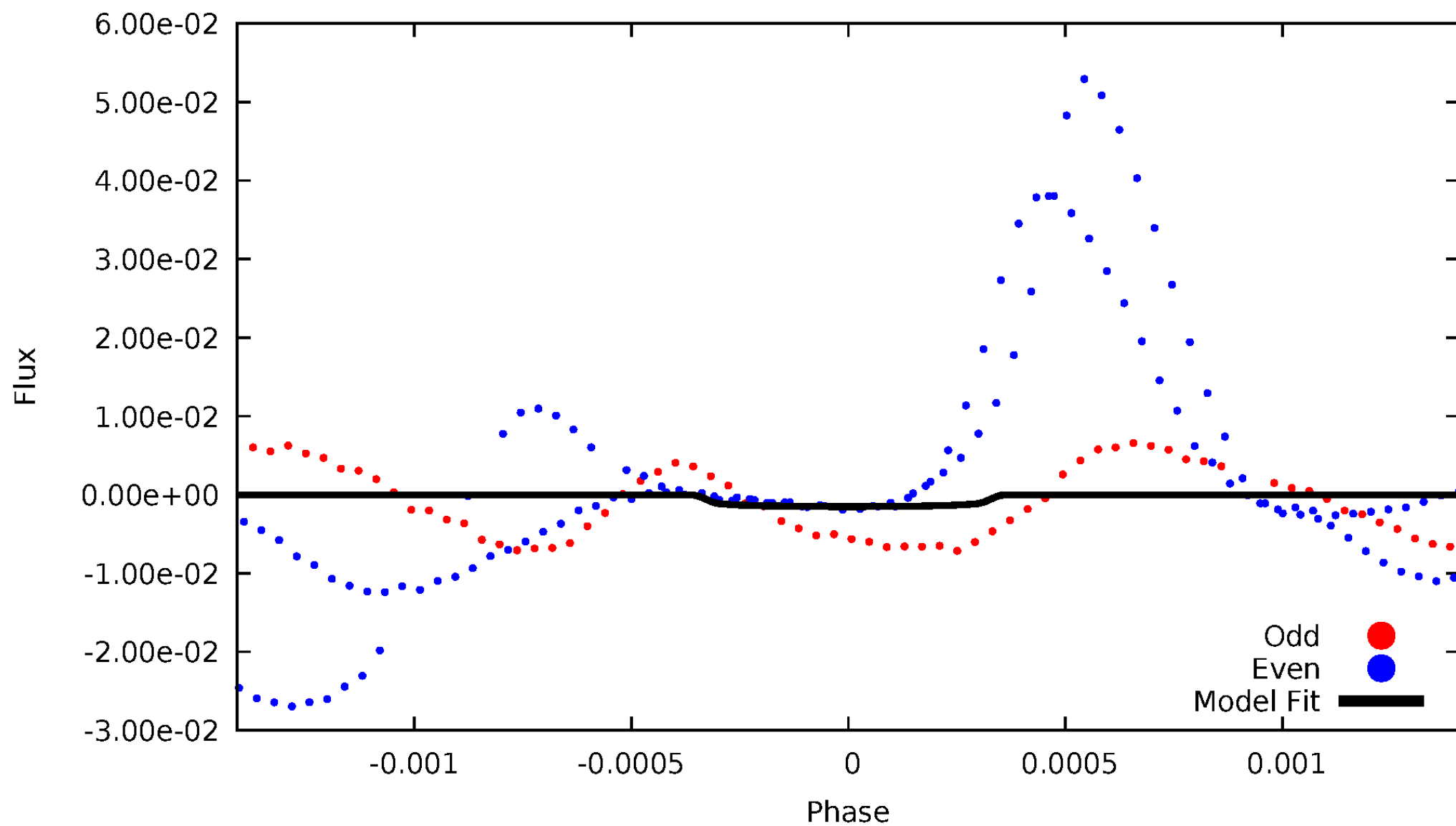


# TCE 010669516-01



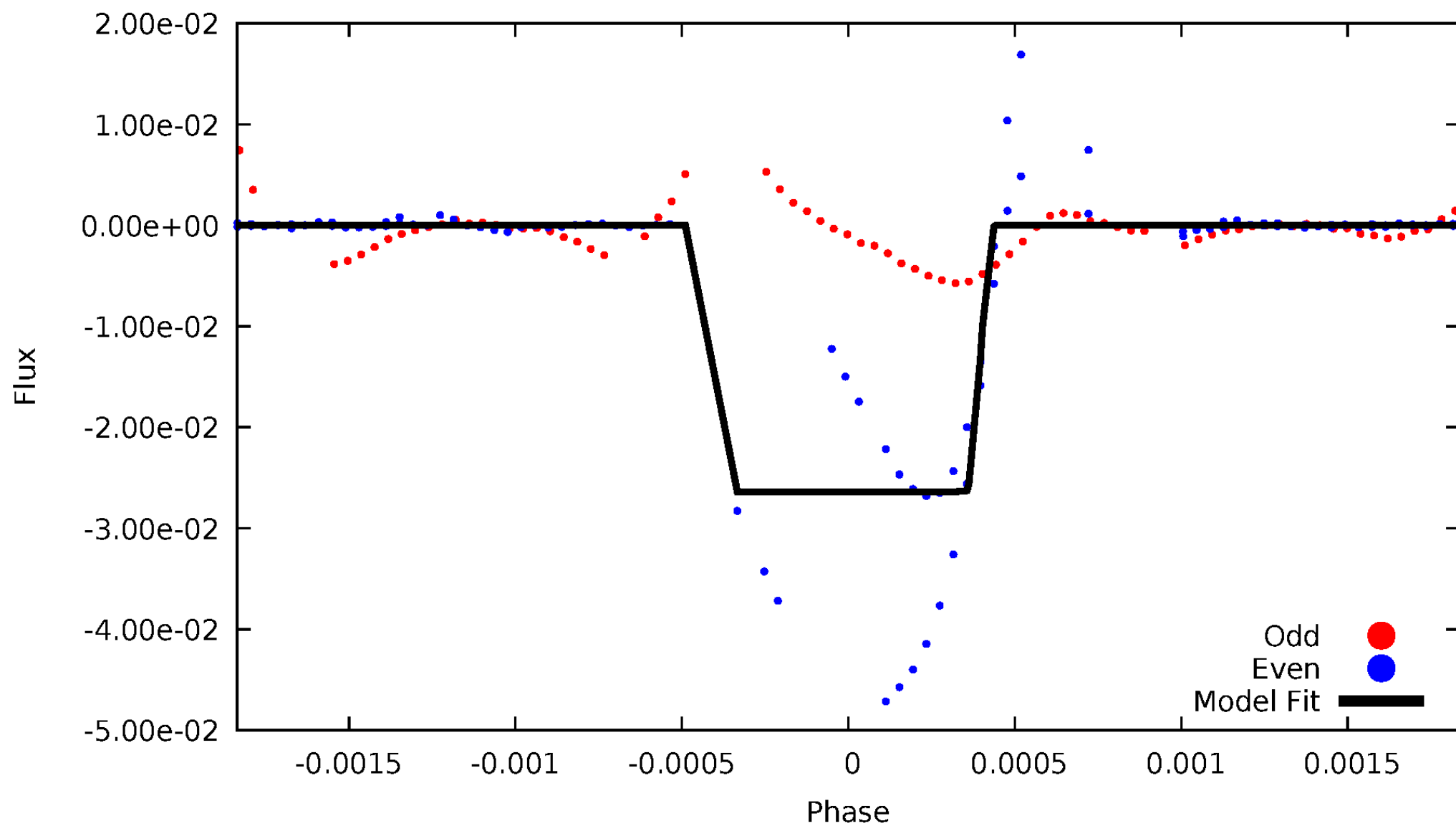
# DV Odd/Even

TCE 010669516-01



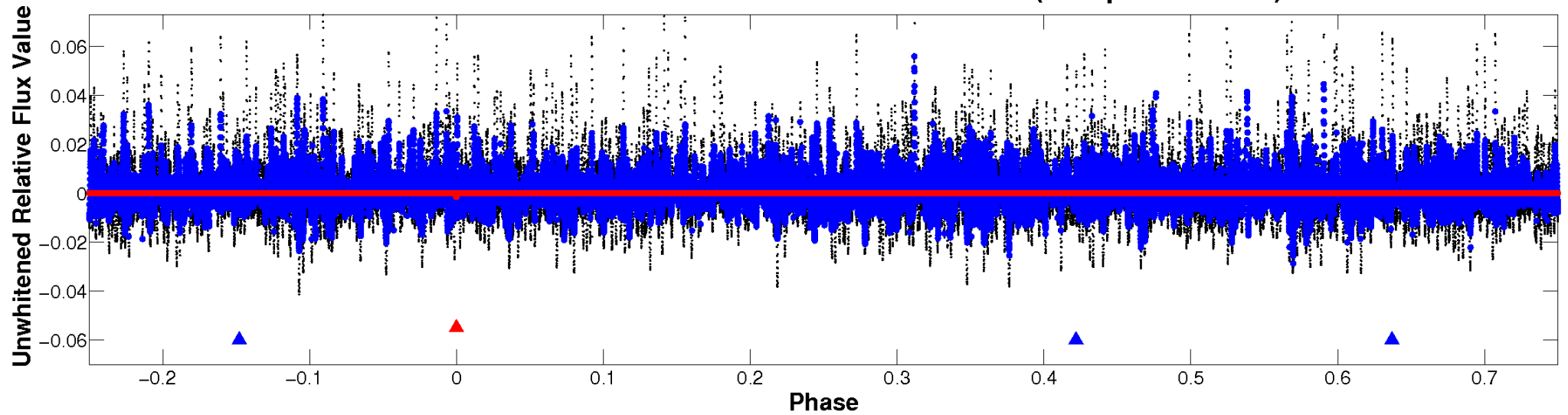
# ALT Odd/Even

TCE 010669516-01

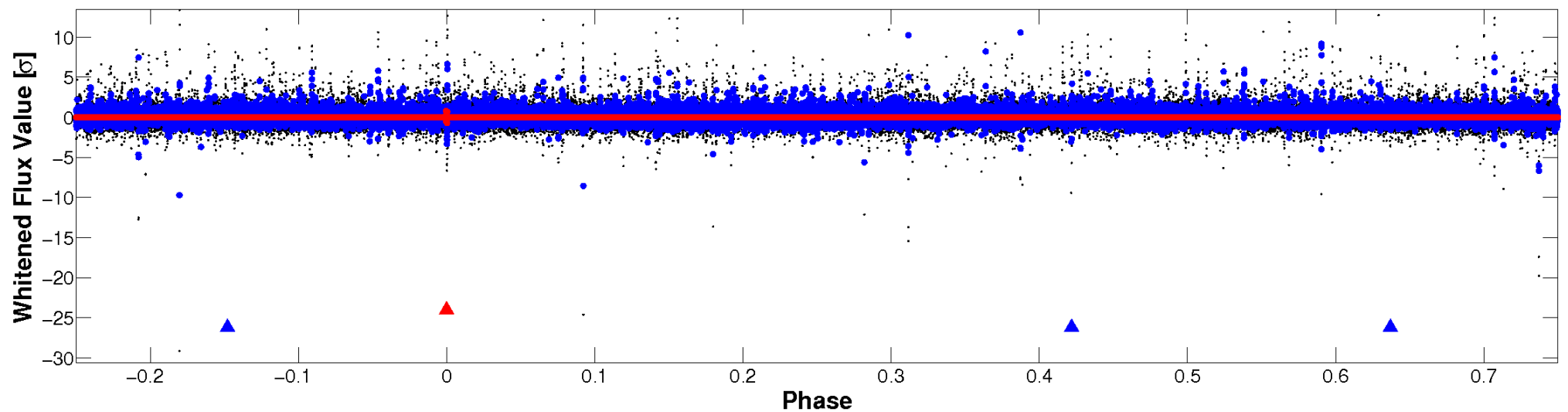


# Non-Whitened Vs. Whitened Light Curve

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



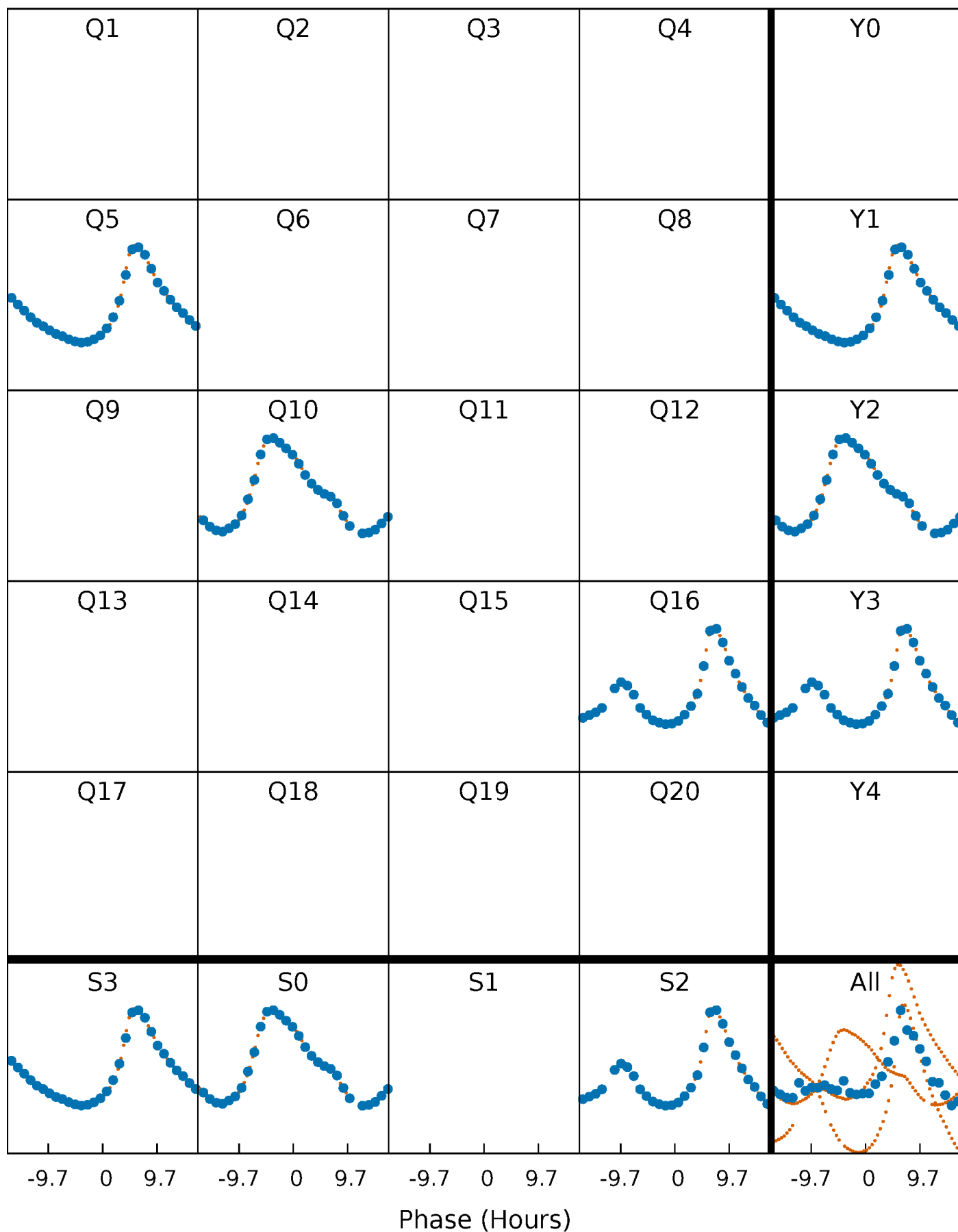
**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**





# PDC Quarter-Phased Transit Curves

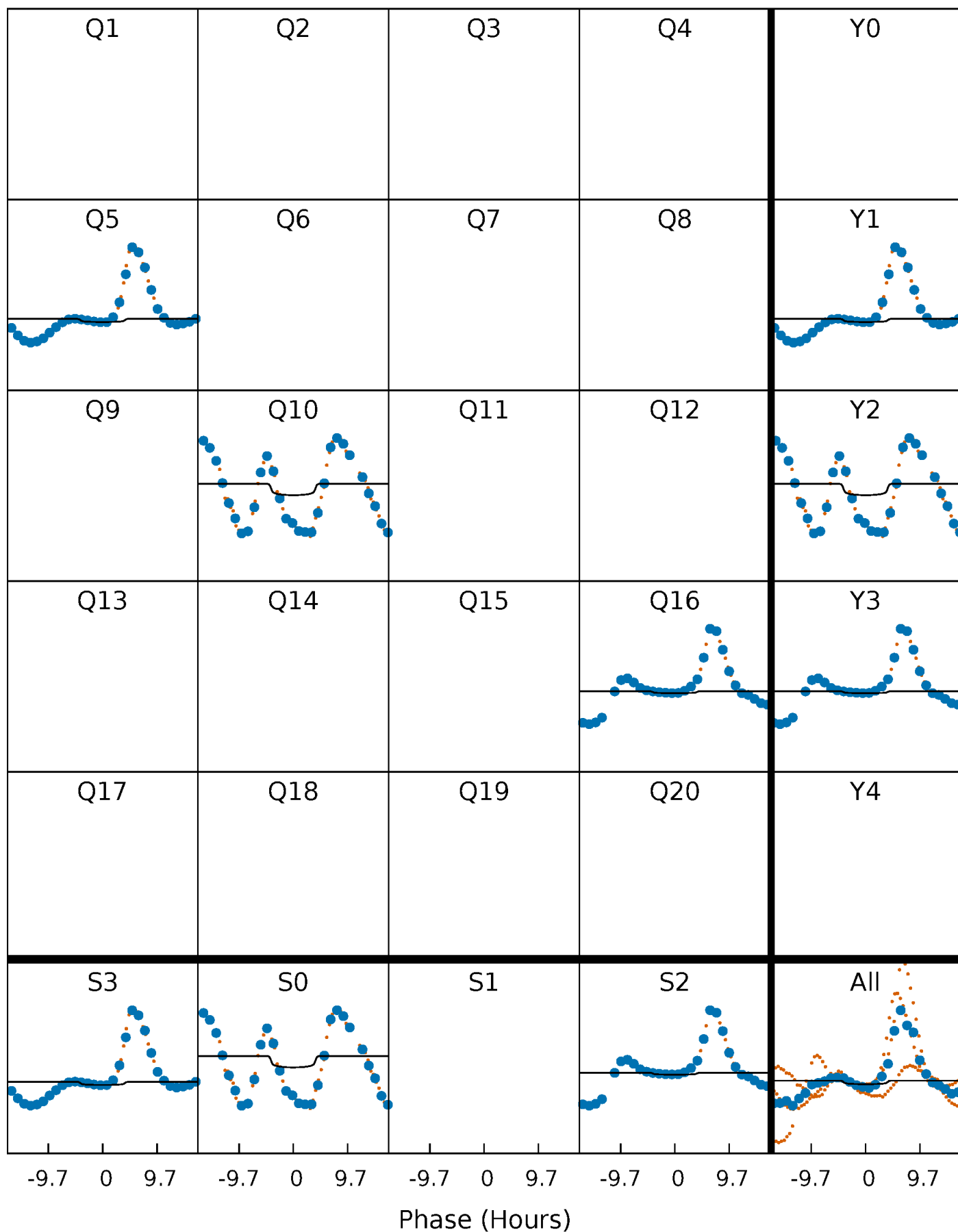
TCE 010669516-01 P=503.741192 Days  $T_0=491.660427$  (BKJD)





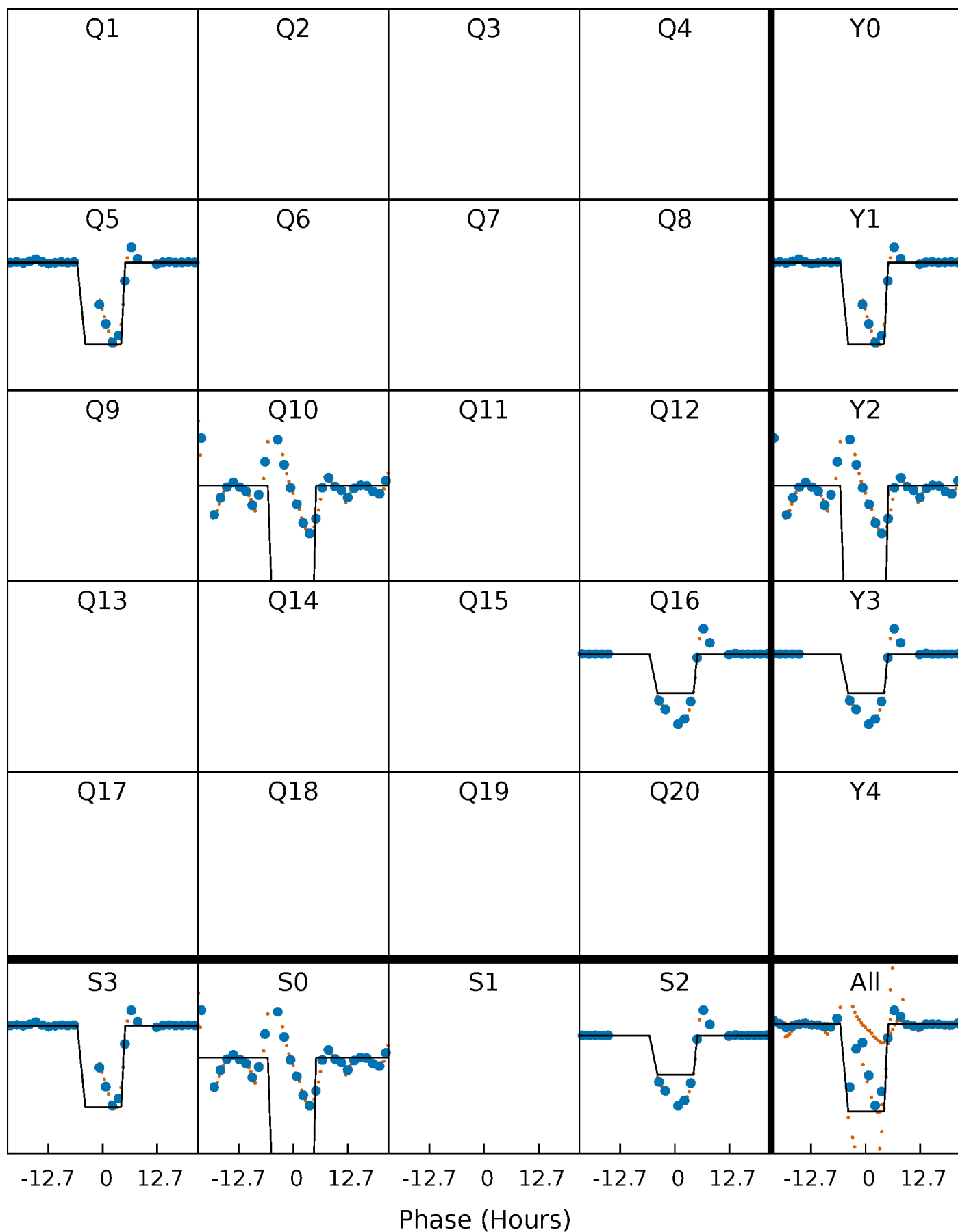
# DV Quarter-Phased Transit Curves

TCE 010669516-01 P=503.741192 Days  $T_0=491.660427$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

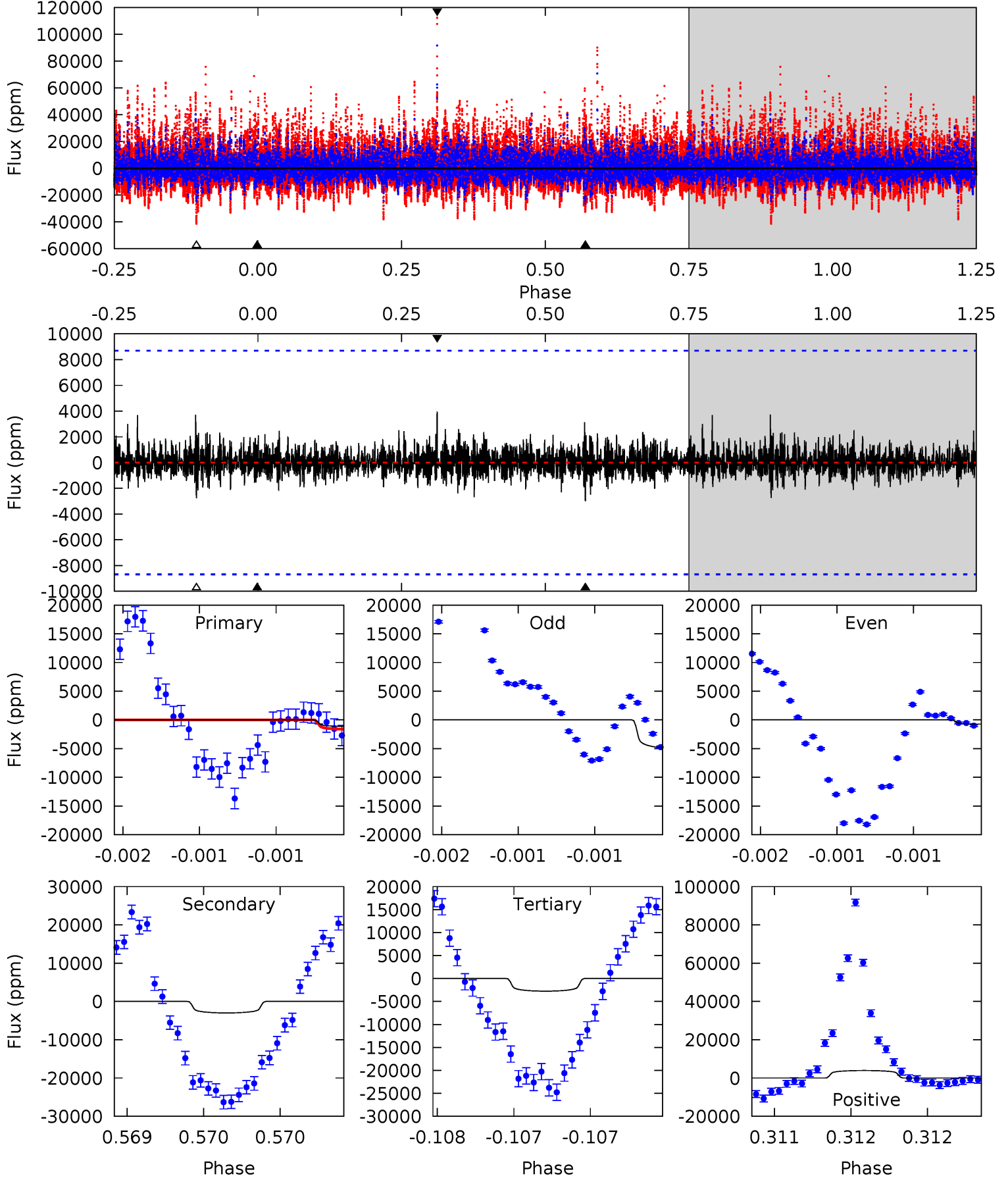
TCE 010669516-01 P=503.768988 Days  $T_0=491.617446$  (BKJD)



# DV Model-Shift Uniqueness Test

010669516-01, P = 503.741192 Days, E = 491.660427 Days

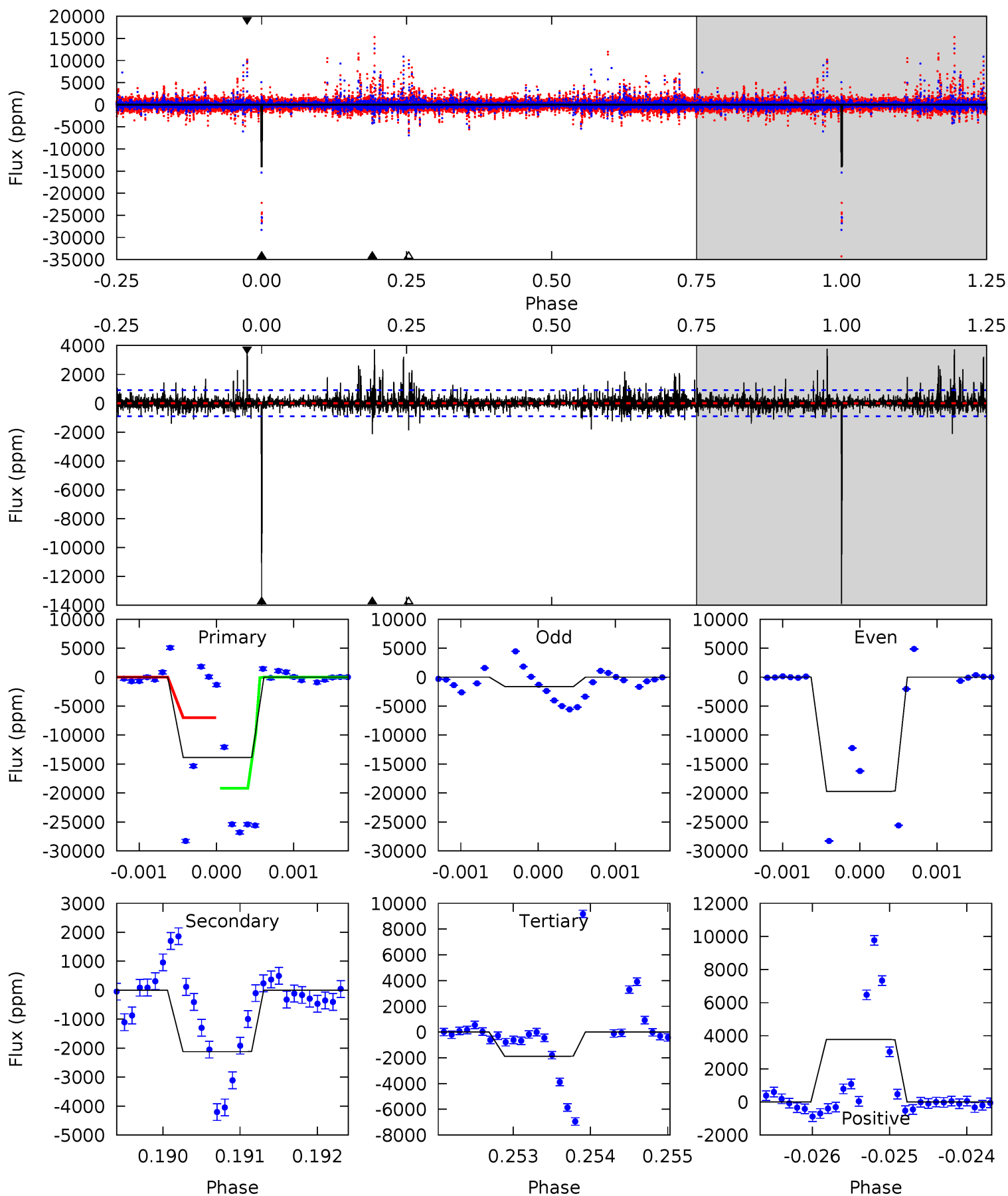
| Pri  | Sec  | Ter  | Pos  | FA <sub>1</sub> | FA <sub>2</sub> | F <sub>Red</sub> | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM   | Shape | TAT  |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|-------|-------|------|
| 0.72 | 1.90 | 1.75 | 2.48 | 5.51            | 3.38            | 0.52             | -1.03   | -1.76   | 0.15    | -0.58   | 1.18    | -4.26 | 0.57  | 0.32 |



# Alt Model-Shift Uniqueness Test

010669516-01, P = 503.768988 Days, E = 491.617446 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  |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 84.7 | 12.9 | 11.4 | 23.0 | 5.50            | 3.36            | 1.82             | 73.2    | 61.7    | 1.48    | -10.1   | 32.5    | 0.93 | 0.21  | 36.9 |



### Stellar Parameters For KIC 010669516

|        | $T_{\text{eff}} (K)$ | $\log(g)$                 | $[\text{Fe}/\text{H}]$     | $R (R_{\odot})$           | $M (M_{\odot})$           | $p_{\star} (\text{g}\cdot\text{cm}^{-3})$ |
|--------|----------------------|---------------------------|----------------------------|---------------------------|---------------------------|-------------------------------------------|
|        | $7204^{+199}_{-299}$ | $4.009^{+0.240}_{-0.160}$ | $-0.180^{+0.250}_{-0.350}$ | $2.029^{+0.542}_{-0.663}$ | $1.531^{+0.205}_{-0.308}$ | $0.258^{+0.384}_{-0.117}$                 |
|        | +3%/-4%              | +6%/-4%                   | +139%/-194%                | +27%/-33%                 | +13%/-20%                 | +149%/-45%                                |
| Source | PHO1                 | KIC0                      | KIC0                       | DSEP                      |                           |                                           |

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

### Secondary Eclipse Parameters for KIC 010669516-01 / KOI

| Detrend | Depth (ppm)      | $R_p (R_{\oplus})$      | $T_{\text{max}} (K)$ | $T_{\text{obs}} (K)$   | $A_{\text{obs}}$          |
|---------|------------------|-------------------------|----------------------|------------------------|---------------------------|
| DV      | $-2996 \pm 1579$ | $8.16^{+3.42}_{-2.85}$  | $525^{+42}_{-42}$    | $8821^{+4025}_{-2221}$ | $47615^{+78654}_{-30675}$ |
| Alt.    | $-2120 \pm 164$  | $35.51^{+6.56}_{-5.92}$ | $523^{+39}_{-39}$    | $4078^{+151}_{-153}$   | $1863^{+742}_{-520}$      |

$T_{\text{max}}$  = 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

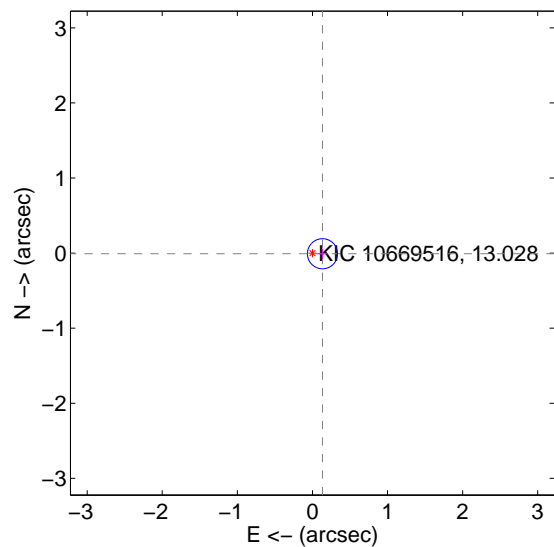
Supplemental centroid analysis for 010669516-01. Kepler magnitude: 13.03. Transit SNR 2.31

There are 1 quarters with good PRF difference image offsets

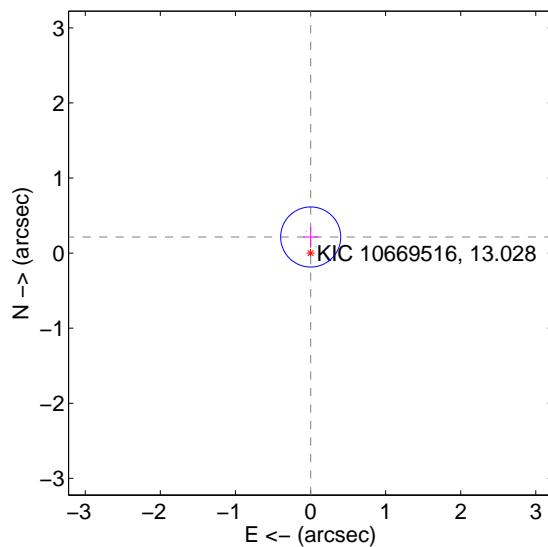
The direct PRF centroid is offset from the target star catalog position by about 0.36 arcsec

|                                         | Distance in arcsec | Distance / $\sigma$ | $\Delta$ RA        | $\Delta$ Dec       |
|-----------------------------------------|--------------------|---------------------|--------------------|--------------------|
| PRF-fit source offset from OOT          | $0.134 \pm 0.067$  | 2.00                | $-0.134 \pm 0.067$ | $-0.009 \pm 0.068$ |
| PRF-fit source offset from KIC position | $0.214 \pm 0.133$  | 1.61                | $-0.002 \pm 0.101$ | $0.214 \pm 0.133$  |
| photometric centroid source offset      | $0.94 \pm 0.58$    | 1.60                | $-0.91 \pm 0.60$   | $0.22 \pm 0.25$    |

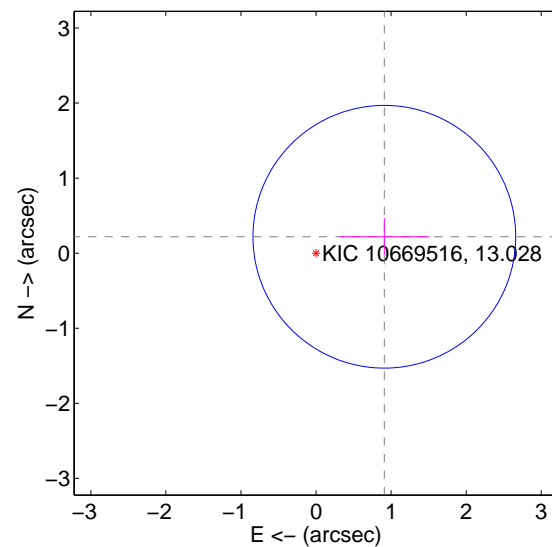
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



offset from photometric centroids



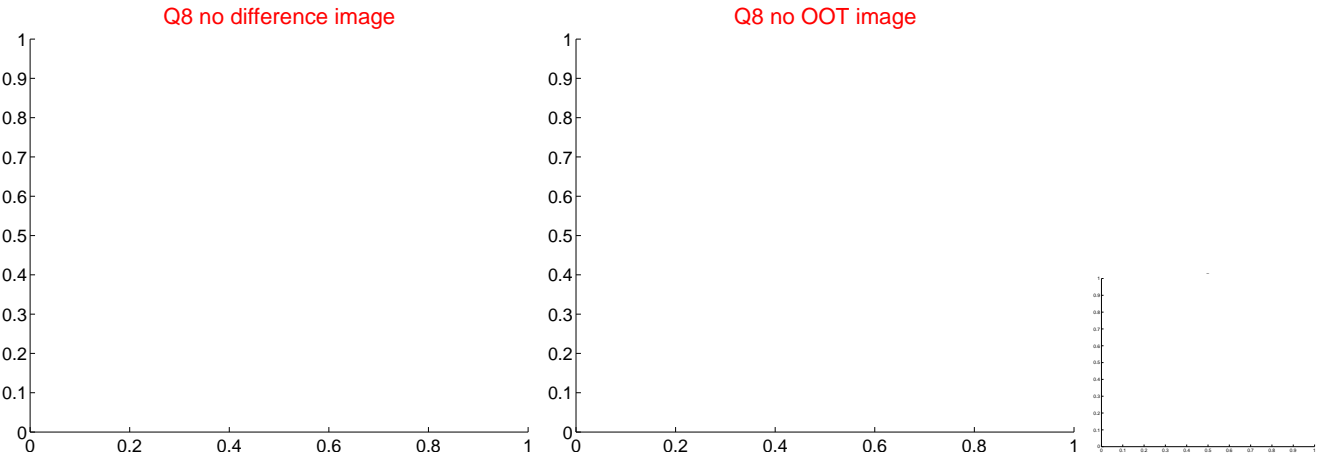
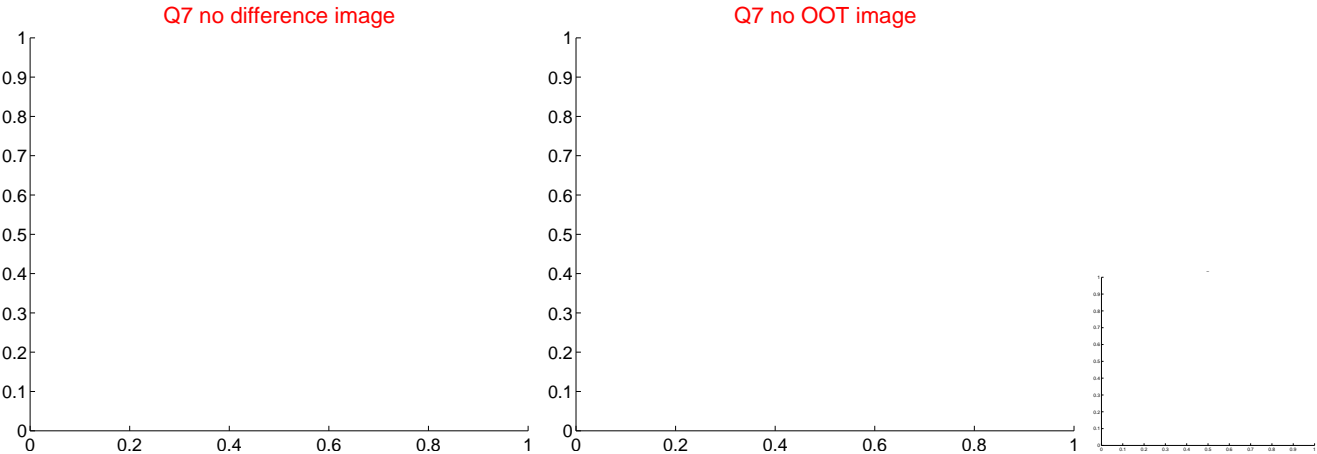
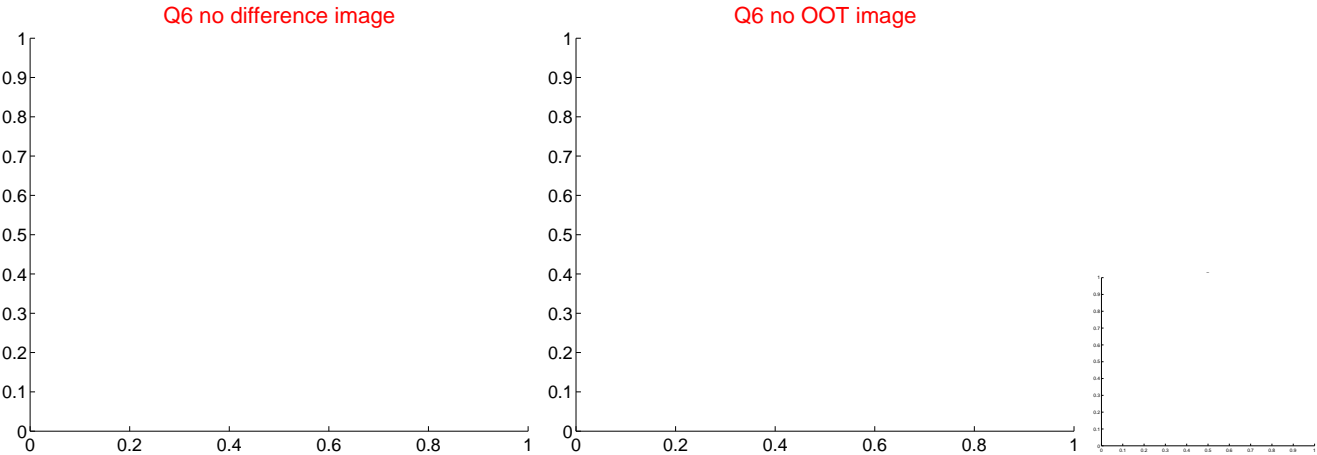
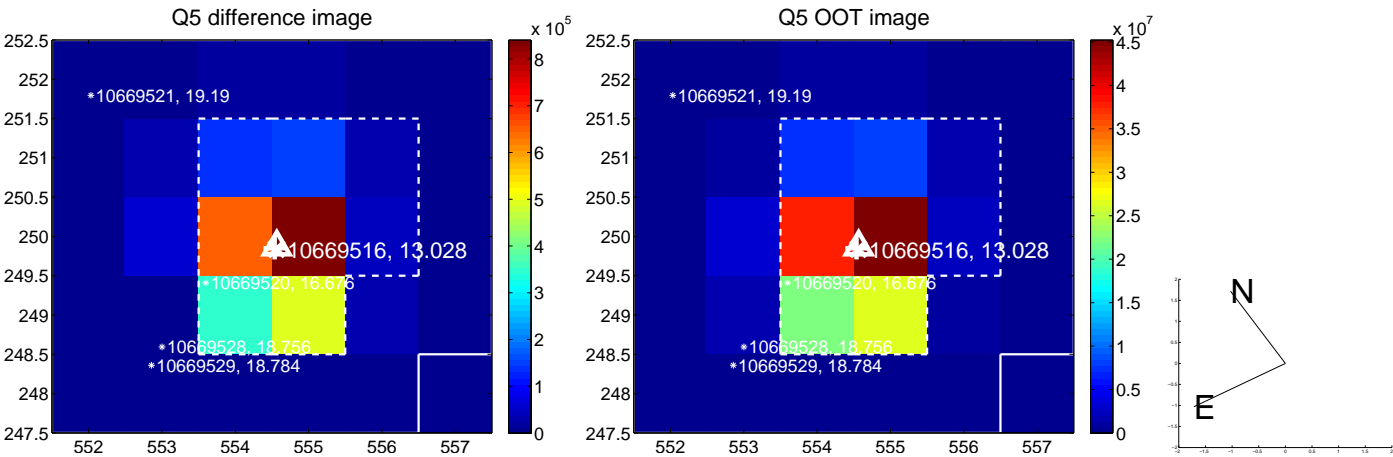
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

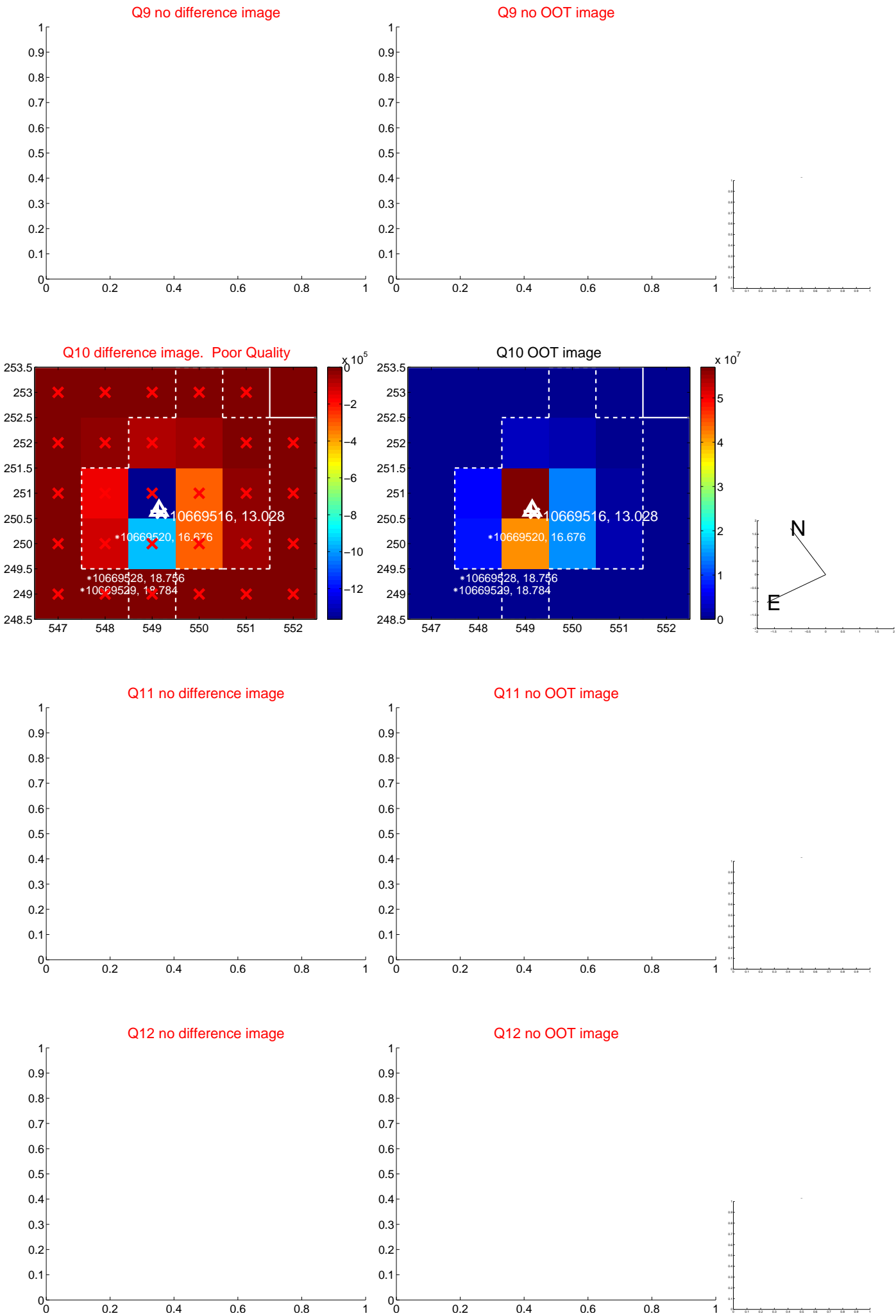




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



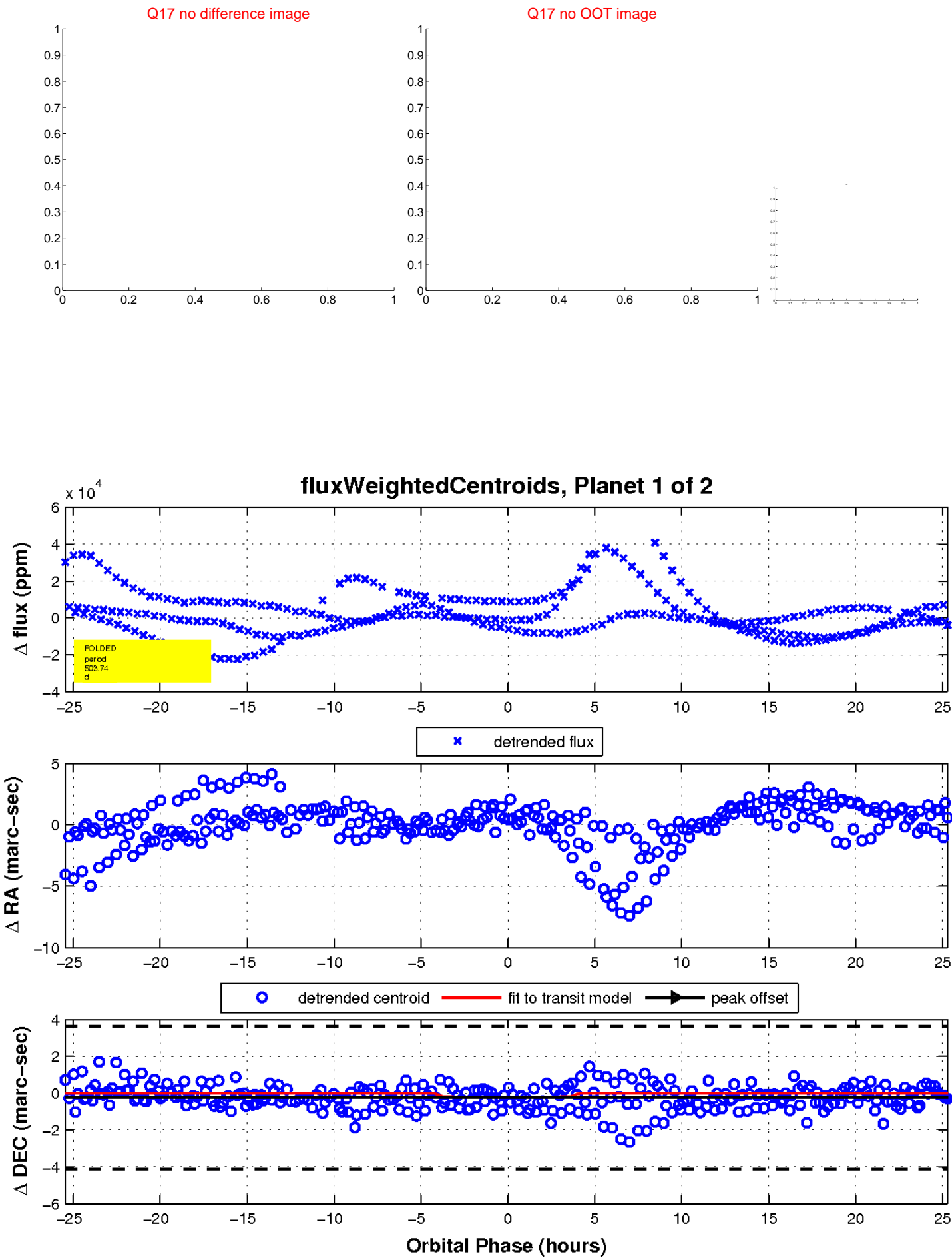
white ×: KIC target position; +: OOT centroid; △: difference centroid. red ×: large negative pixel value.



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

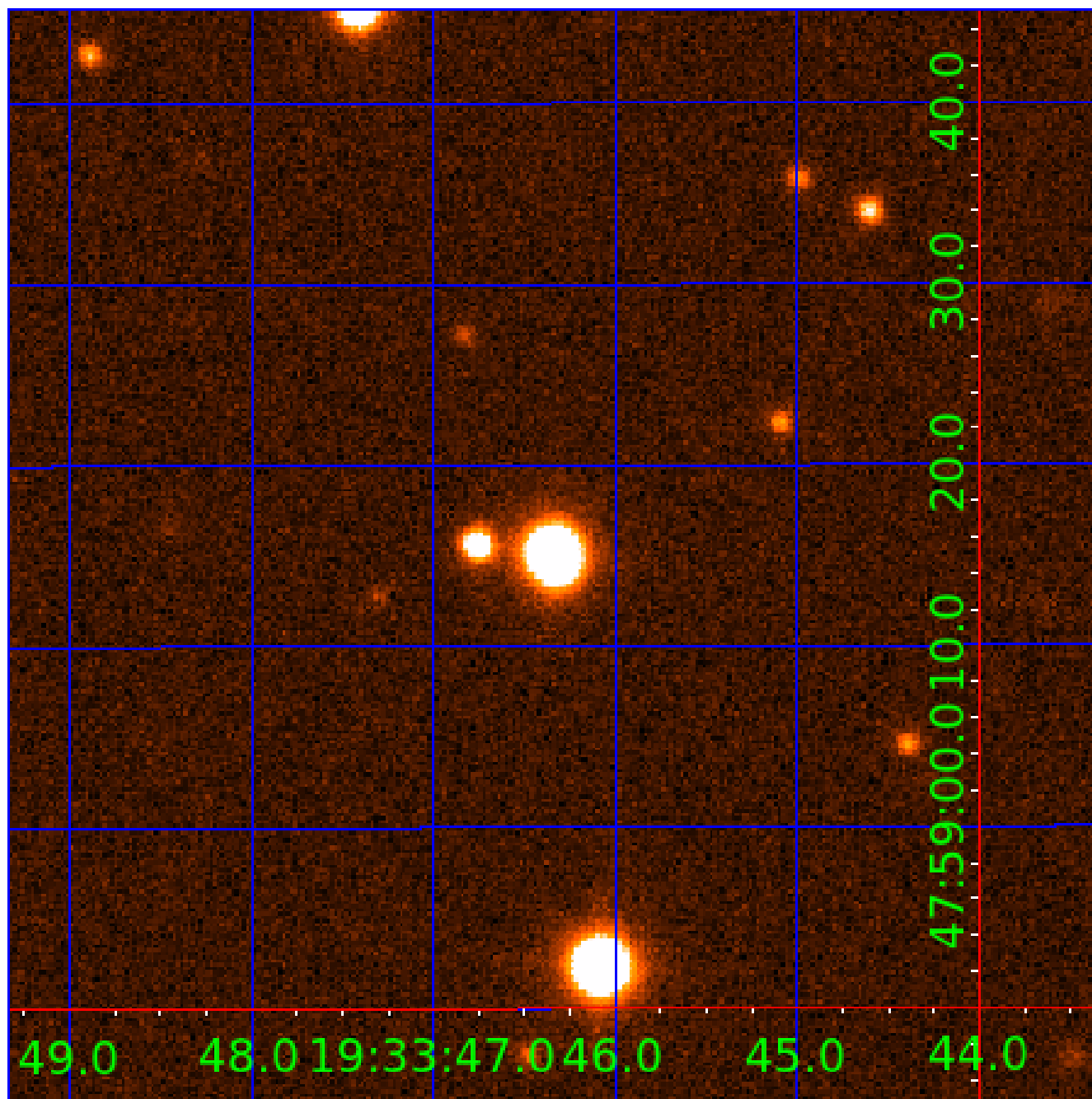


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 010669516

## 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) | $R_p$ ( $R_{\oplus}$ ) | $S_p$ ( $S_{\oplus}$ ) |
|--------------|----------|------|---------------|--------------|-------------|------------------|------|------|-----------------------------|-----------------|------------------------|------------------------|
| 010669516-01 | OBS      | No   | 503.741192    | 491.660426   | 1526.1      | 8.510            | 18.3 | 2.3  | 2.03                        | 7204            | 8.37                   | 4.87                   |
| 010669516-02 | OBS      | No   | 395.355573    | 417.184315   | 12597.5     | 6.010            | 15.9 | 12.1 | 2.03                        | 7204            | 39.64                  | 6.72                   |

## Robovetter Results

| TCE          | Run Type | Disp | Score | N | S | C | E | Comments                                                                                                               |
|--------------|----------|------|-------|---|---|---|---|------------------------------------------------------------------------------------------------------------------------|
| 010669516-01 | OBS      | FP   | 0.00  | 1 | 0 | 0 | 0 | INDIV_TRANS_CHASES_ZUMA—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS |
| 010669516-02 | OBS      | FP   | 0.00  | 1 | 0 | 0 | 0 | INDIV_TRANS_CHASES—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS                                           |

**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.

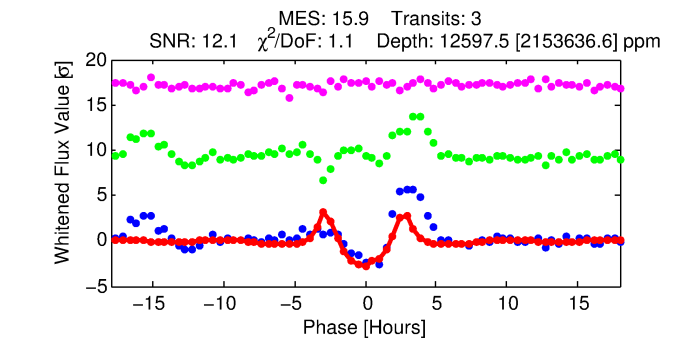
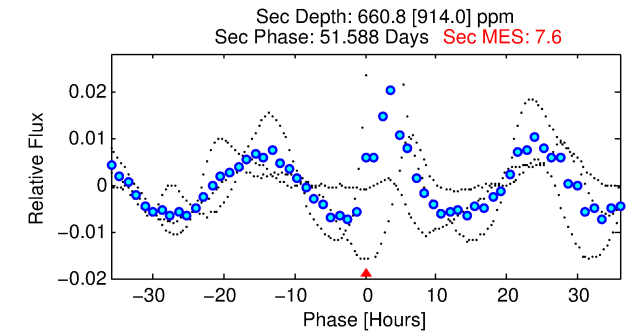
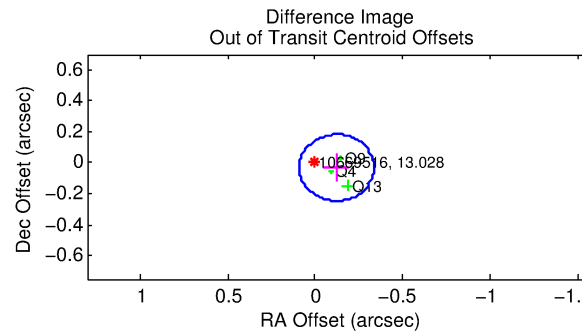
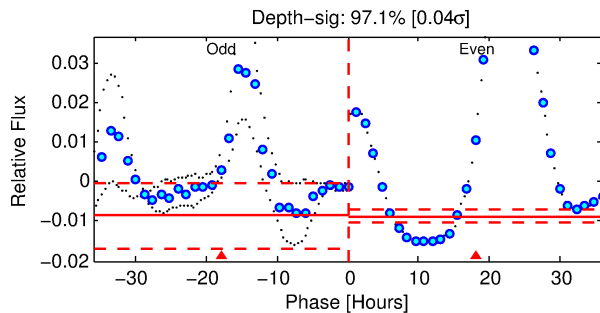
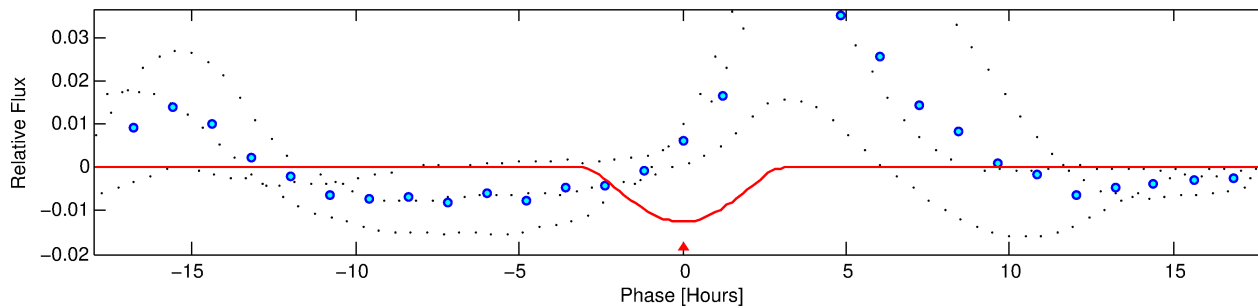
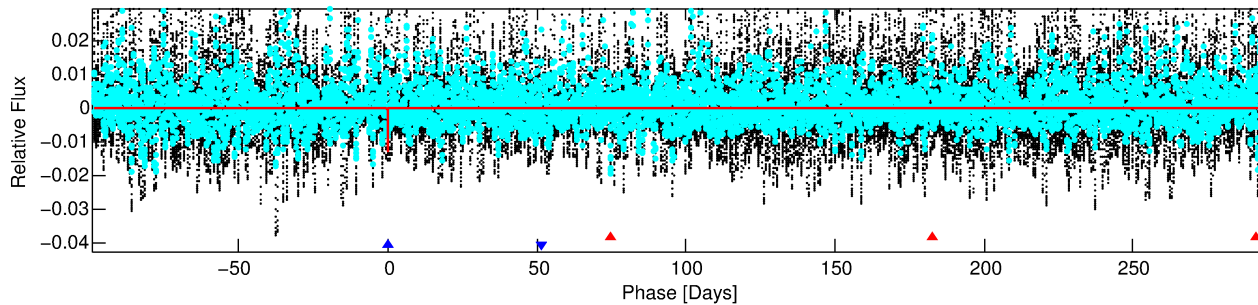
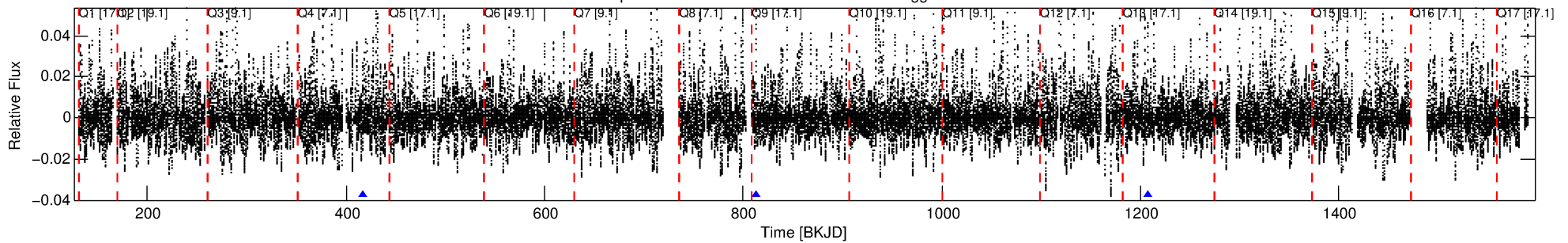
## Ephemeris Match Information For 010669516-02

No Significant Match Found

# DV One-Page Summary

KIC: 10669516 Candidate: 2 of 2 Period: 395.356 d

Kp: 13.03 R\*: 2.03 Rs Teff: 7204.0 K Logg: 4.01 Fe/H: -0.180



## DV Fit Results:

Period = 395.35557 [0.00351] d  
Epoch = 417.1843 [0.0047] BKJD  
Rp/R\* = 0.1790 [0.1532]  
a/R\* = 313.91 [35.77]  
b = 1.00 [20.78]  
Seff = 6.72 [3.09]  
Teq = 411 [47] K  
Rp = 39.64 [36.31] Re  
a = 1.2158 [0.3469] AU  
Ag = 341.99 [766.56] [0.44σ]  
Teffp = 2730 [1506] K [1.54σ]

## DV Diagnostic Results:

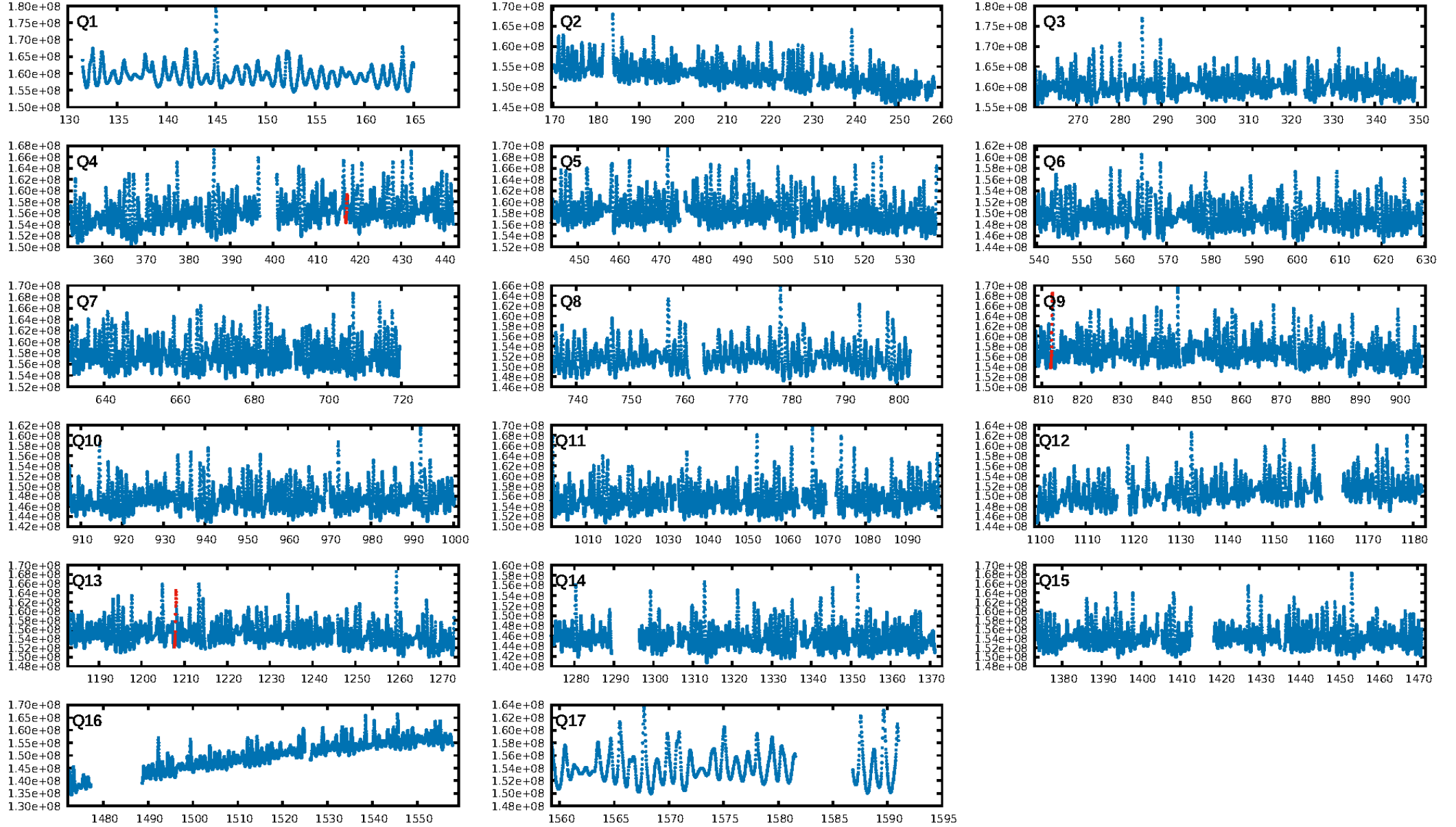
ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [249.69σ]  
ModelChiSquare2-sig: 20.4%  
ModelChiSquareGof-sig: 77.6%  
Bootstrap-pfa: 3.05e-08  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 0.9294  
Centroid-sig: N/A  
Centroid-so: 0.058 arcsec [1.76σ]  
OotOffset-rm: 0.125 arcsec [1.75σ]  
KicOffset-rm: 0.079 arcsec [1.08σ]  
OotOffset-st: 0/0/1/2 [3]  
KicOffset-st: 0/0/1/2 [3]  
DiffImageQuality-fgm: 1.00 [3/3]  
DiffImageOverlap-fno: 1.00 [3/3]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 04:09:48 Z

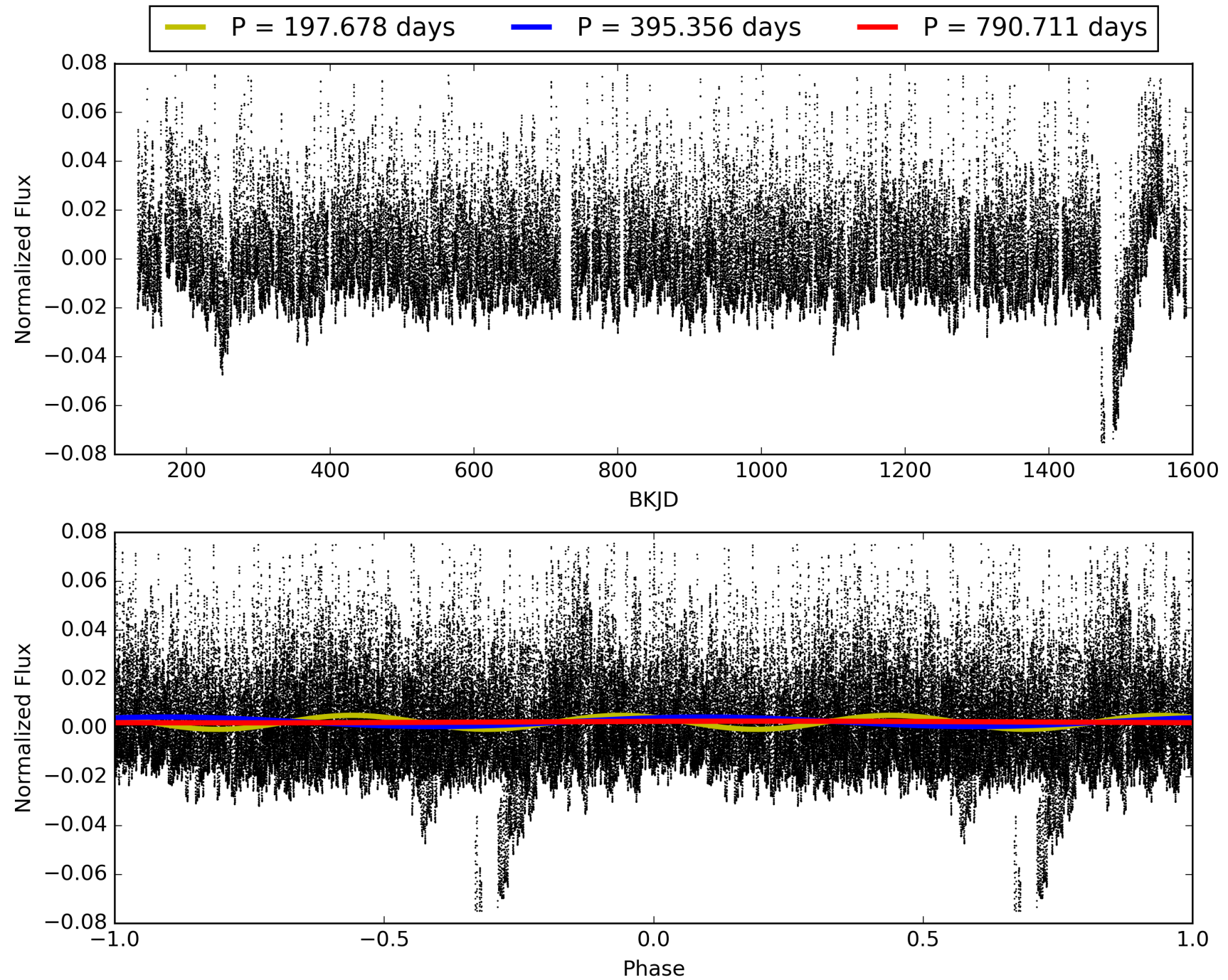
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center



# TCE 010669516-02, PDC Light Curves

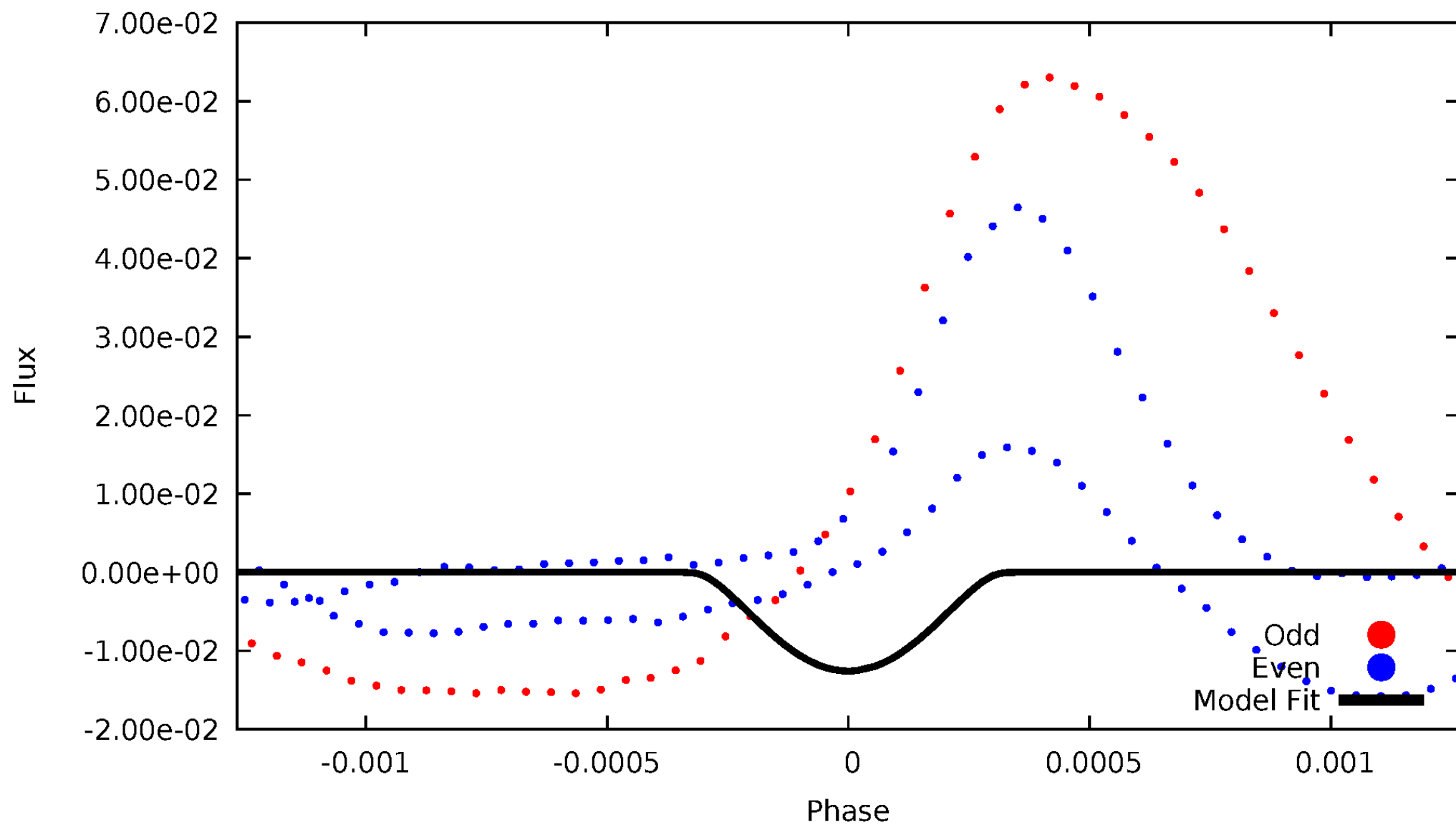


# TCE 010669516-02



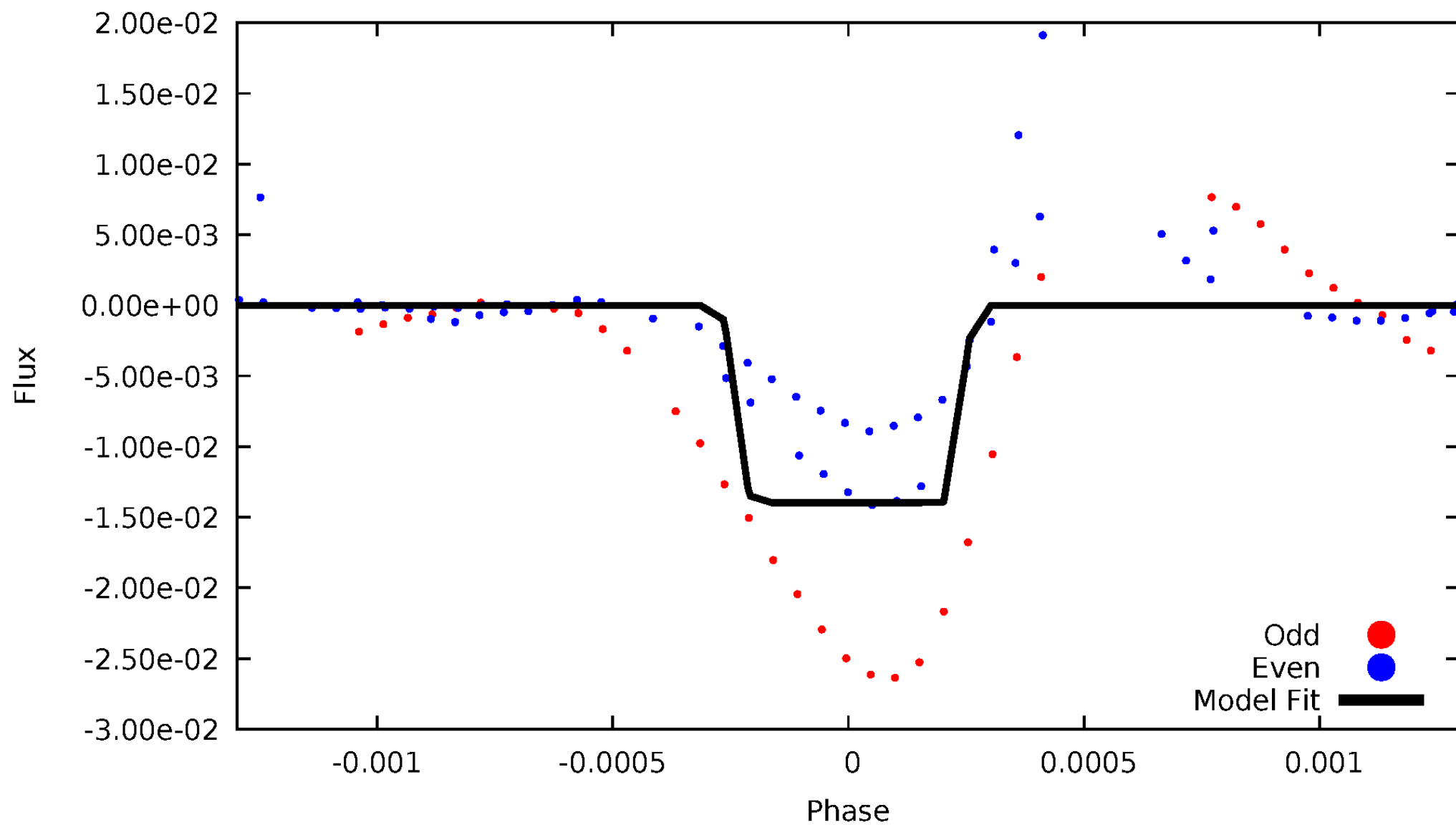
# DV Odd/Even

TCE 010669516-02



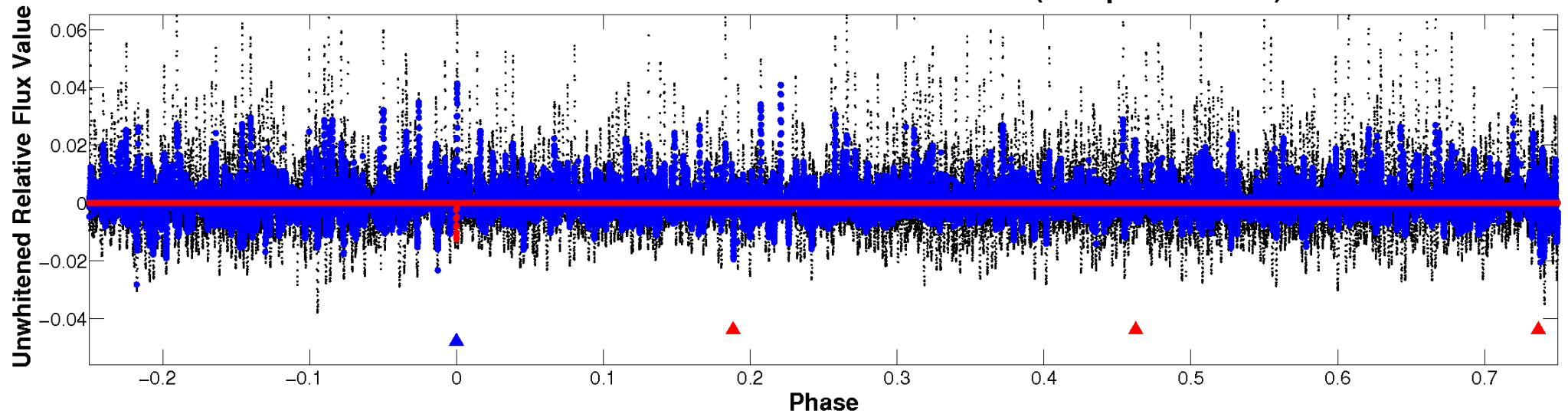
# ALT Odd/Even

TCE 010669516-02

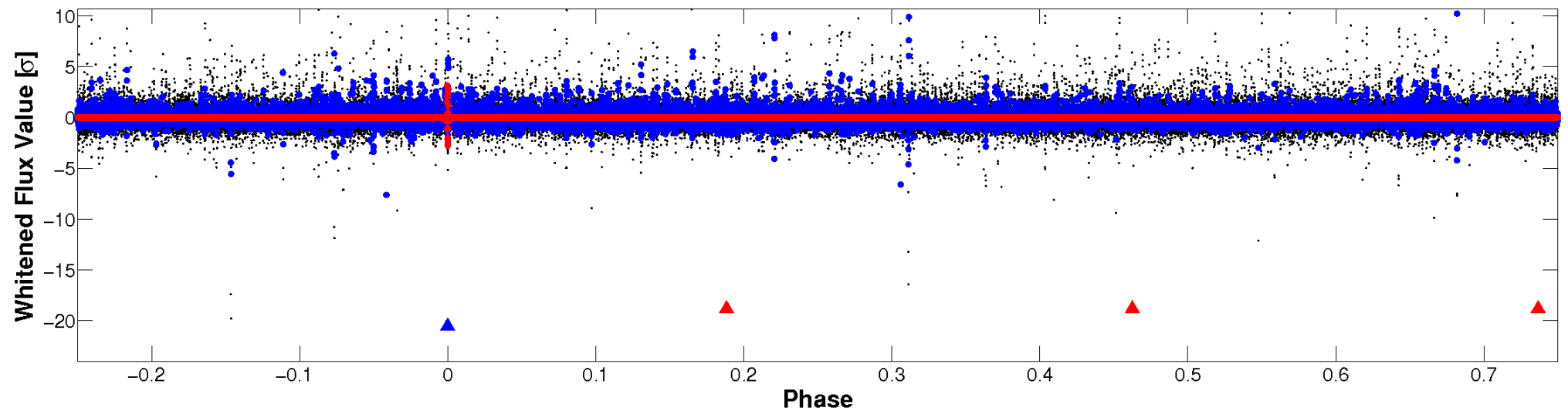


# Non-Whitened Vs. Whitened Light Curve

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

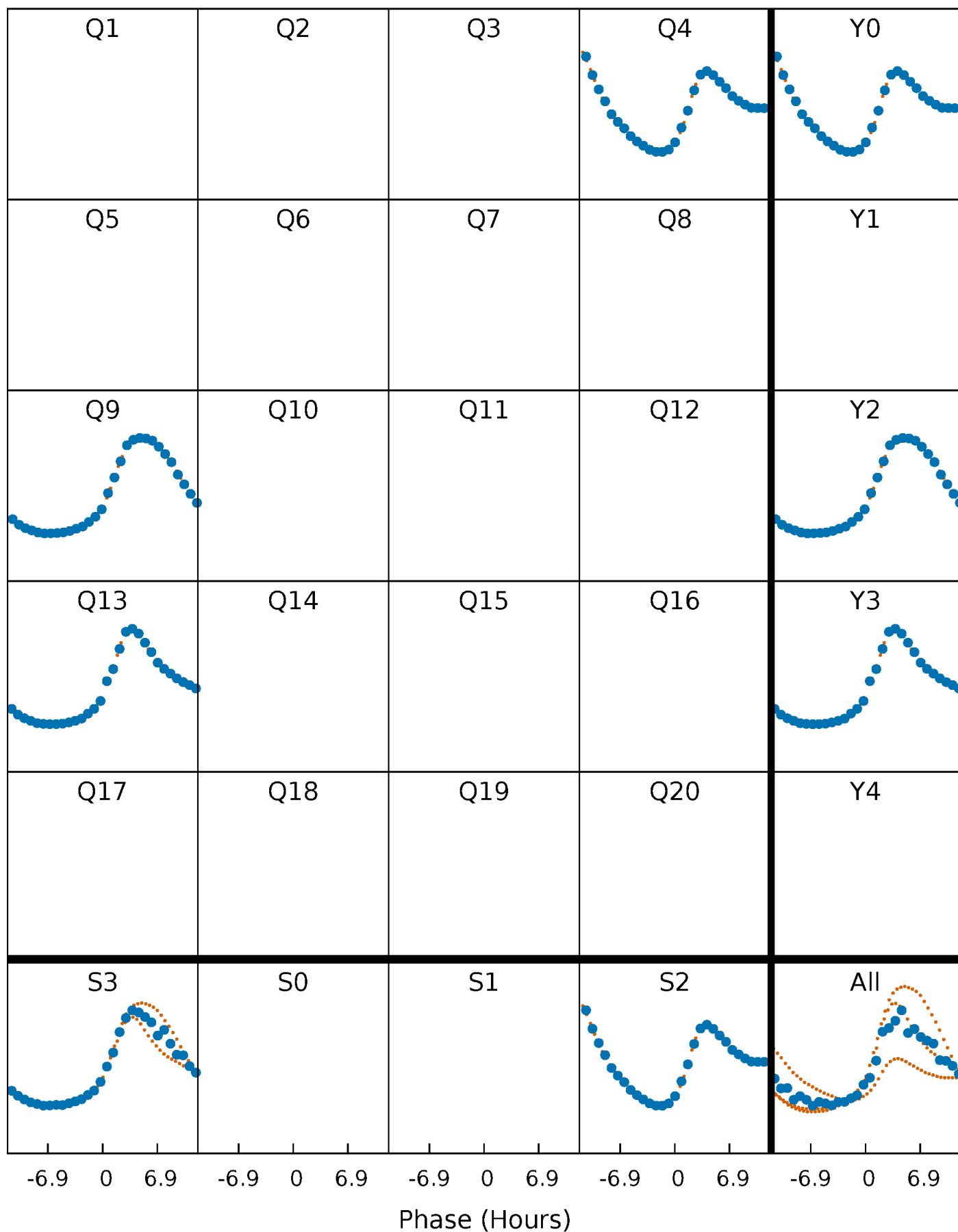


**Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



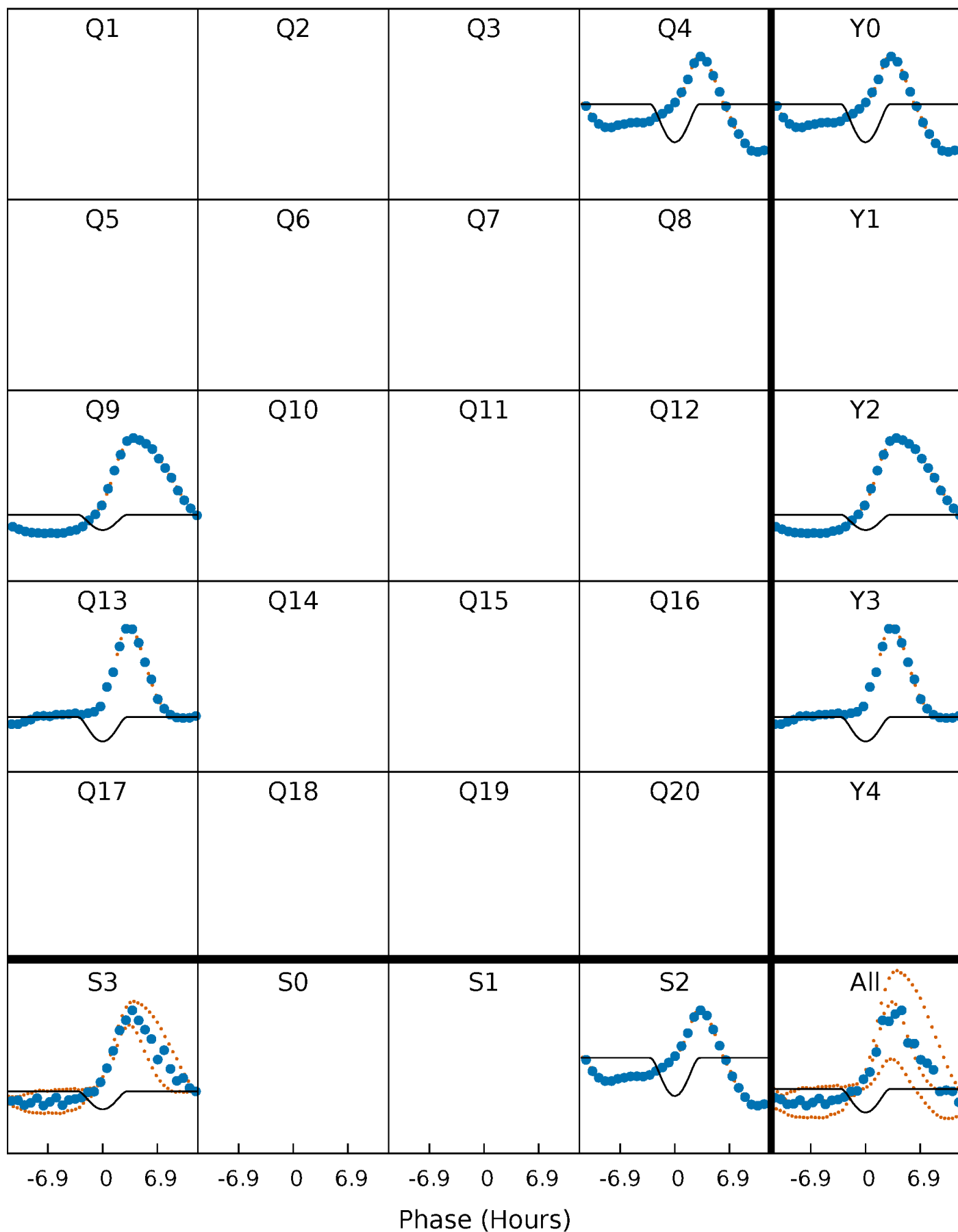
# PDC Quarter-Phased Transit Curves

TCE 010669516-02 P=395.355573 Days  $T_0=417.184315$  (BKJD)



# DV Quarter-Phased Transit Curves

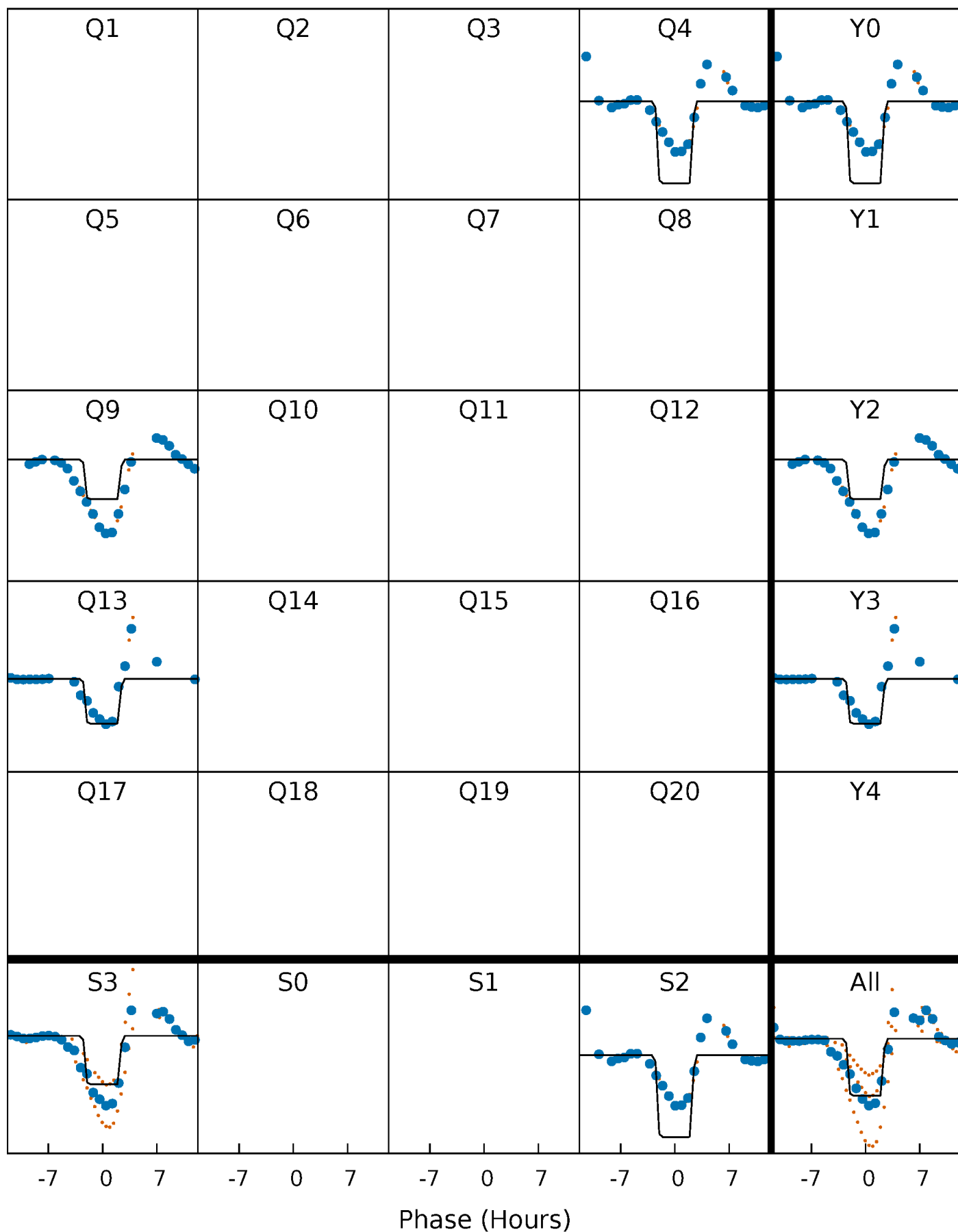
TCE 010669516-02 P=395.355573 Days  $T_0=417.184315$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

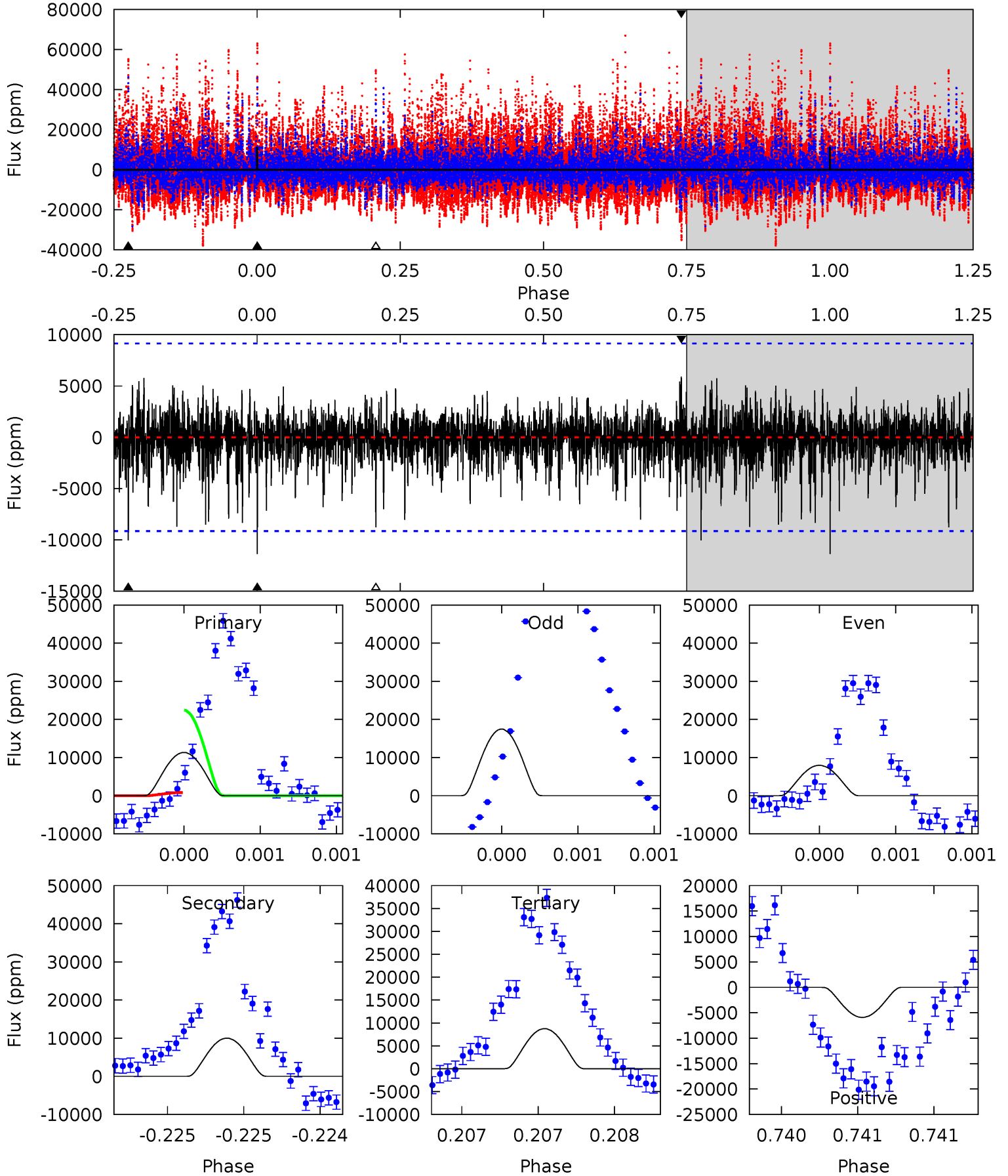
TCE 010669516-02 P=395.348519 Days  $T_0=417.133307$  (BKJD)



# DV Model-Shift Uniqueness Test

010669516-02, P = 395.355573 Days, E = 21.828742 Days

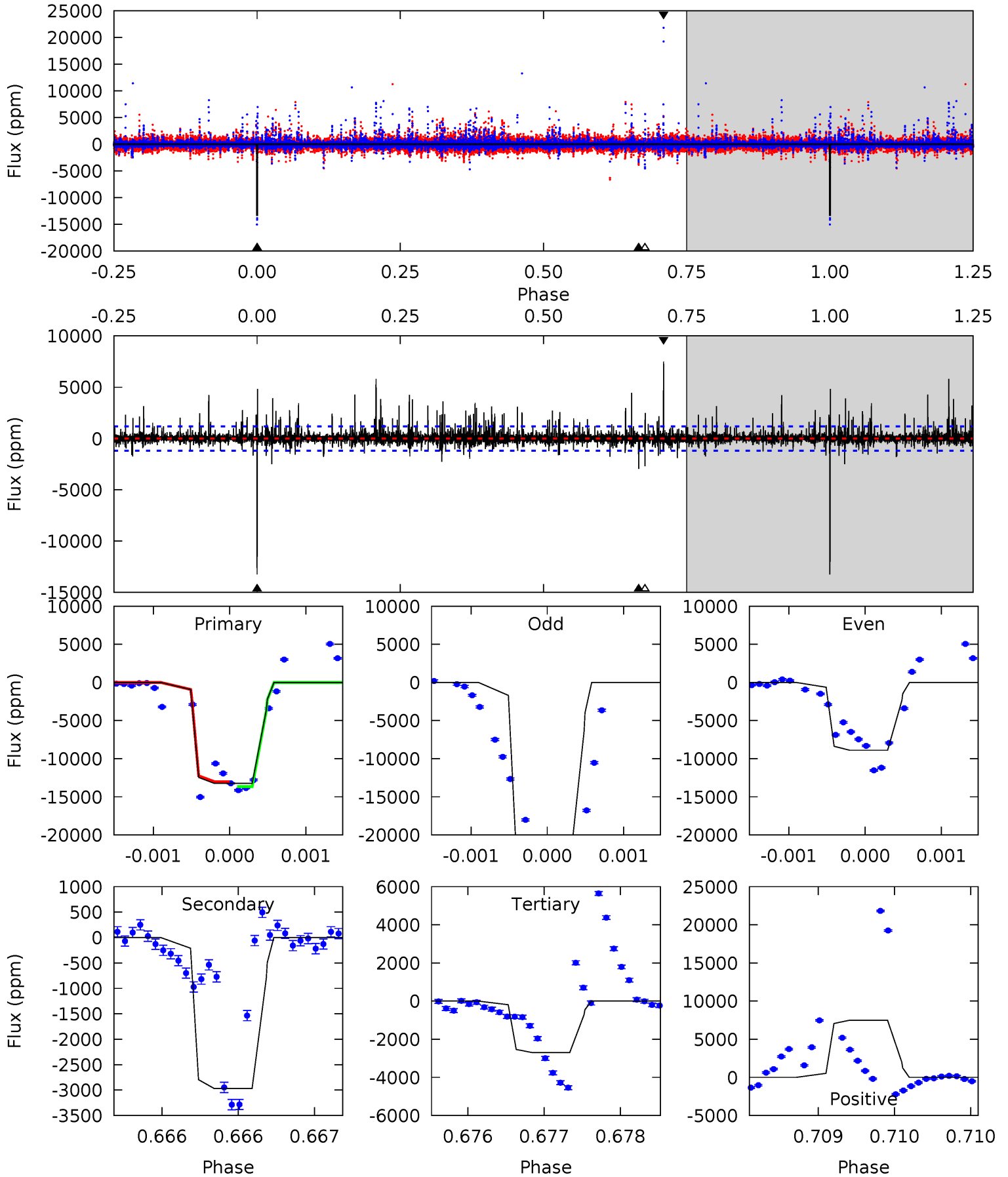
| Pri  | Sec  | Ter  | Pos  | FA <sub>1</sub> | FA <sub>2</sub> | F <sub>Red</sub> | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM  | Shape | TAT  |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 6.87 | 6.06 | 5.30 | 3.58 | 5.53            | 3.41            | 1.11             | 1.57    | 3.28    | 0.76    | 2.48    | 2.56    | 0.76 | 0.34  | 6.60 |



# Alt Model-Shift Uniqueness Test

010669516-02, P = 395.348519 Days, E = 21.784788 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  |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 62.4 | 14.0 | 12.7 | 35.3 | 5.57            | 3.47            | 1.83             | 49.7    | 27.0    | 1.29    | -21.3   | 33.8    | 1.17 | 0.36  | 1.60 |



### Stellar Parameters For KIC 010669516

|        | $T_{\text{eff}}(K)$  | $\log(g)$                 | [Fe/H]                     | $R (R_{\odot})$           | $M(M_{\odot})$            | $\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$ |
|--------|----------------------|---------------------------|----------------------------|---------------------------|---------------------------|----------------------------------------------|
|        | $7204^{+199}_{-299}$ | $4.009^{+0.240}_{-0.160}$ | $-0.180^{+0.250}_{-0.350}$ | $2.029^{+0.542}_{-0.663}$ | $1.531^{+0.205}_{-0.308}$ | $0.258^{+0.384}_{-0.117}$                    |
|        | +3%/-4%              | +6%/-4%                   | +139%/-194%                | +27%/-33%                 | +13%/-20%                 | +149%/-45%                                   |
| Source | PHO1                 | KIC0                      | KIC0                       | DSEP                      |                           |                                              |

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

### Secondary Eclipse Parameters for KIC 010669516-02 / KOI

| Detrend | Depth (ppm)       | $R_p (R_{\oplus})$        | $T_{\text{max}} (K)$ | $T_{\text{obs}} (K)$   | $A_{\text{obs}}$        |
|---------|-------------------|---------------------------|----------------------|------------------------|-------------------------|
| DV      | $-10022 \pm 1654$ | $42.95^{+32.21}_{-27.95}$ | $569^{+41}_{-48}$    | $5155^{+3884}_{-1048}$ | $4405^{+29606}_{-2987}$ |
| Alt.    | $-2969 \pm 212$   | $31.92^{+32.96}_{-20.44}$ | $566^{+46}_{-51}$    | $4496^{+2509}_{-971}$  | $2333^{+15630}_{-1751}$ |

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

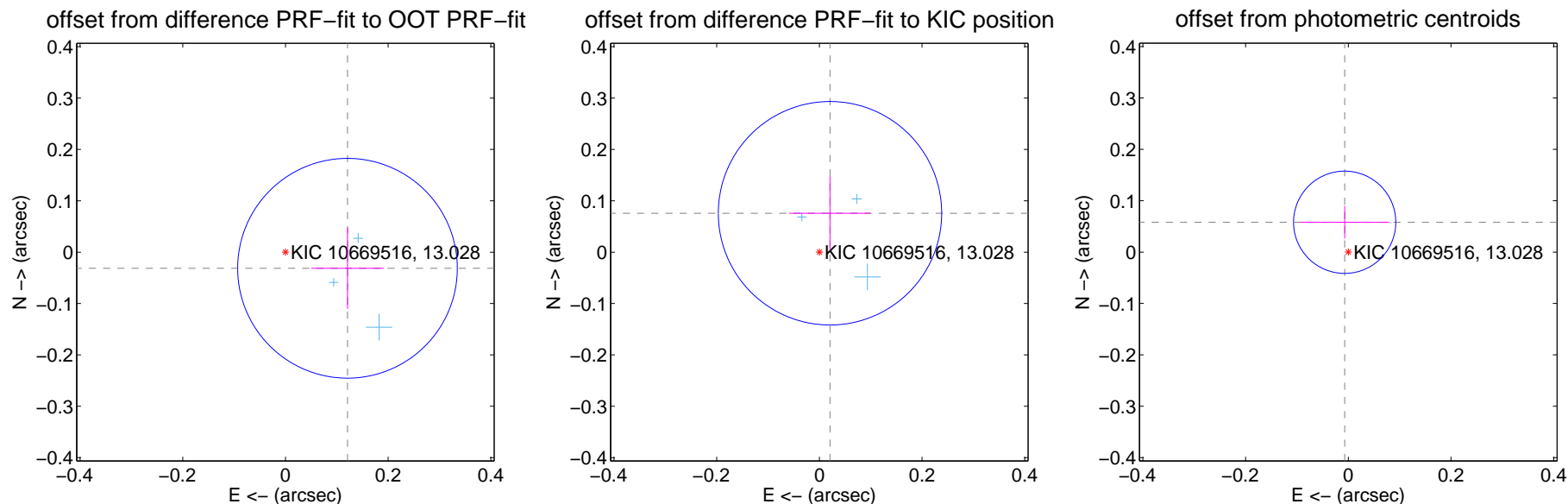
## DV Centroid Data

Supplemental centroid analysis for 010669516-02. Kepler magnitude: 13.03. Transit SNR 12.13

There are 3 quarters with good PRF difference image offsets

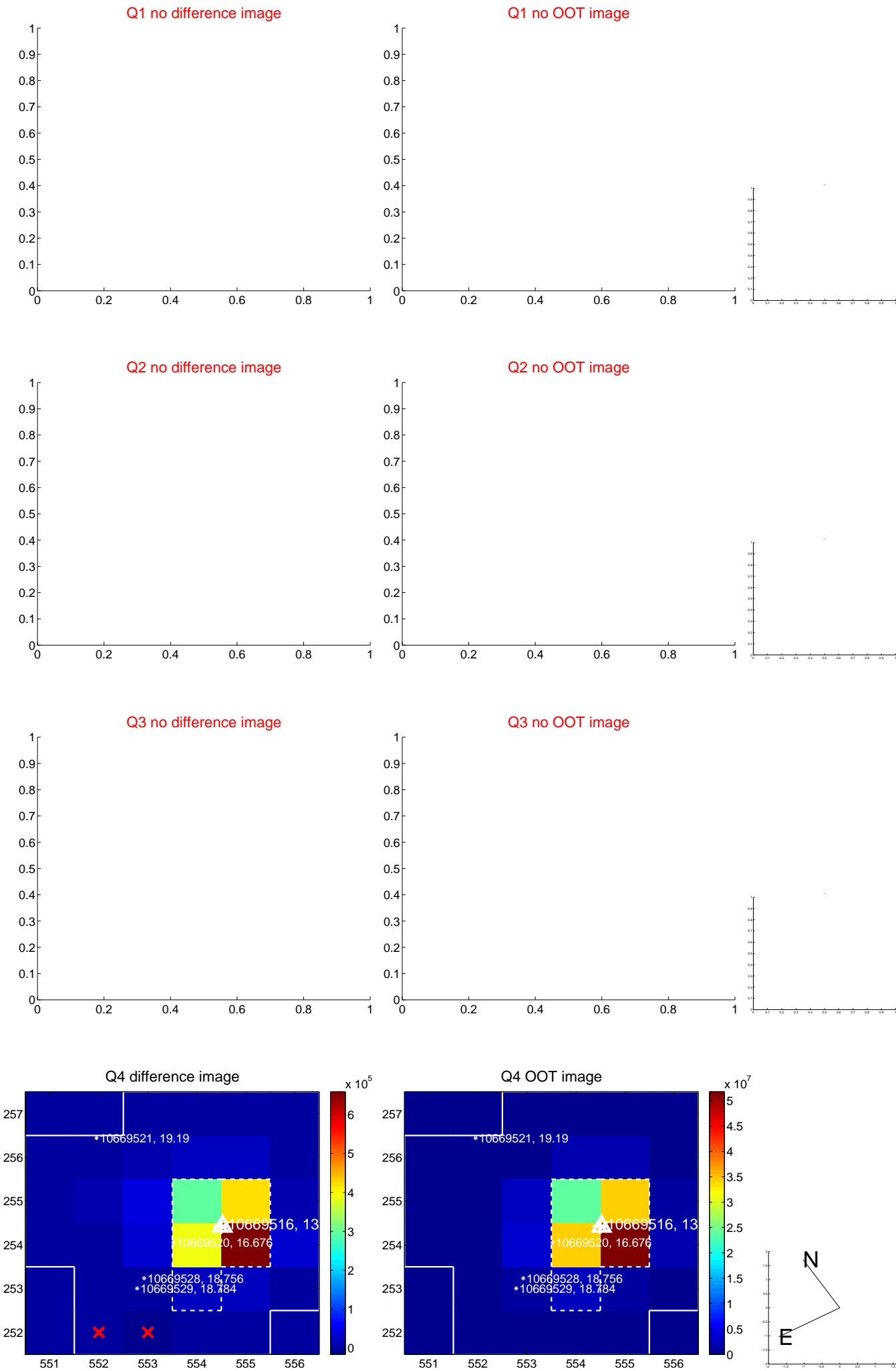
The direct PRF centroid is offset from the target star catalog position by about 0.13 arcsec

|                                         | Distance in arcsec | Distance / $\sigma$ | $\Delta$ RA        | $\Delta$ Dec       |
|-----------------------------------------|--------------------|---------------------|--------------------|--------------------|
| PRF-fit source offset from OOT          | $0.125 \pm 0.071$  | 1.75                | $-0.121 \pm 0.071$ | $-0.031 \pm 0.079$ |
| PRF-fit source offset from KIC position | $0.079 \pm 0.073$  | 1.08                | $-0.021 \pm 0.080$ | $0.076 \pm 0.072$  |
| photometric centroid source offset      | $0.06 \pm 0.03$    | 1.76                | $0.01 \pm 0.09$    | $0.06 \pm 0.03$    |

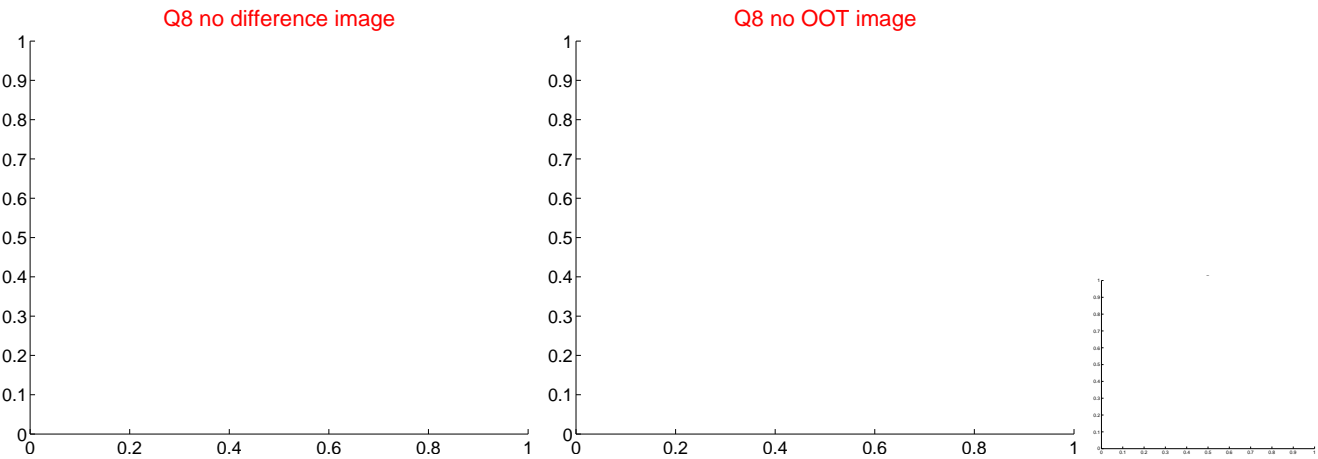
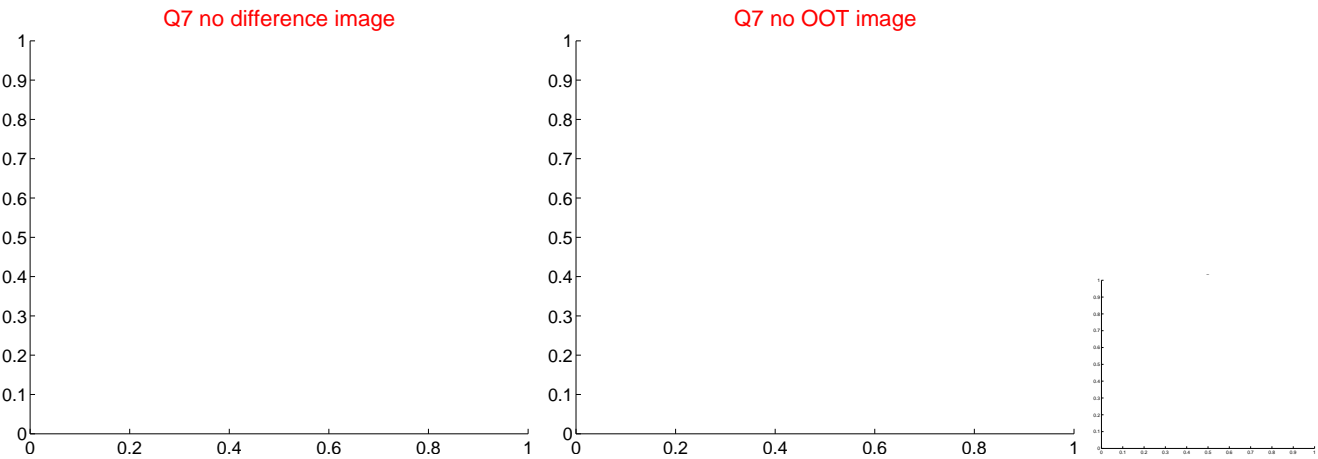
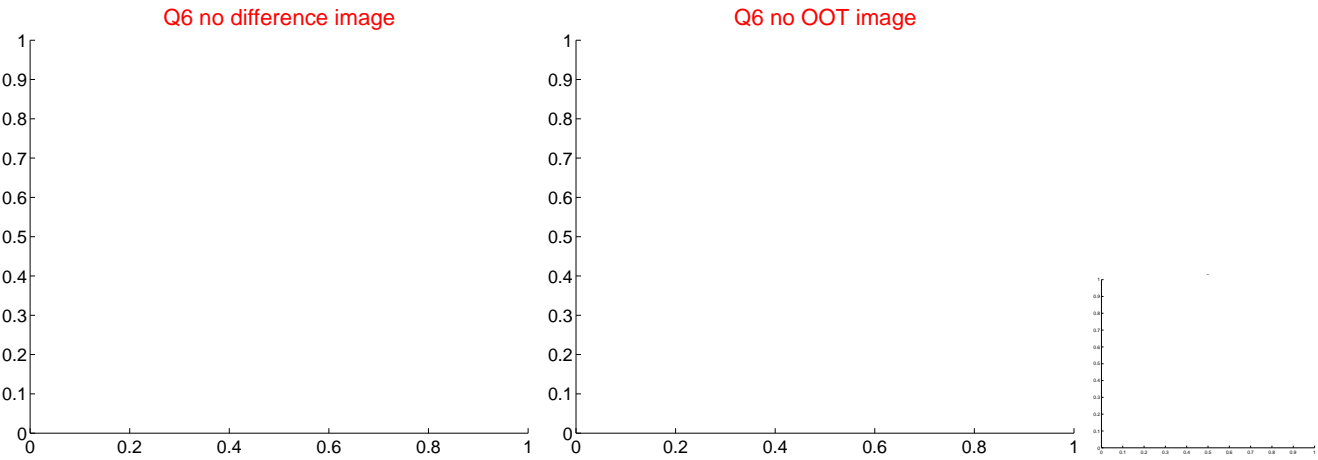
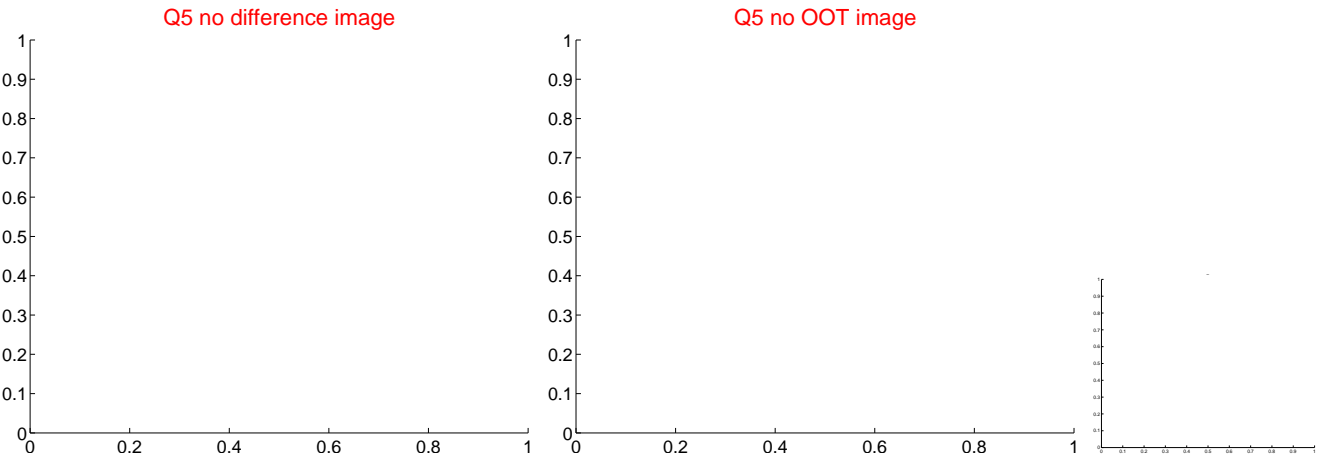


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

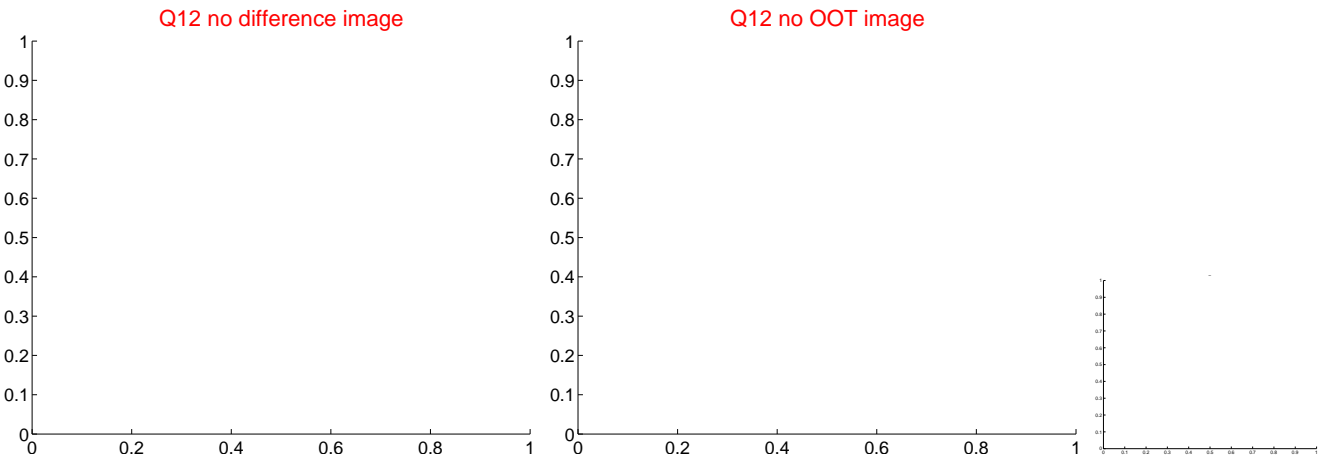
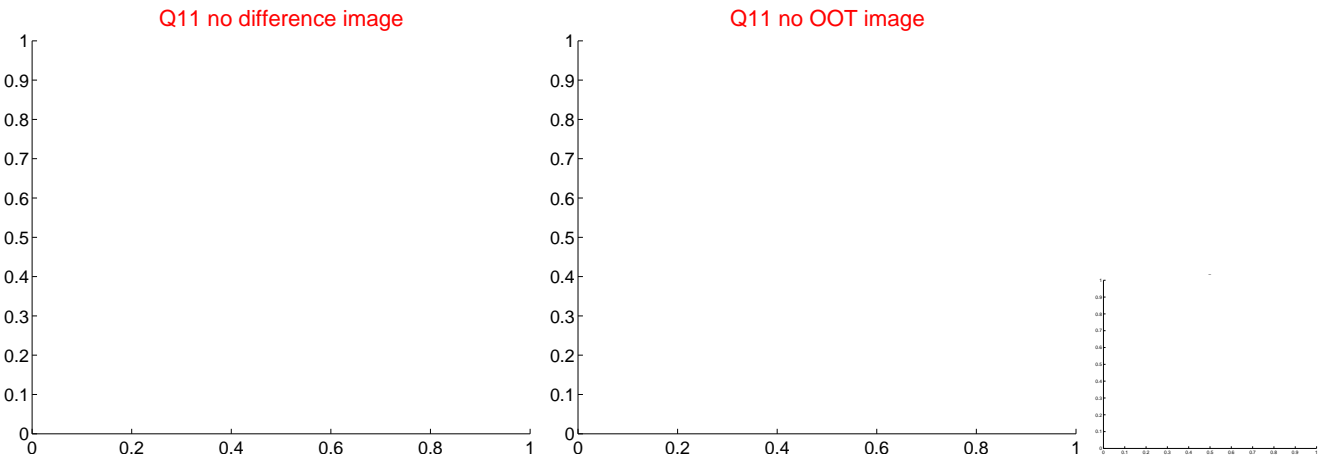
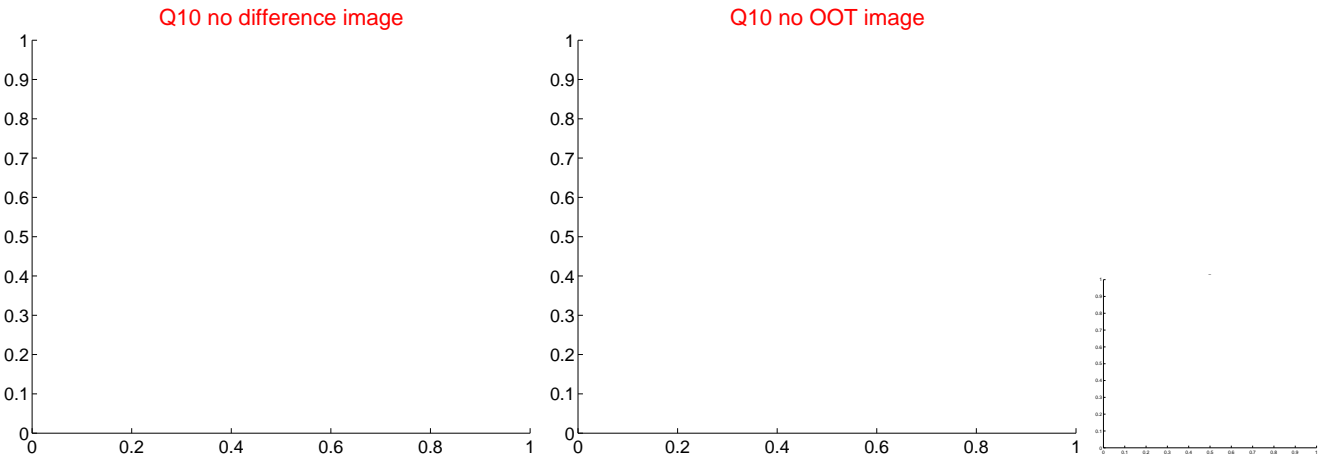
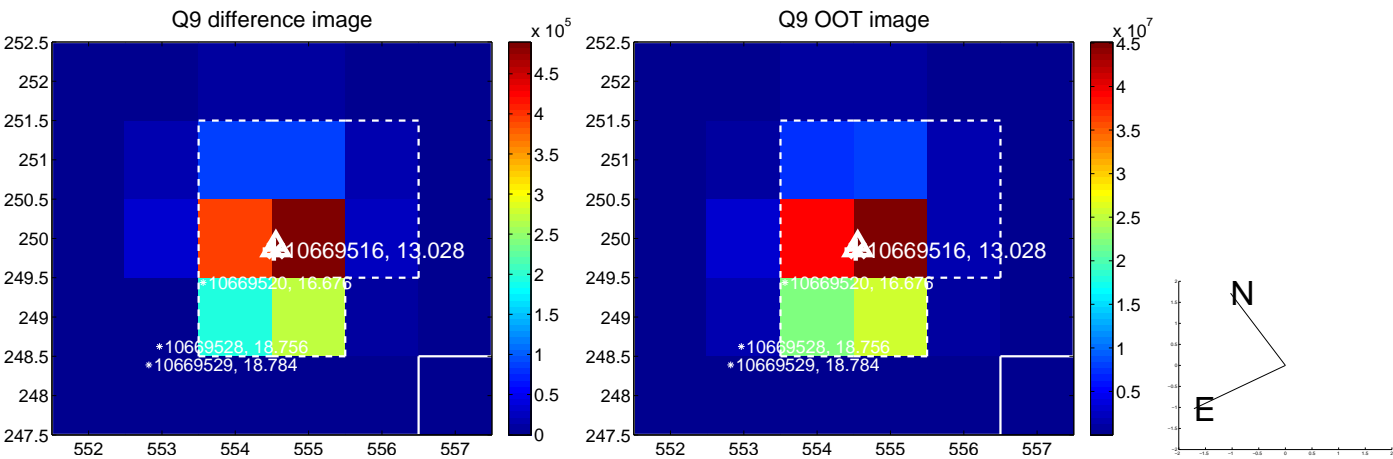


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

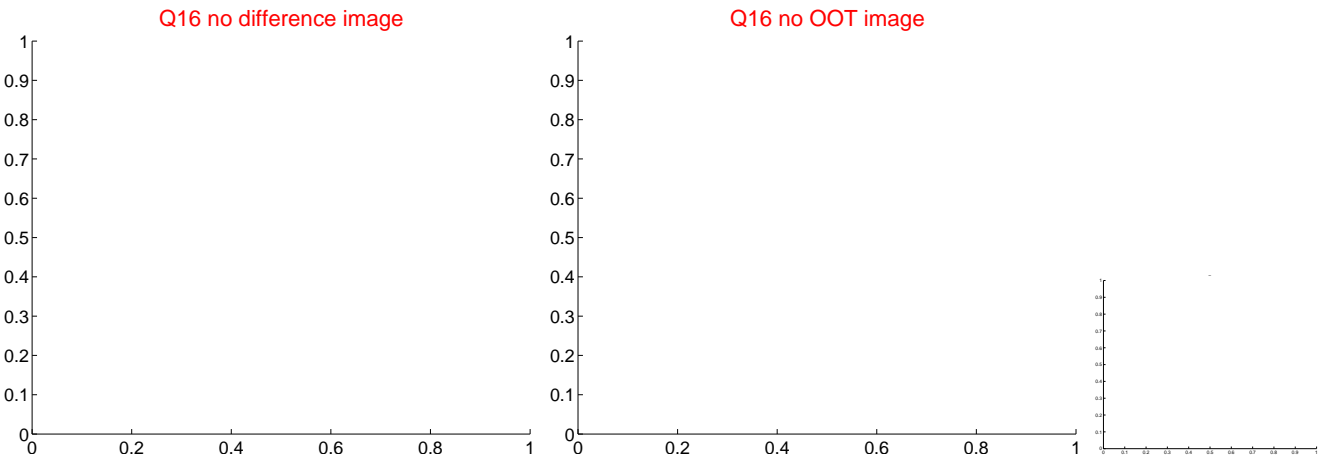
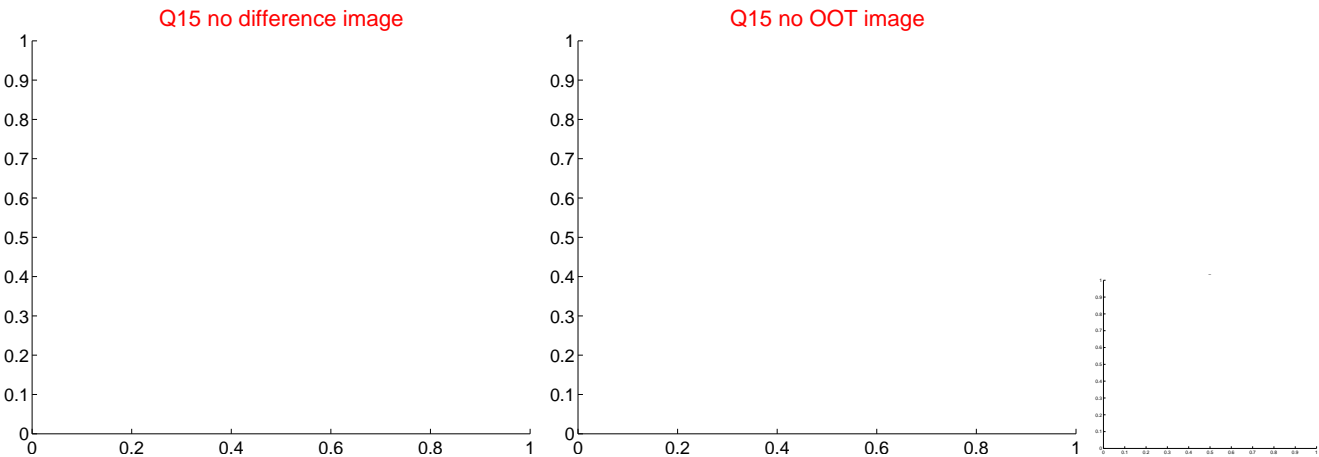
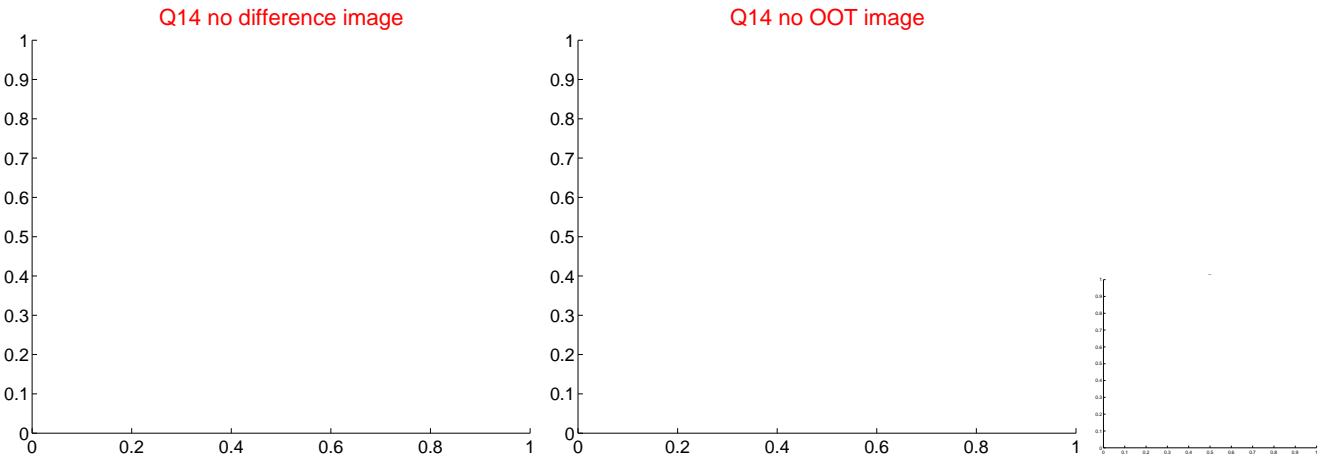
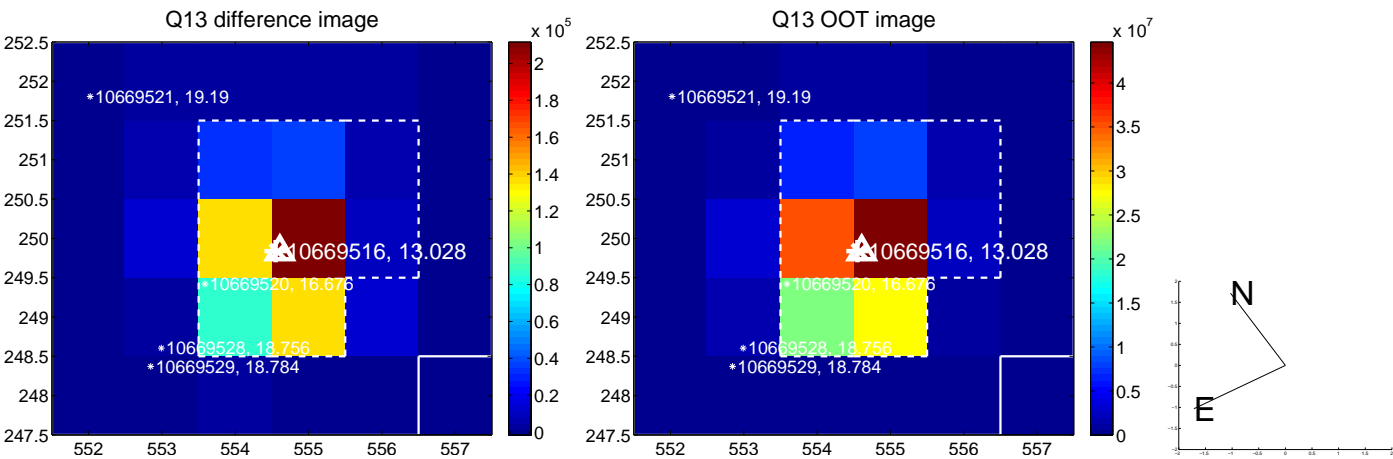




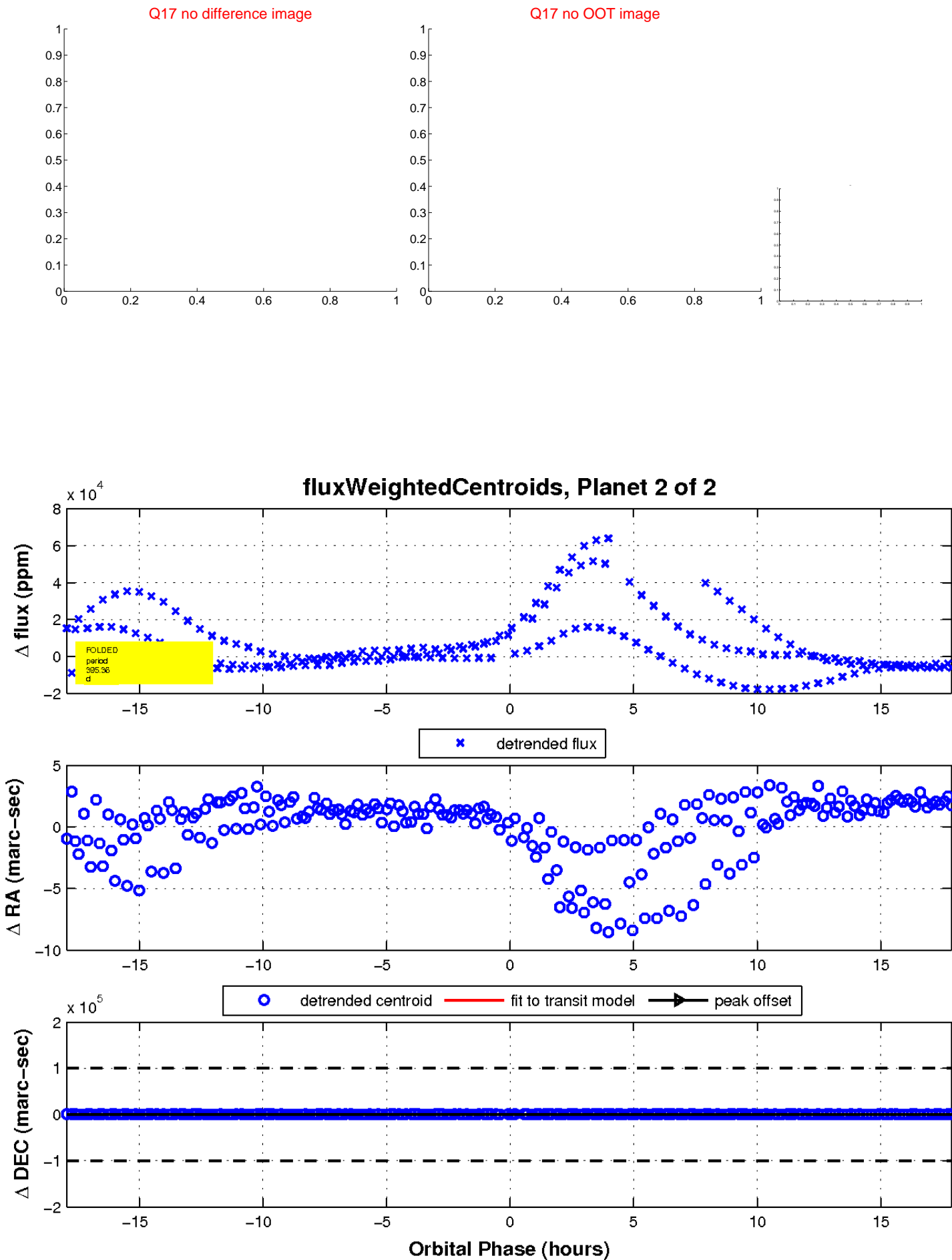
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UKIRT Image

Declination

