

# KIC 003970117

## 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) | $R_p$ ( $R_{\oplus}$ ) | $S_p$ ( $S_{\oplus}$ ) |
|--------------|----------|---------|---------------|--------------|-------------|------------------|--------|--------|-----------------------------|-----------------|------------------------|------------------------|
| 003970117-01 | OBS      | 3556.01 | 110.295159    | 235.750751   | 175681.4    | 16.518           | 2123.3 | 1690.0 | 0.90                        | 5753            | 37.73                  | 4.07                   |
| 003970117-02 | OBS      | No      | 110.295108    | 213.466598   | 25126.4     | 11.540           | 311.9  | 315.7  | 0.90                        | 5753            | 15.22                  | 4.07                   |

## Robovetter Results

| TCE          | Run Type | Disp | Score | N | S | C | E | Comments                           |
|--------------|----------|------|-------|---|---|---|---|------------------------------------|
| 003970117-01 | OBS      | FP   | 0.00  | 0 | 1 | 0 | 0 | MOD_SEC_DV—MOD_SEC_ALT—HAS_SEC_TCE |
| 003970117-02 | OBS      | FP   | 0.00  | 1 | 1 | 0 | 0 | IS_SEC_TCE                         |

**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.

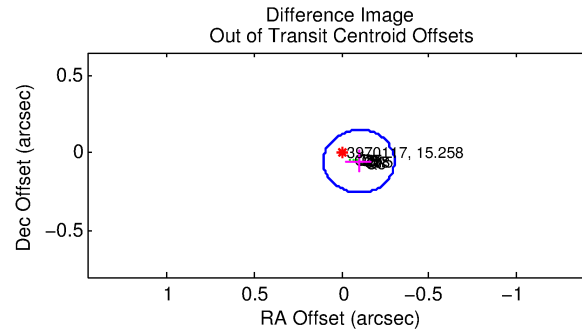
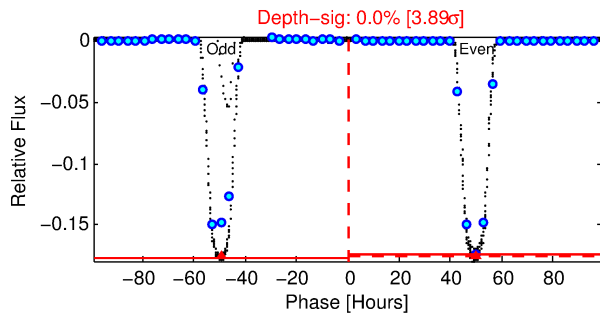
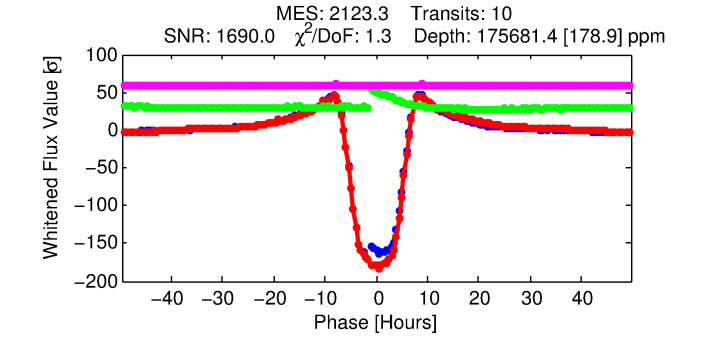
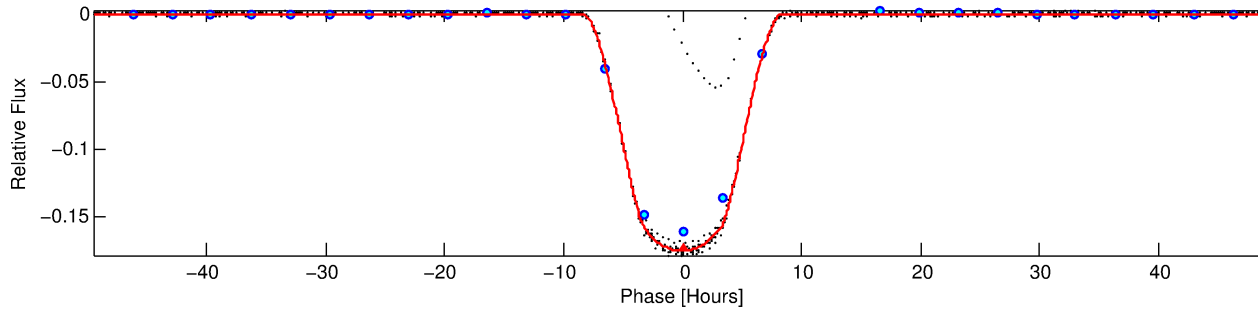
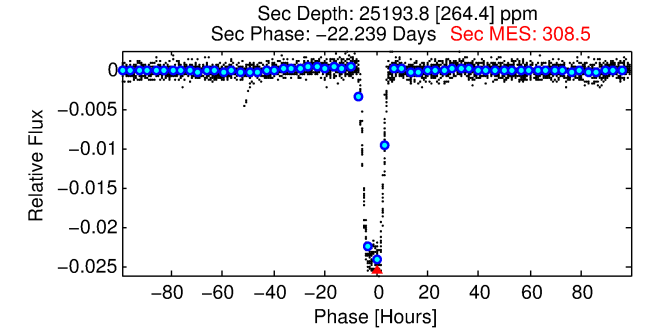
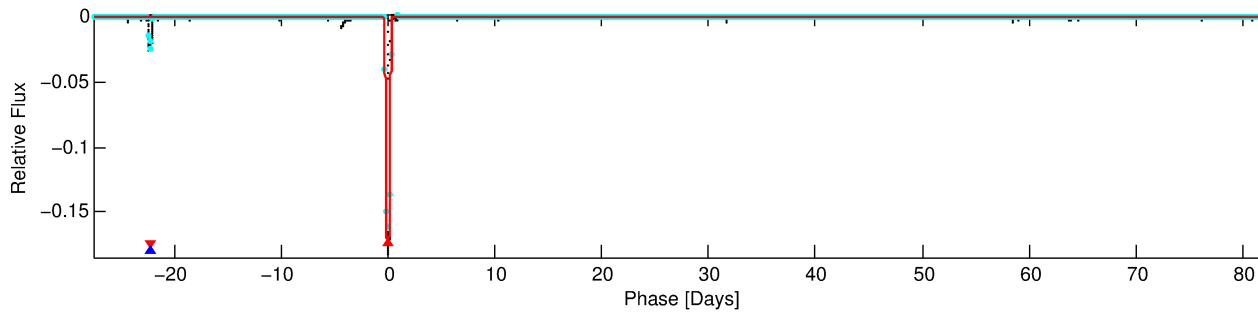
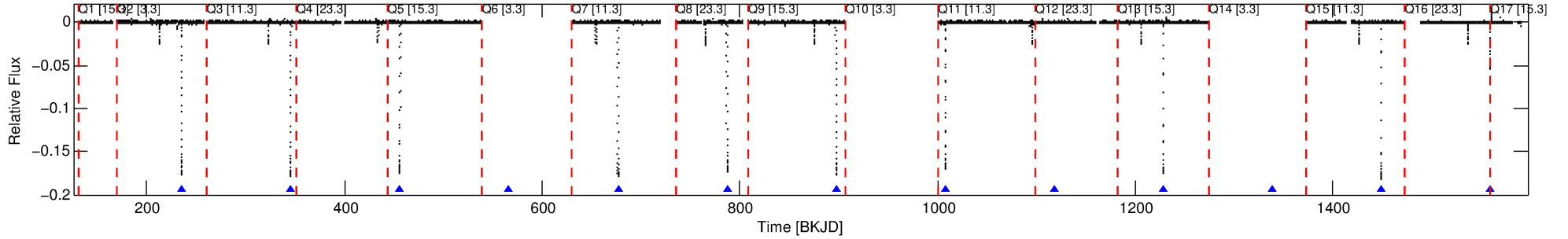
## Ephemeris Match Information For 003970117-01

No Significant Match Found

# DV One-Page Summary

KIC: 3970117 Candidate: 1 of 2 Period: 110.295 d  
KOI: K03556.01 Corr: 0.998

Kp: 15.26 R\*: 0.90 Rs Teff: 5753.0 K Logg: 4.50 Fe/H: -0.140



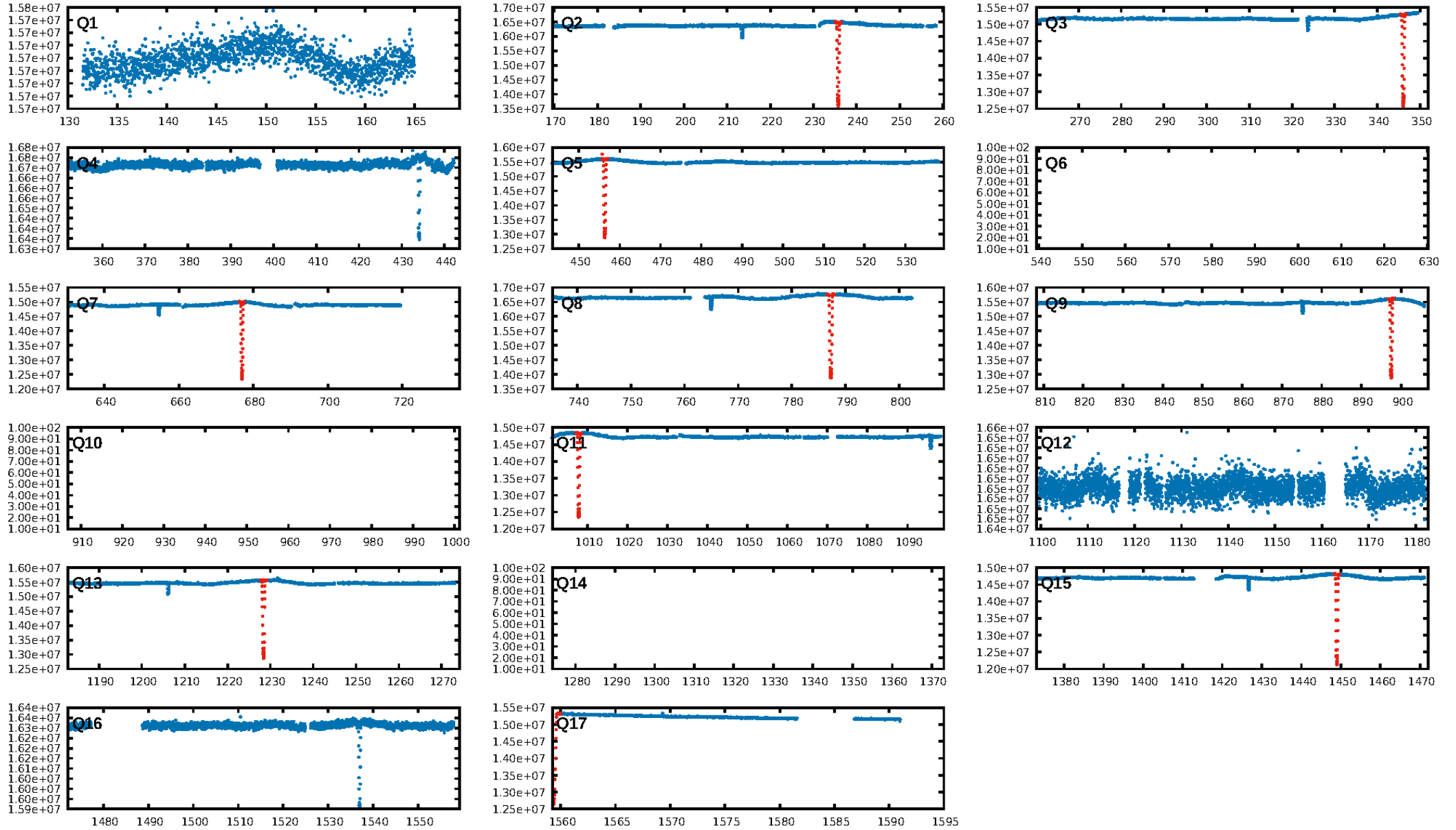
## DV Fit Results:

Period = 110.29516 [0.00004] d  
Epoch = 235.7508 [0.0003] BKJD  
Rp/R\* = 0.3864 [0.0003]  
a/R\* = 69.74 [0.11]  
b = 0.23 [0.01]  
Seff = 4.07 [1.48]  
Teq = 362 [33] K  
Rp = 37.73 [10.50] Re  
a = 0.4395 [0.1033] AU  
Ag = 1880.21 [645.32] [2.91σ]  
Teffp = 3687 [111] K [28.80σ]

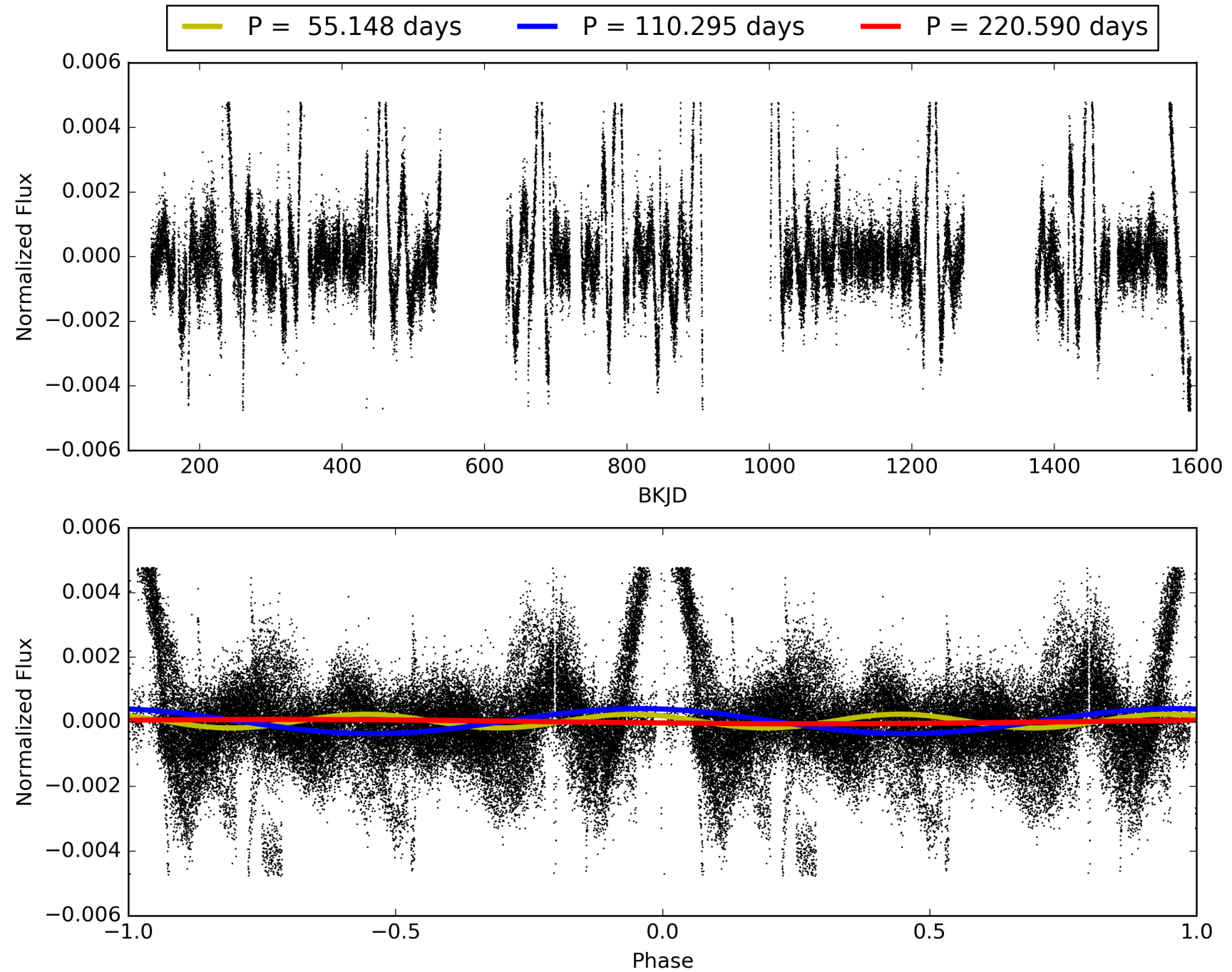
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 0.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [9/9]  
GhostDiagnostic-chr: 3.781  
Centroid-sig: 0.0%  
Centroid-so: 0.298 arcsec [63.36σ]  
OotOffset-rm: 0.112 arcsec [1.66σ]  
OotOffset-st: 1/3/1/2 [7]  
KicOffset-rm: 0.043 arcsec [0.58σ]  
KicOffset-st: 1/3/1/2 [7]  
DiffImageQuality-fgm: 1.00 [7/7]  
DiffImageOverlap-fno: 1.00 [7/7]

# TCE 003970117-01, PDC Light Curves

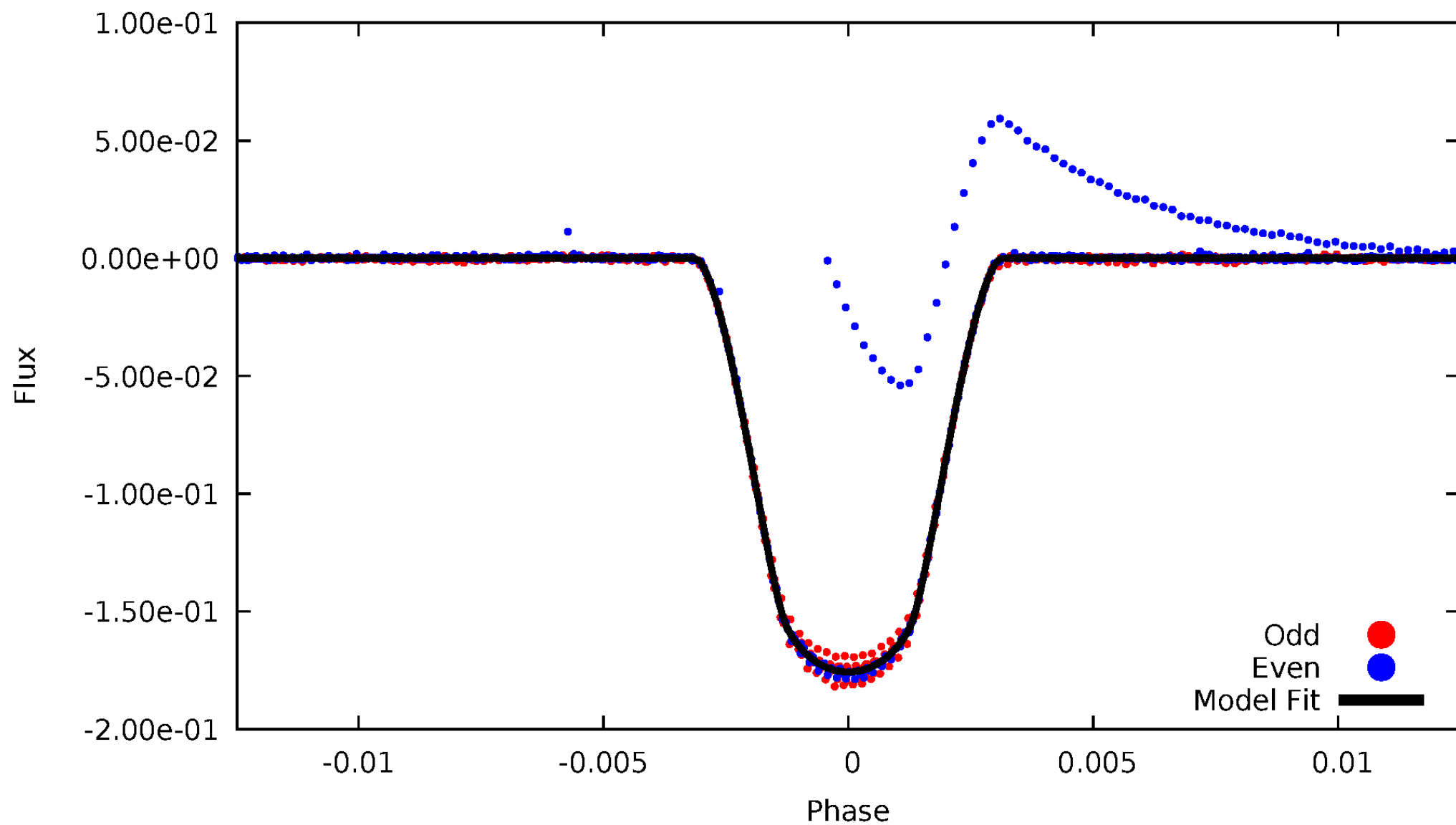


TCE 003970117-01



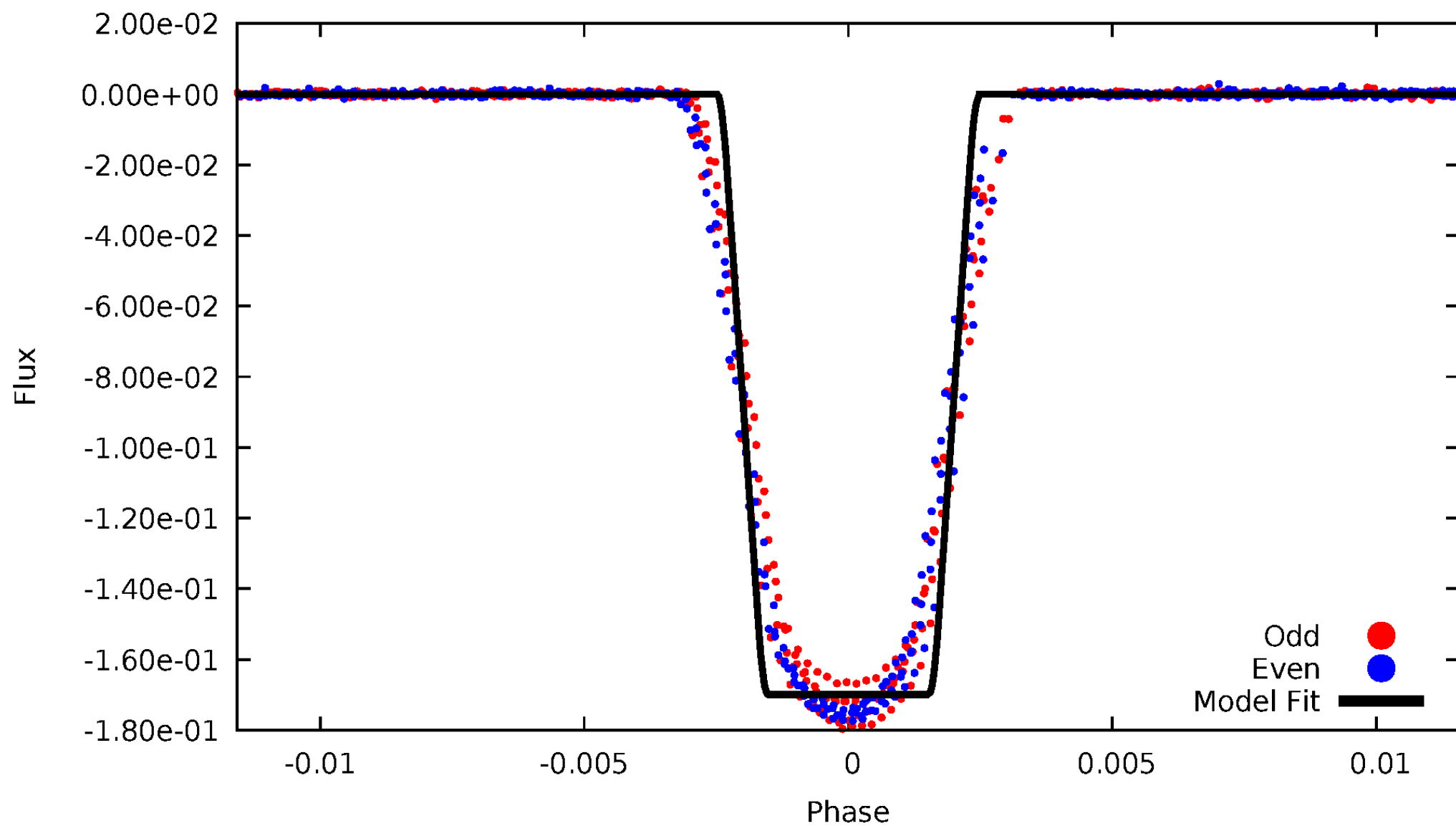
# DV Odd/Even

TCE 003970117-01



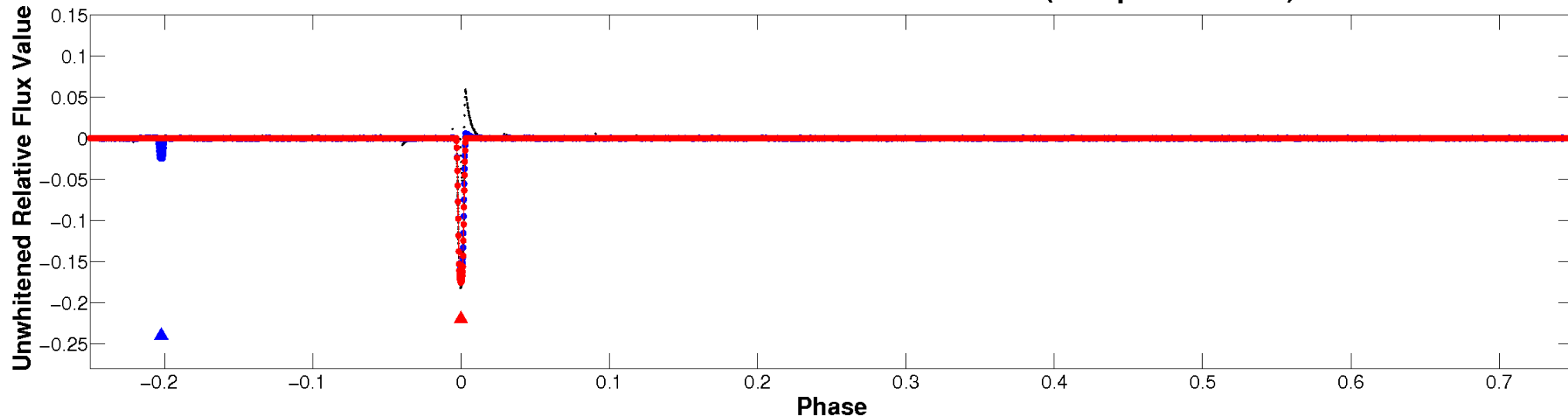
# ALT Odd/Even

TCE 003970117-01

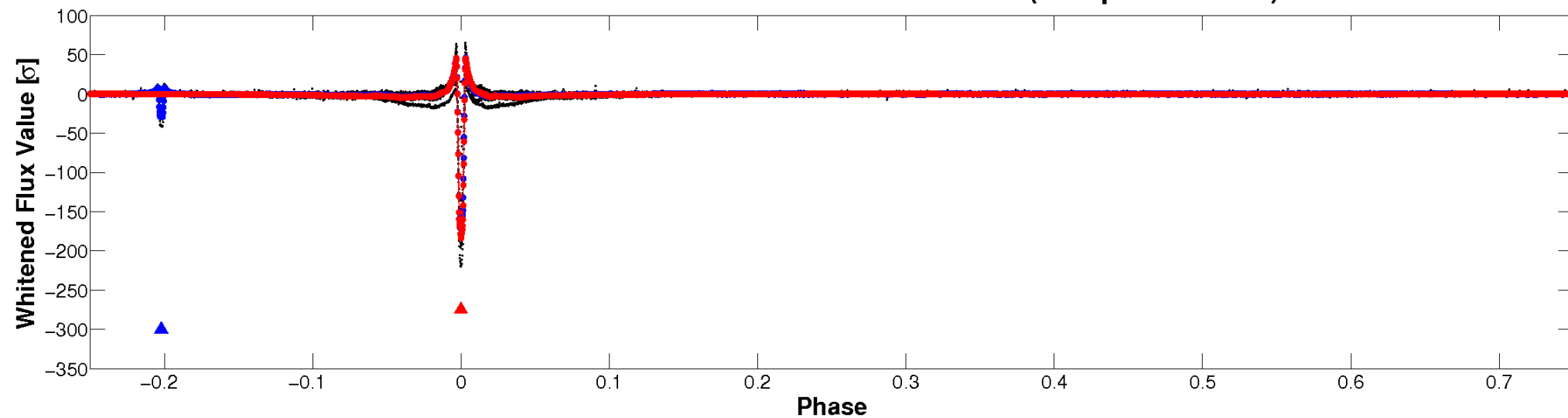


# Non-Whitened Vs. Whitened Light Curve

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

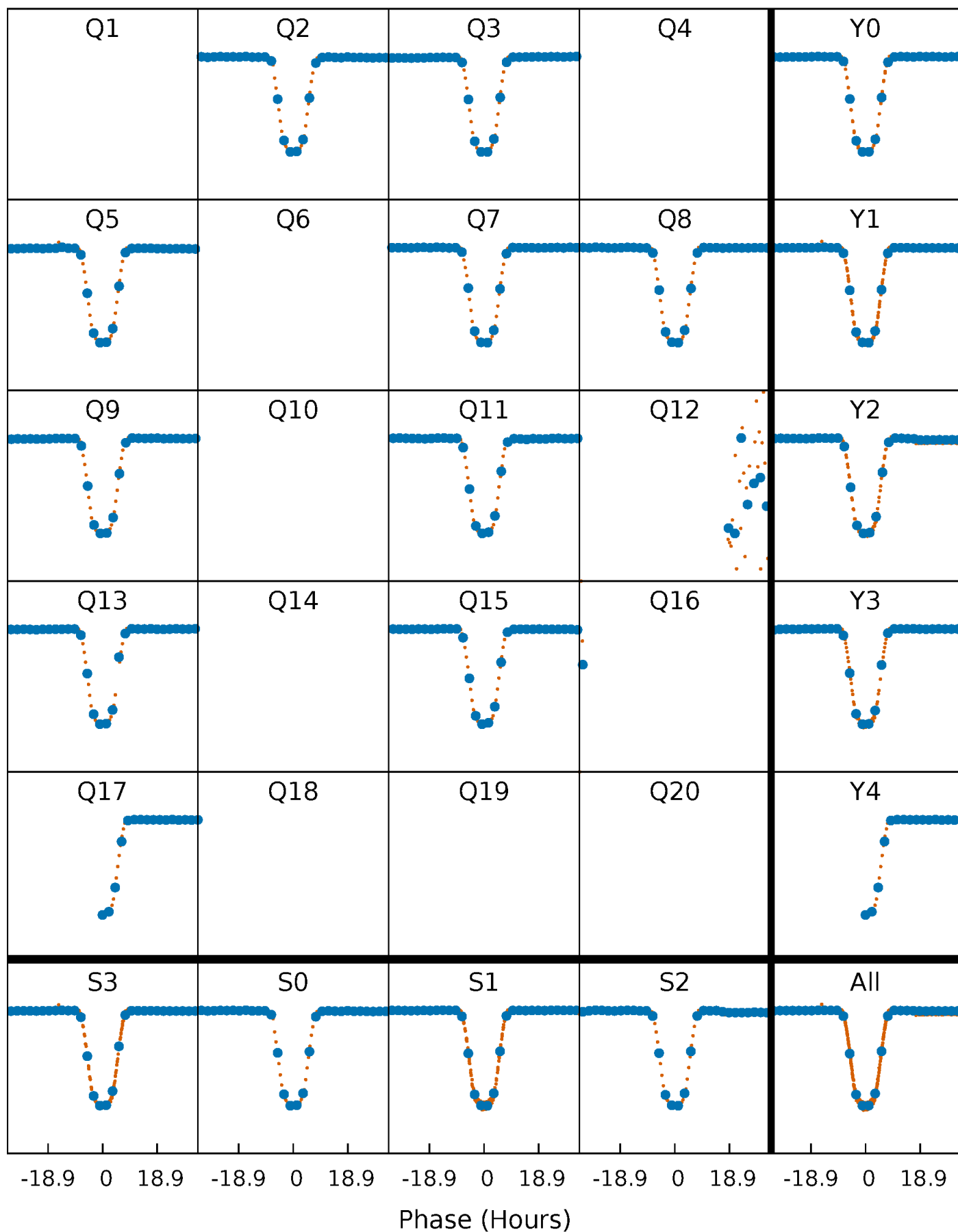


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

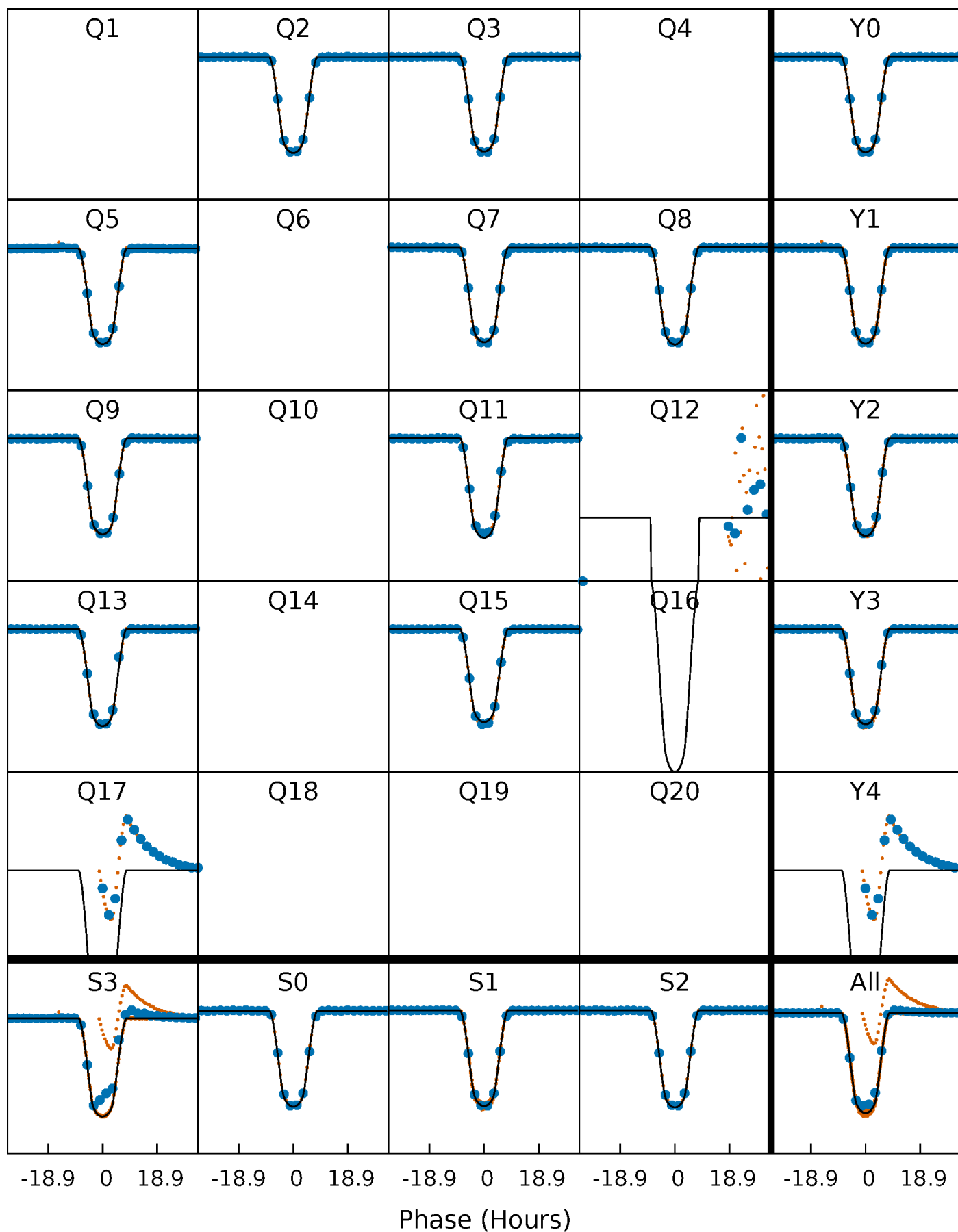
TCE 003970117-01 P=110.295158 Days  $T_0=235.750751$  (BKJD)





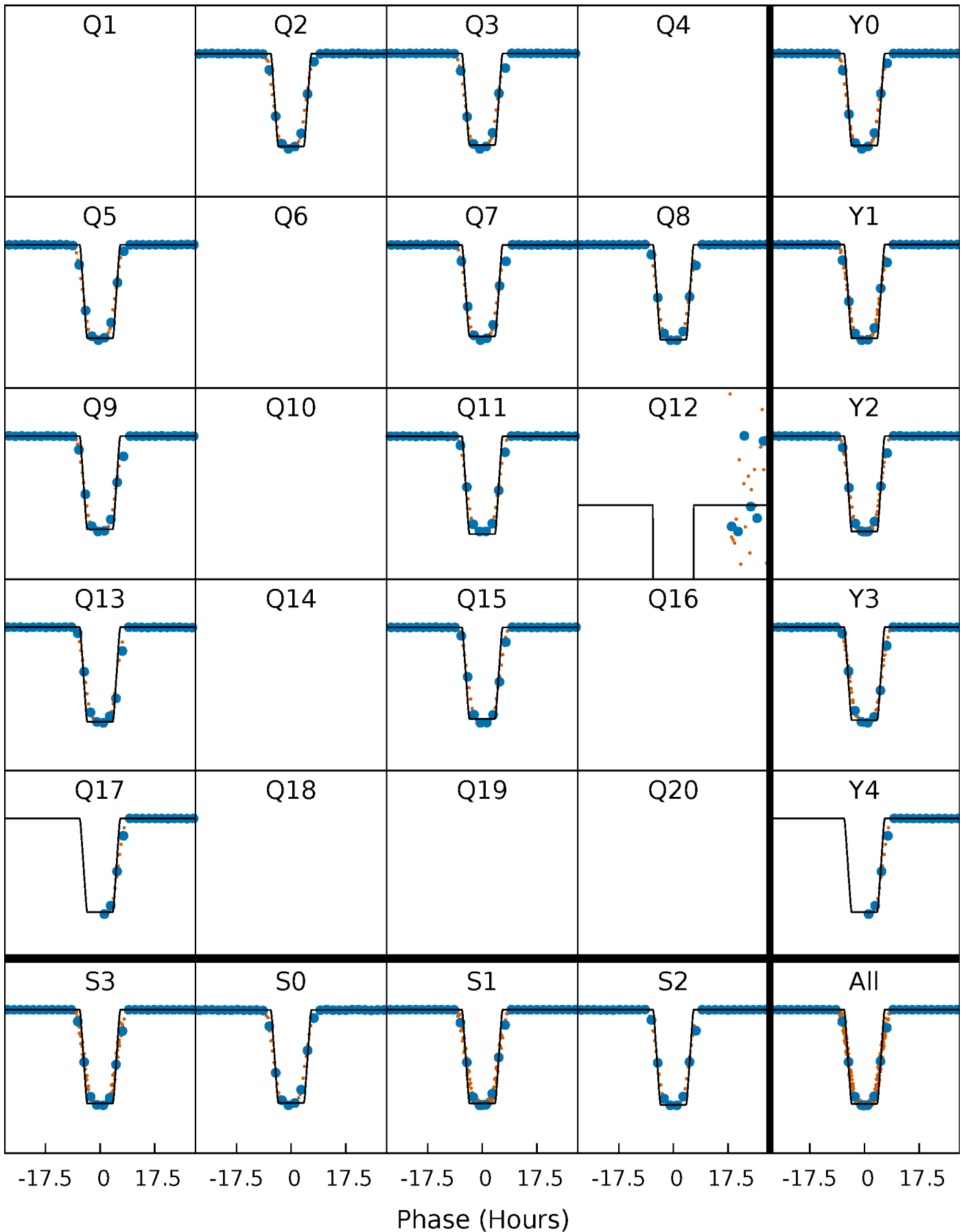
# DV Quarter-Phased Transit Curves

TCE 003970117-01 P=110.295158 Days  $T_0=235.750751$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

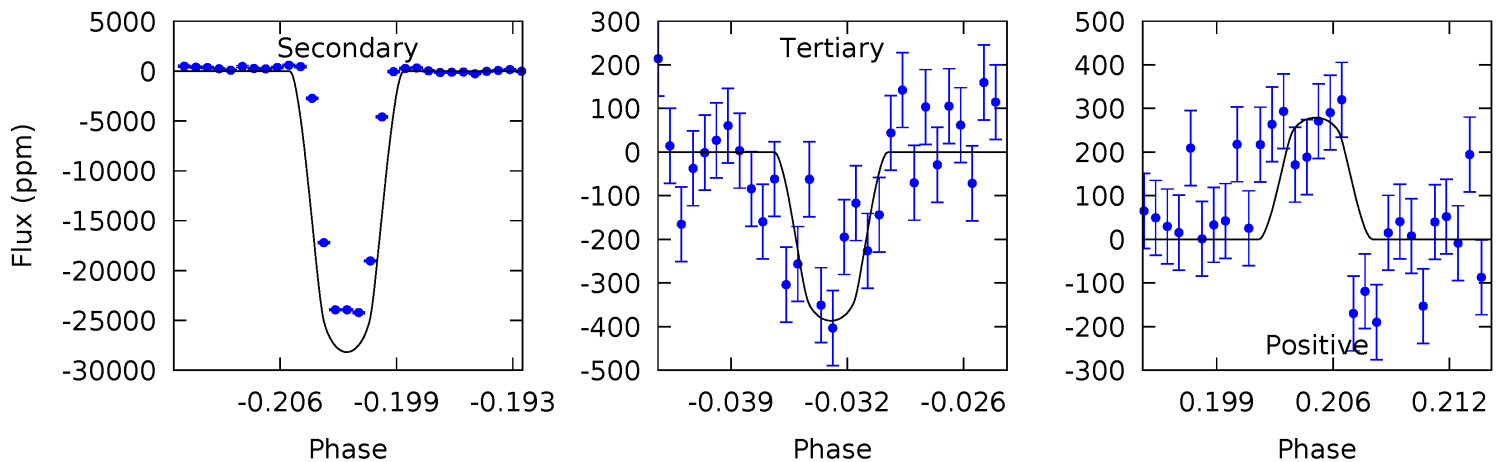
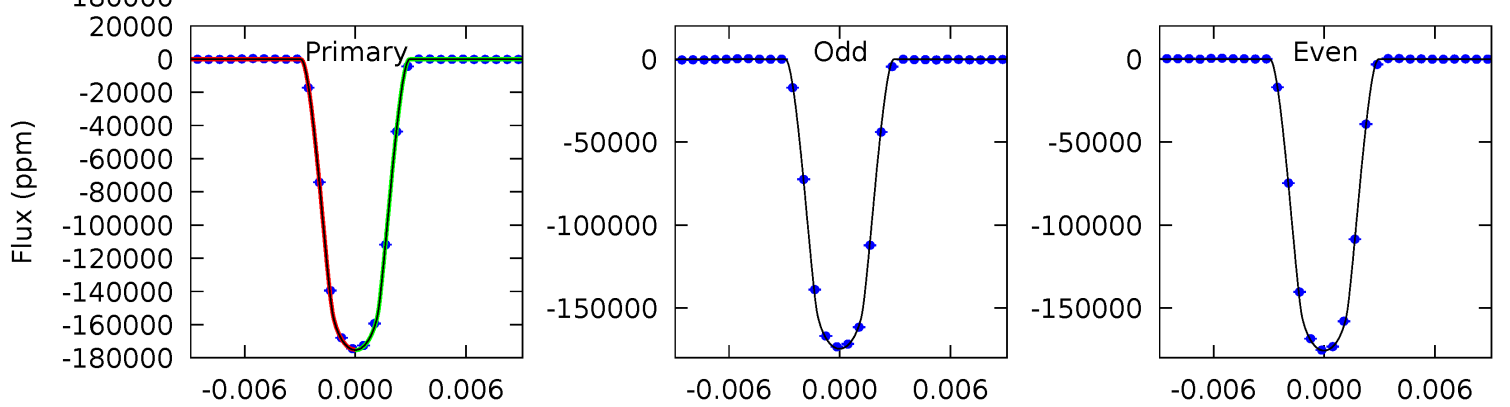
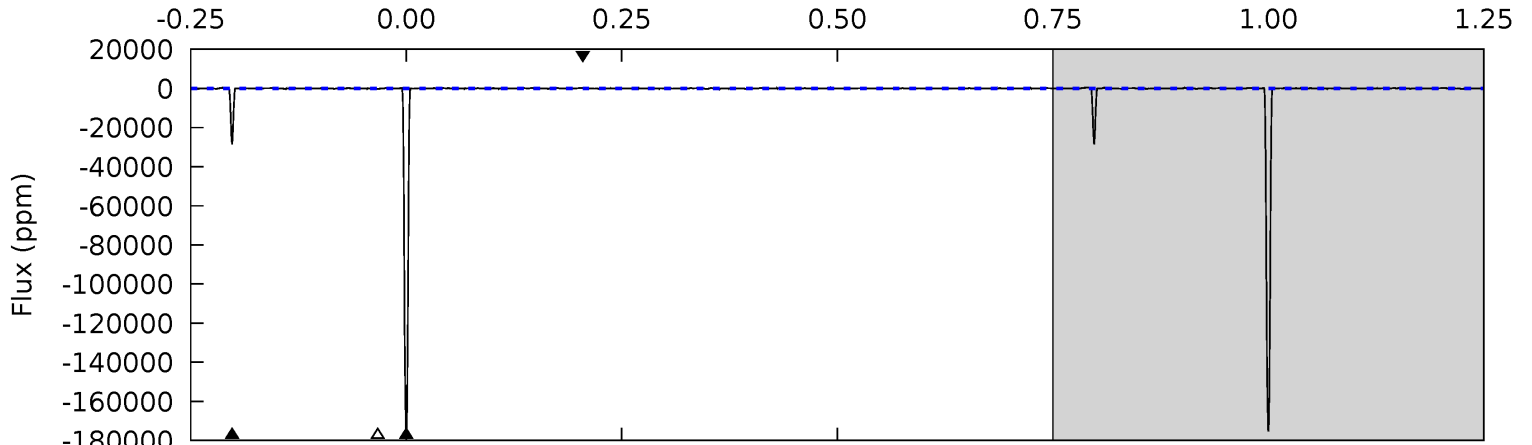
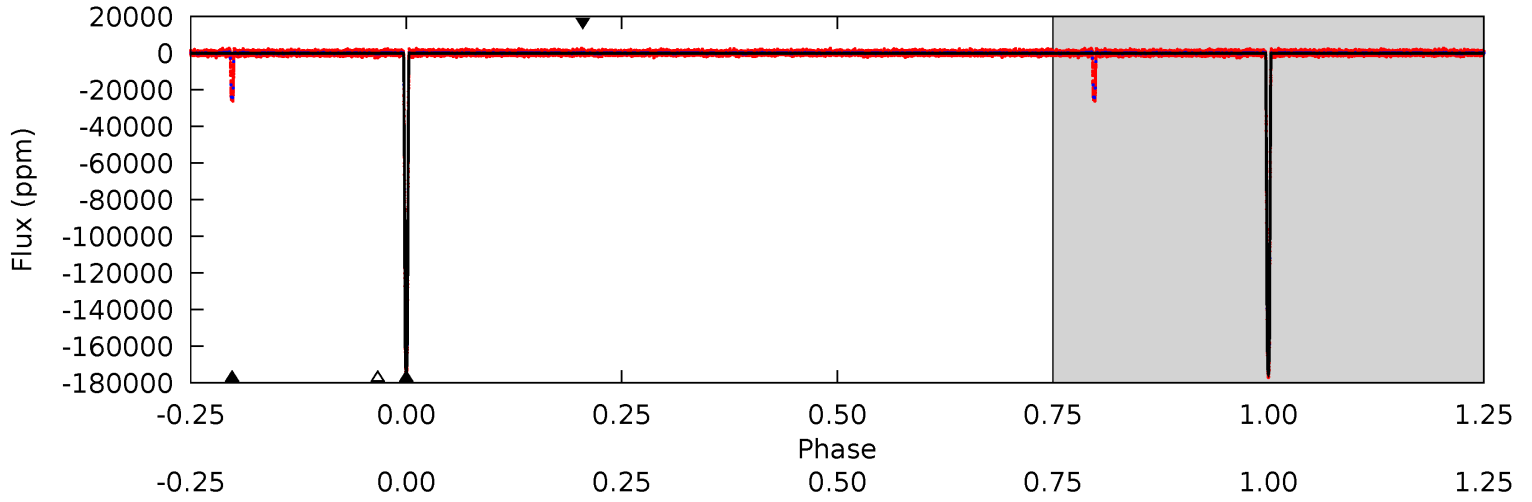
TCE 003970117-01 P=110.291782 Days  $T_0=235.769637$  (BKJD)



# DV Model-Shift Uniqueness Test

003970117-01, P = 110.295158 Days, E = 125.455593 Days

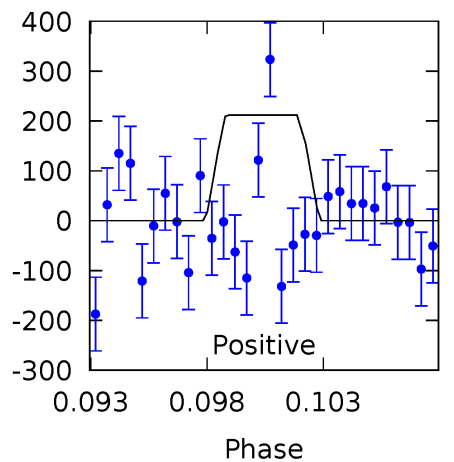
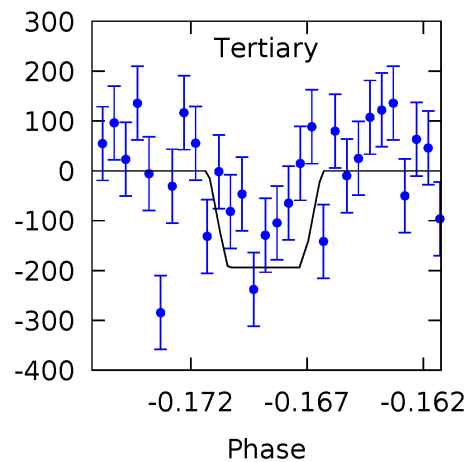
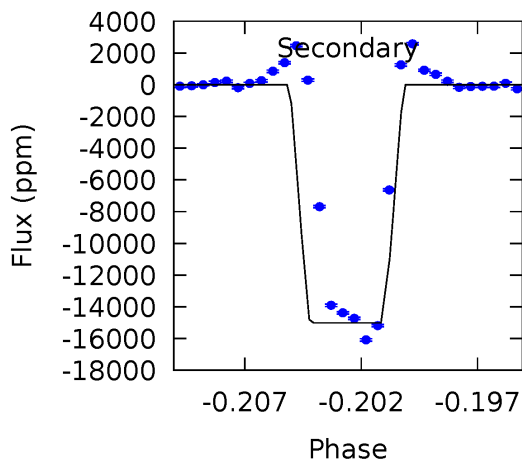
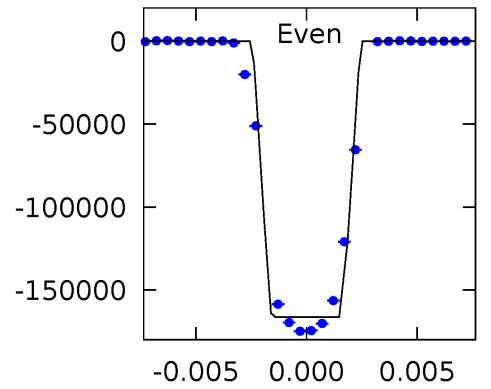
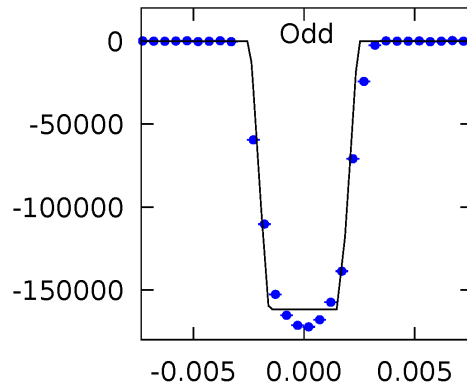
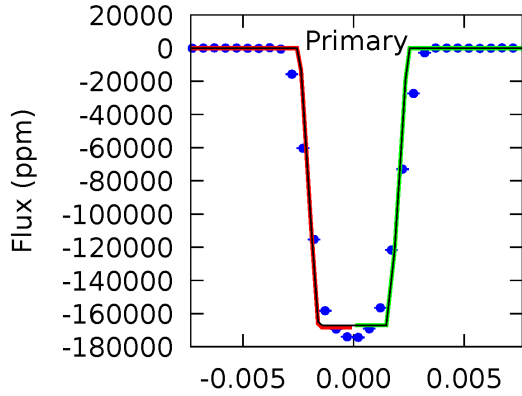
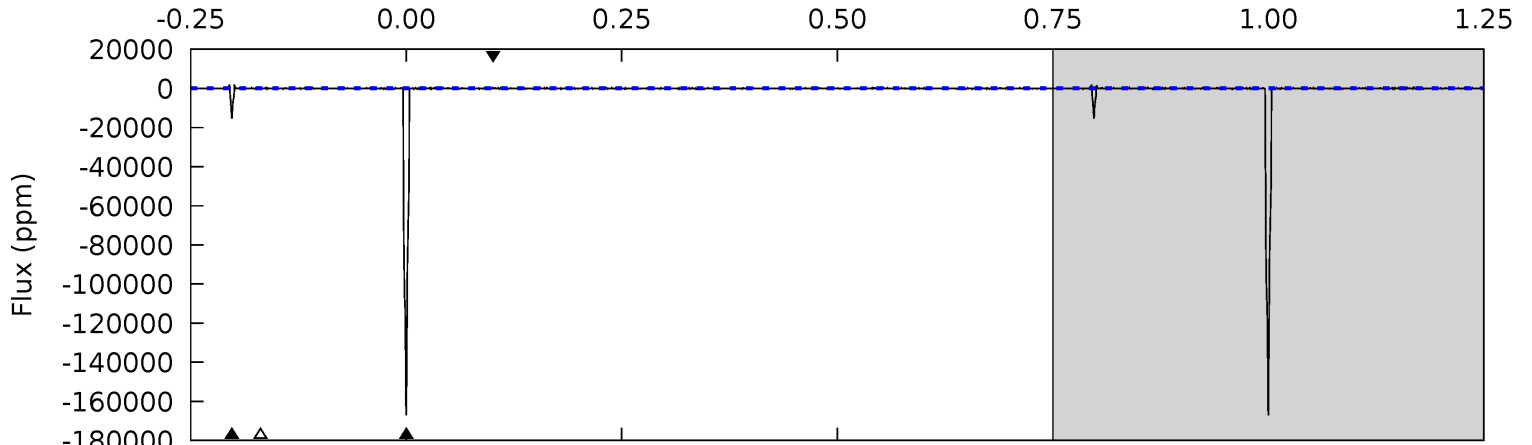
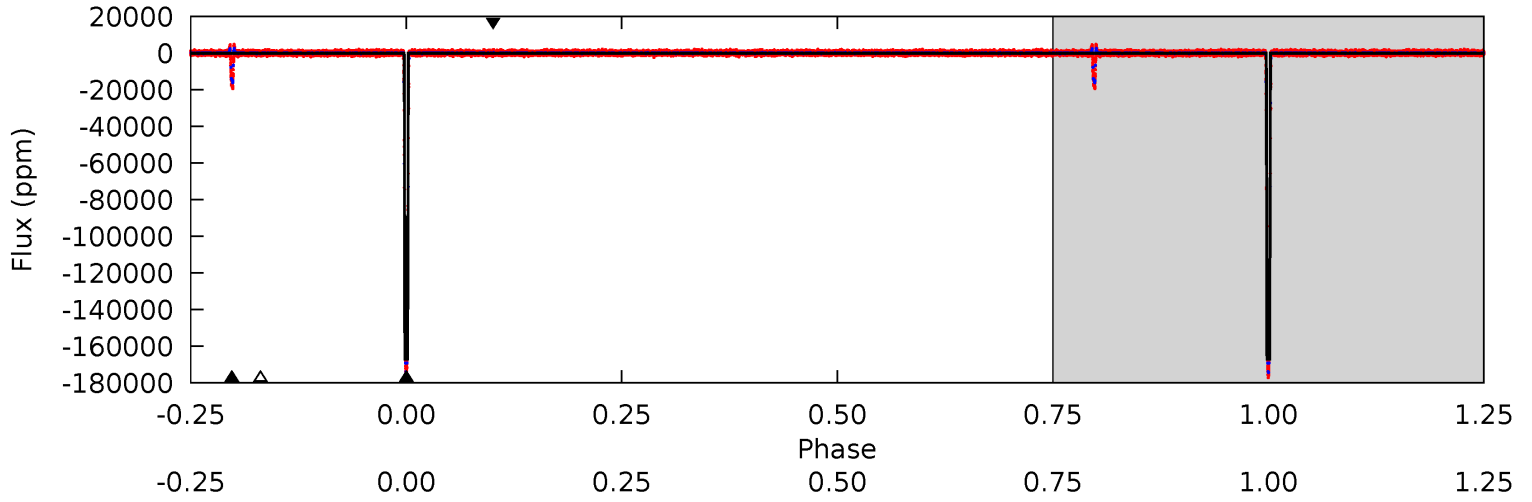
| Pri  | Sec   | Ter  | Pos  | FA <sub>1</sub> | FA <sub>2</sub> | F <sub>Red</sub> | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM  | Shape | TAT  |
|------|-------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 4714 | 757.9 | 10.4 | 7.50 | 5.11            | 2.72            | 2.57             | 4704    | 4707    | 747.5   | 750.4   | 14.9    | 0.92 | 0.00  | 1.59 |



# Alt Model-Shift Uniqueness Test

003970117-01, P = 110.291782 Days, E = 125.477855 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 |
|------|-------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|-----|
| 2882 | 258.9 | 3.35 | 3.66 | 5.16            | 2.81            | 0.91             | 2878    | 2878    | 255.6   | 255.3   | 44.1    | 1.00 | 0.01  | 0   |



### Stellar Parameters For KIC 003970117

|        | $T_{\text{eff}}(K)$  | $\log(g)$                 | [Fe/H]                     | $R (R_{\odot})$           | $M(M_{\odot})$            | $p_{\star} (\text{g}\cdot\text{cm}^{-3})$ |
|--------|----------------------|---------------------------|----------------------------|---------------------------|---------------------------|---|
|        | $5753^{+155}_{-172}$ | $4.503^{+0.062}_{-0.188}$ | $-0.140^{+0.300}_{-0.300}$ | $0.895^{+0.249}_{-0.107}$ | $0.931^{+0.111}_{-0.100}$ | $1.828^{+0.479}_{-0.923}$                 |
|        | +3%/-3%              | +1%/-4%                   | +214%/-214%                | +28%/-12%                 | +12%/-11%                 | +26%/-50%                                 |
| 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 003970117-01 / KOI 3556.01

| Detrend | Depth (ppm)     | $R_p (R_{\oplus})$      | $T_{max} (K)$     | $T_{obs} (K)$      | $A_{obs}$            |
|---------|-----------------|-------------------------|-------------------|--------------------|----------------------|
| DV      | $-28179 \pm 37$ | $39.09^{+5.10}_{-3.32}$ | $516^{+31}_{-25}$ | $4103^{+83}_{-95}$ | $2005^{+322}_{-405}$ |
| Alt.    | $-15016 \pm 58$ | $41.33^{+6.31}_{-3.15}$ | $517^{+33}_{-25}$ | $3593^{+70}_{-66}$ | $938^{+140}_{-211}$  |

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

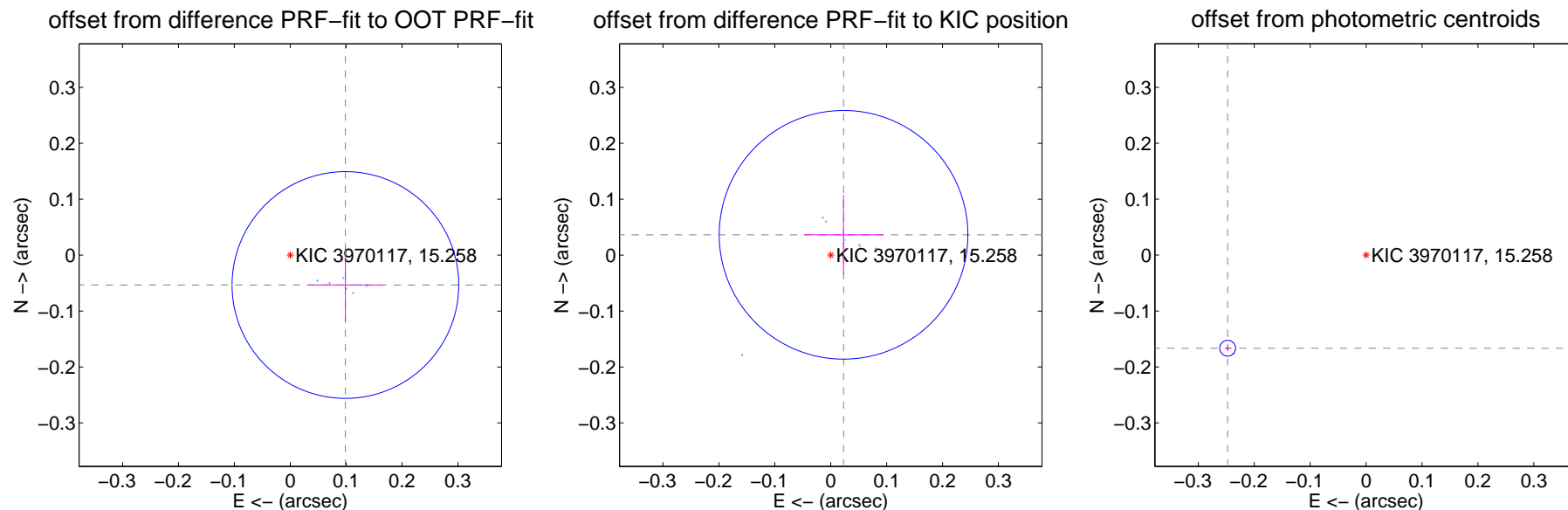
## DV Centroid Data

Supplemental centroid analysis for 003970117-01. Kepler magnitude: 15.26. Transit SNR 1690.03

There are 7 quarters with good PRF difference image offsets

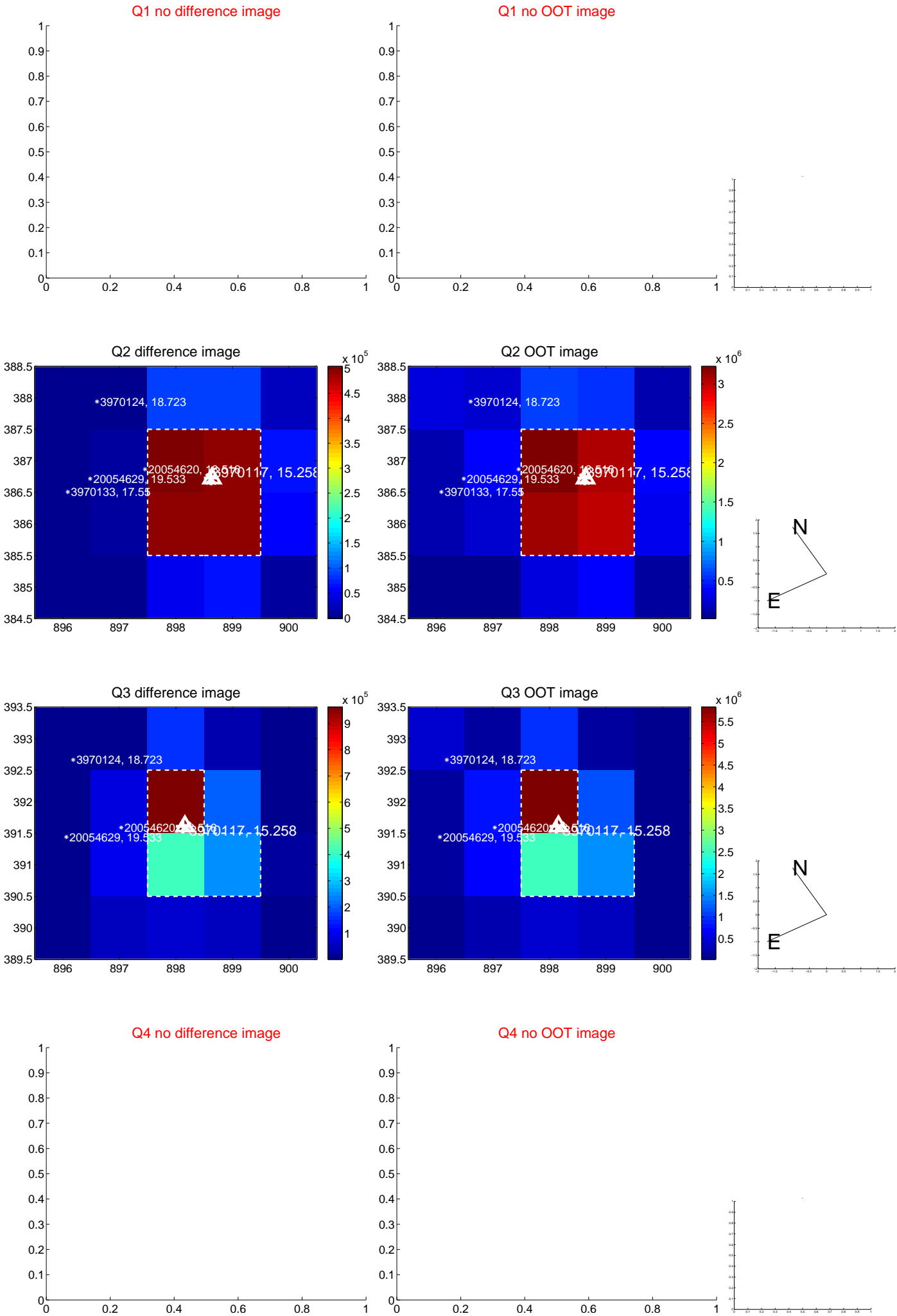
The direct PRF centroid is offset from the target star catalog position by about 0.16 arcsec

|   | Distance in arcsec | Distance / $\sigma$ | $\Delta$ RA        | $\Delta$ Dec       |
|---|--------------------|---------------------|--------------------|--------------------|
| PRF-fit source offset from OOT          | $0.112 \pm 0.068$  | 1.66                | $-0.099 \pm 0.068$ | $-0.053 \pm 0.067$ |
| PRF-fit source offset from KIC position | $0.043 \pm 0.074$  | 0.58                | $-0.023 \pm 0.071$ | $0.036 \pm 0.071$  |
| photometric centroid source offset      | $0.30 \pm 0.00$    | 63.36               | $0.25 \pm 0.00$    | $-0.17 \pm 0.00$   |

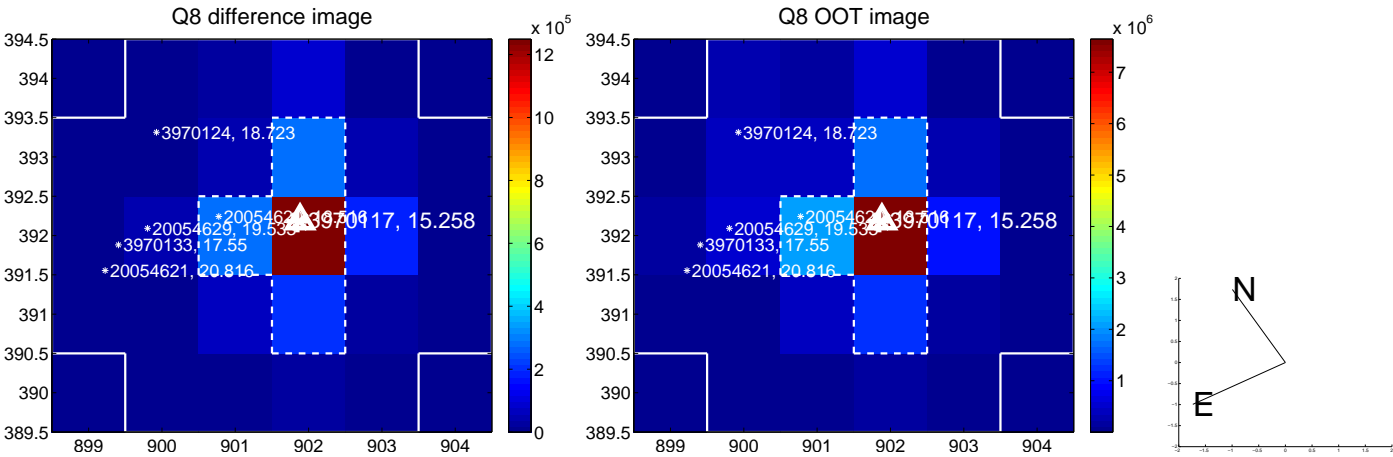
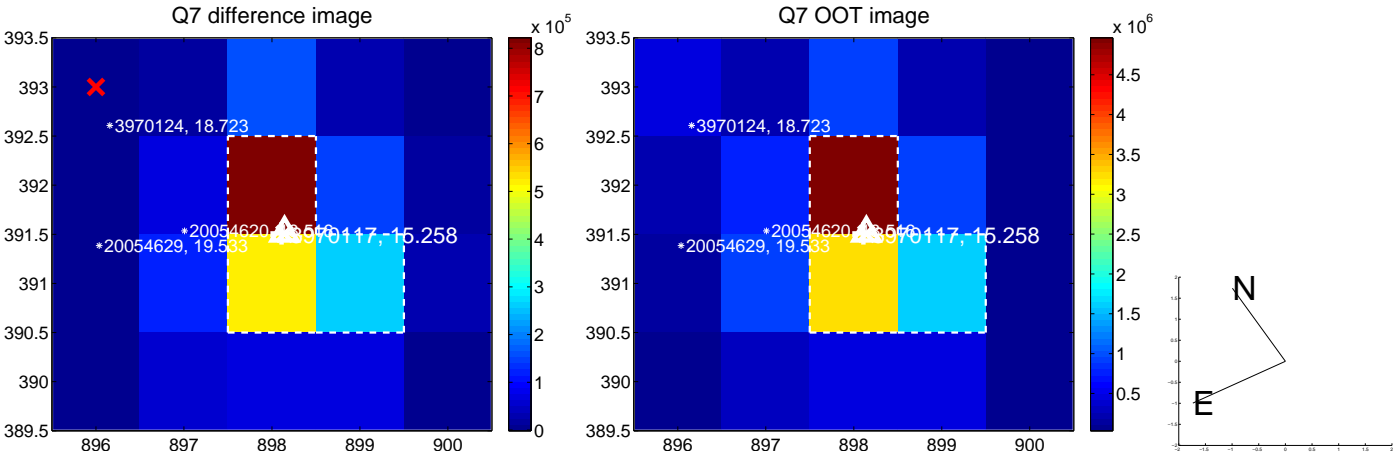
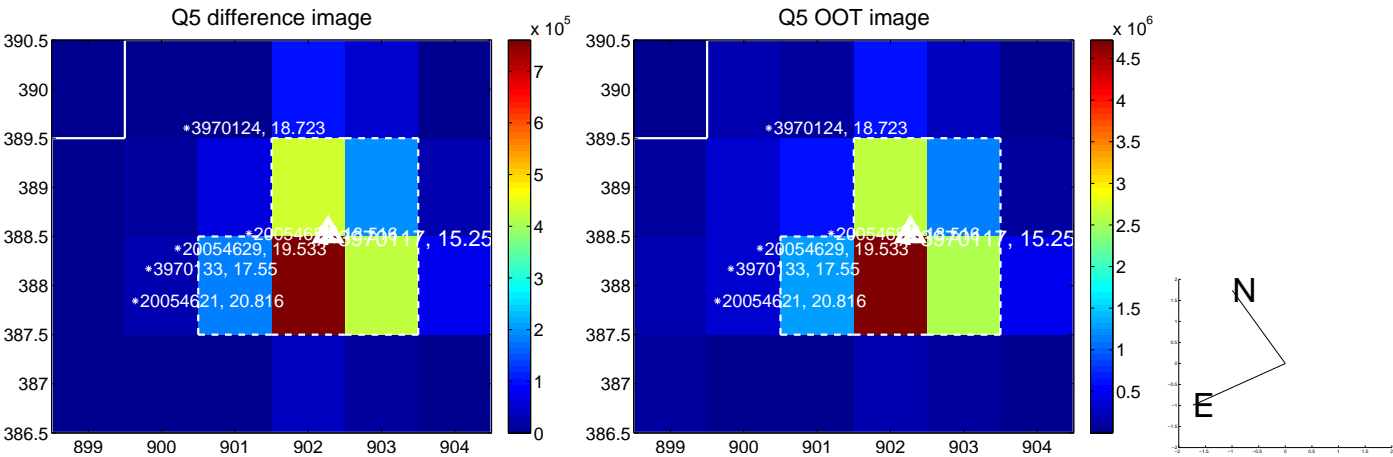


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

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

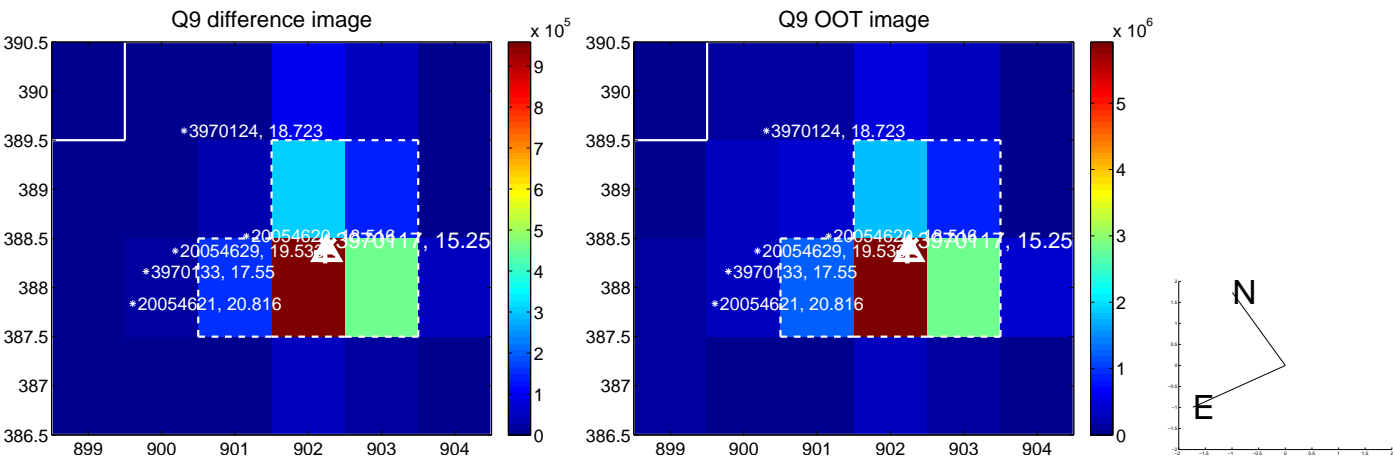


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

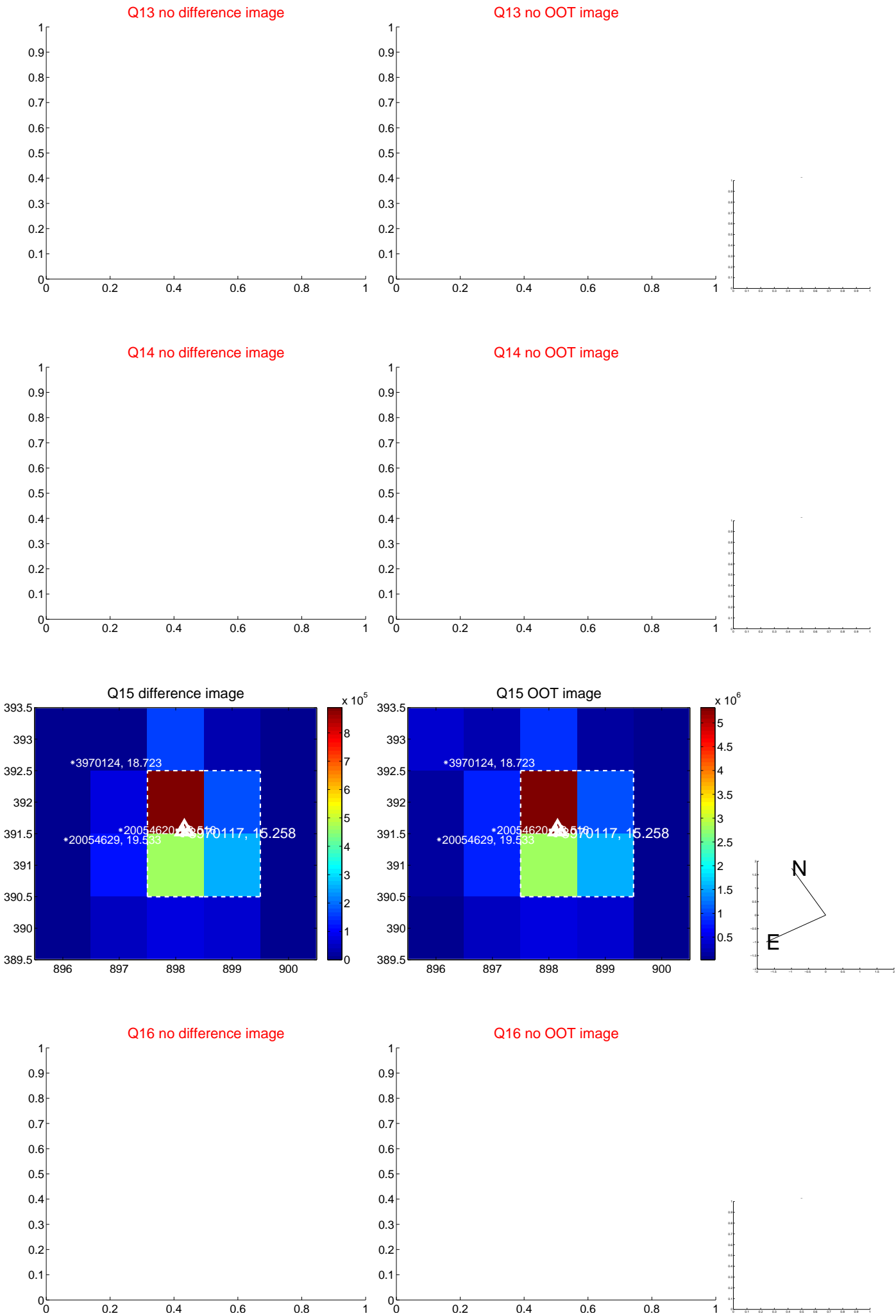




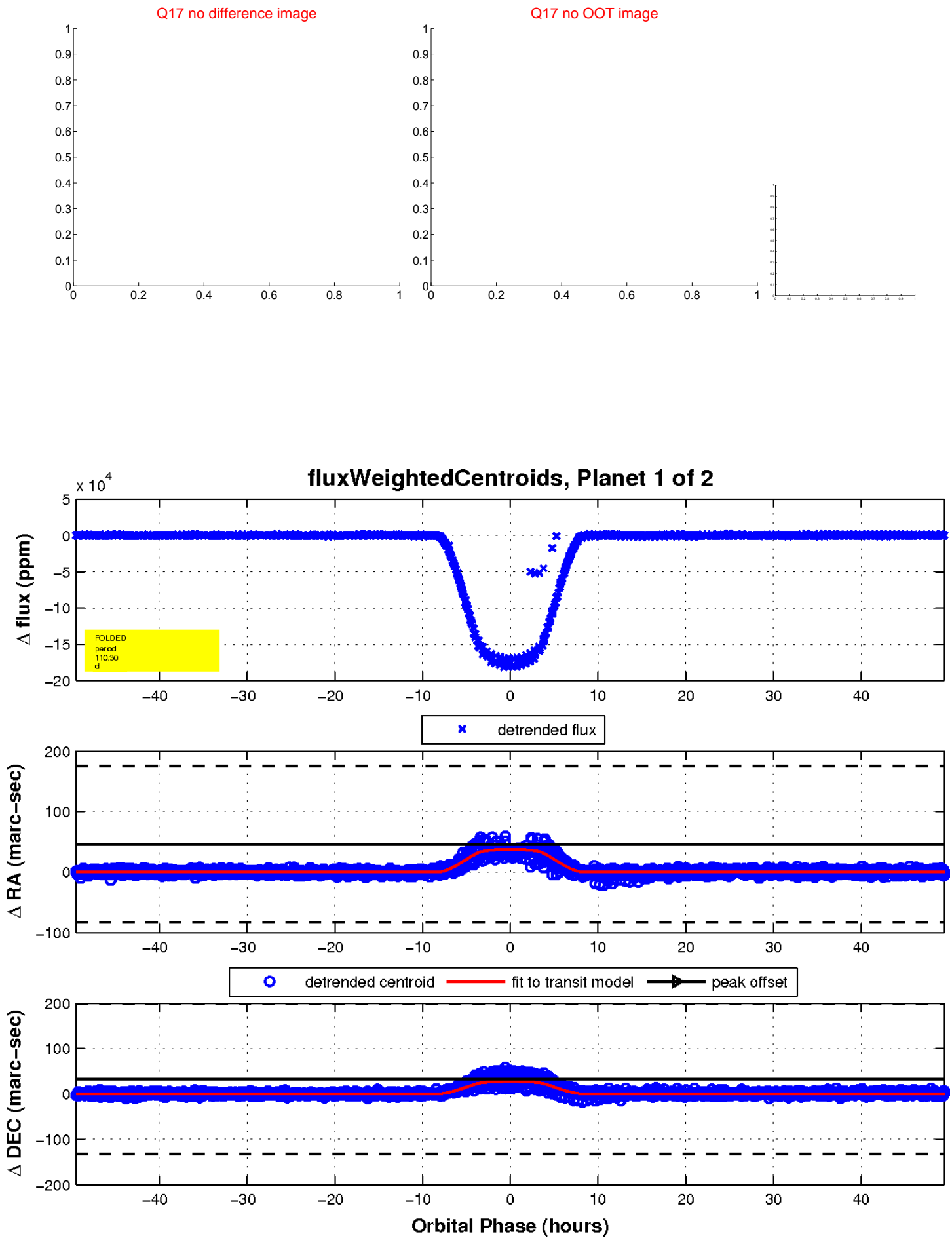
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

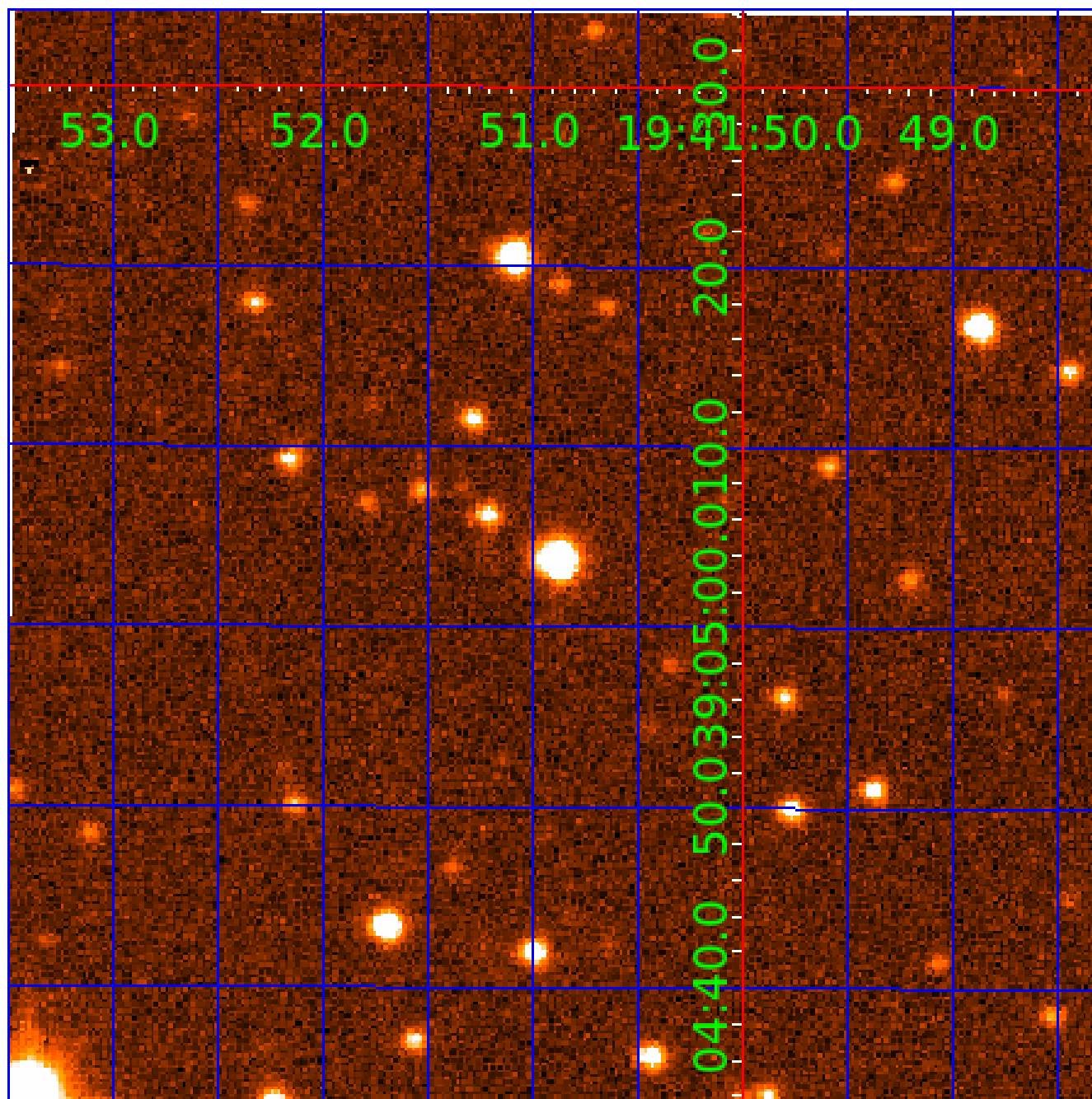


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



# UKIRT Image

Declination



# KIC 003970117

## 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) | $R_p$ ( $R_{\oplus}$ ) | $S_p$ ( $S_{\oplus}$ ) |
|--------------|----------|---------|---------------|--------------|-------------|------------------|--------|--------|-----------------------------|-----------------|------------------------|------------------------|
| 003970117-01 | OBS      | 3556.01 | 110.295159    | 235.750751   | 175681.4    | 16.518           | 2123.3 | 1690.0 | 0.90                        | 5753            | 37.73                  | 4.07                   |
| 003970117-02 | OBS      | No      | 110.295108    | 213.466598   | 25126.4     | 11.540           | 311.9  | 315.7  | 0.90                        | 5753            | 15.22                  | 4.07                   |

## Robovetter Results

| TCE          | Run Type | Disp | Score | N | S | C | E | Comments                           |
|--------------|----------|------|-------|---|---|---|---|------------------------------------|
| 003970117-01 | OBS      | FP   | 0.00  | 0 | 1 | 0 | 0 | MOD_SEC_DV—MOD_SEC_ALT—HAS_SEC_TCE |
| 003970117-02 | OBS      | FP   | 0.00  | 1 | 1 | 0 | 0 | IS_SEC_TCE                         |

**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.

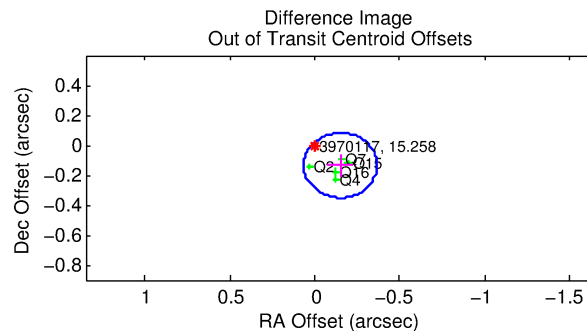
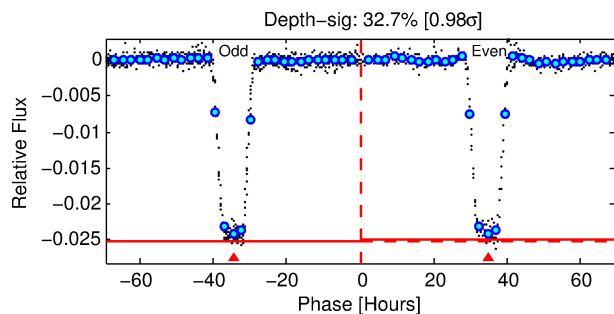
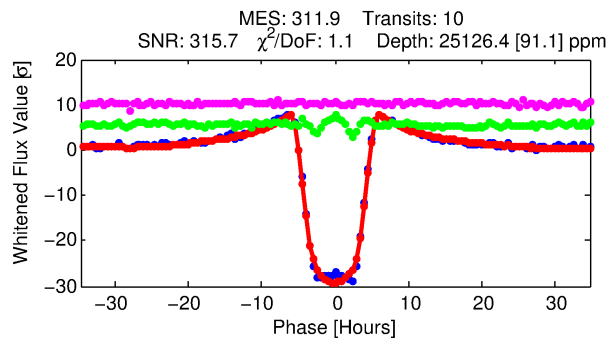
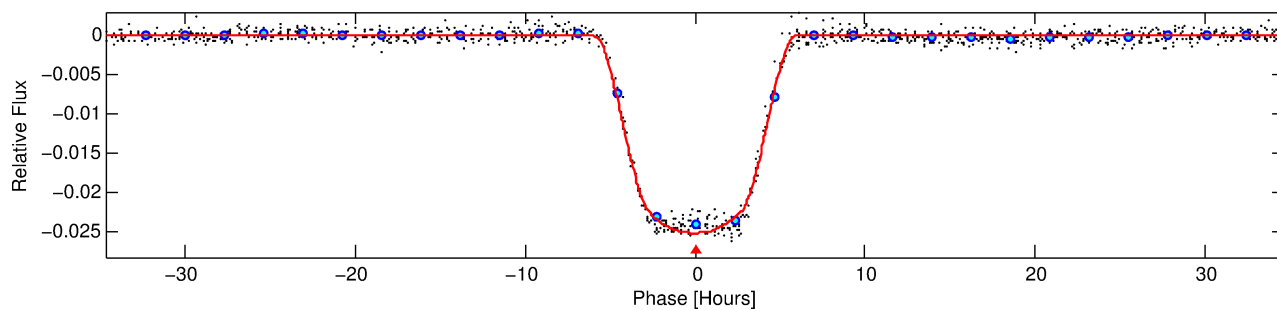
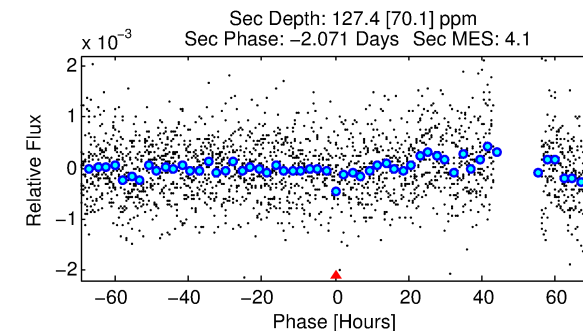
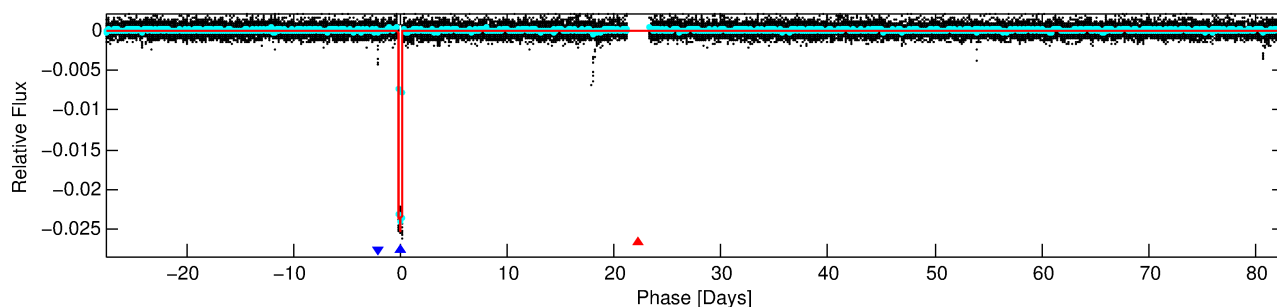
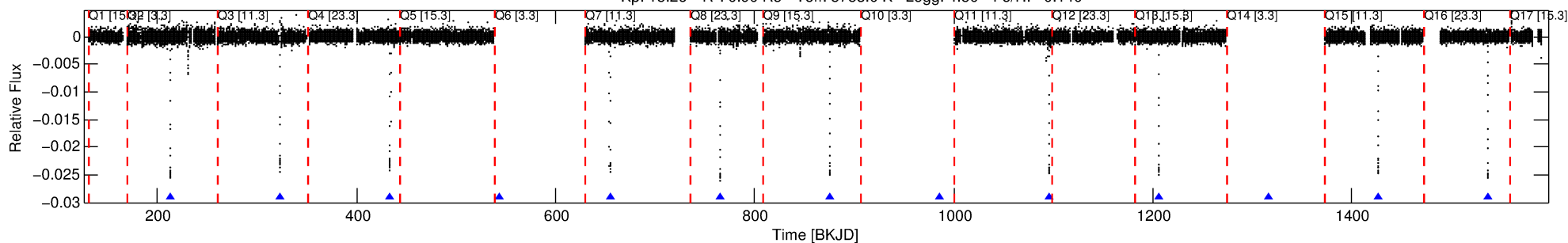
## Ephemeris Match Information For 003970117-02

No Significant Match Found

# DV One-Page Summary

KIC: 3970117 Candidate: 2 of 2 Period: 110.295 d  
KOI: K03556 Corr: No Ephemeris Match

Kp: 15.26 R\*: 0.90 Rs Teff: 5753.0 K Logg: 4.50 Fe/H: -0.140



## DV Fit Results:

Period = 110.29511 [0.00009] d  
Epoch = 213.4666 [0.0007] BKJD  
Rp/R\* = 0.1559 [0.0005]  
a/R\* = 67.07 [0.51]  
b = 0.70 [0.01]  
Seff = 4.07 [1.48]  
Teq = 362 [33] K  
Rp = 15.22 [4.24] Re  
a = 0.4395 [0.1033] AU  
Ag = 58.40 [37.88] [1.52σ]  
Teff = 1548 [218] K [5.38σ]

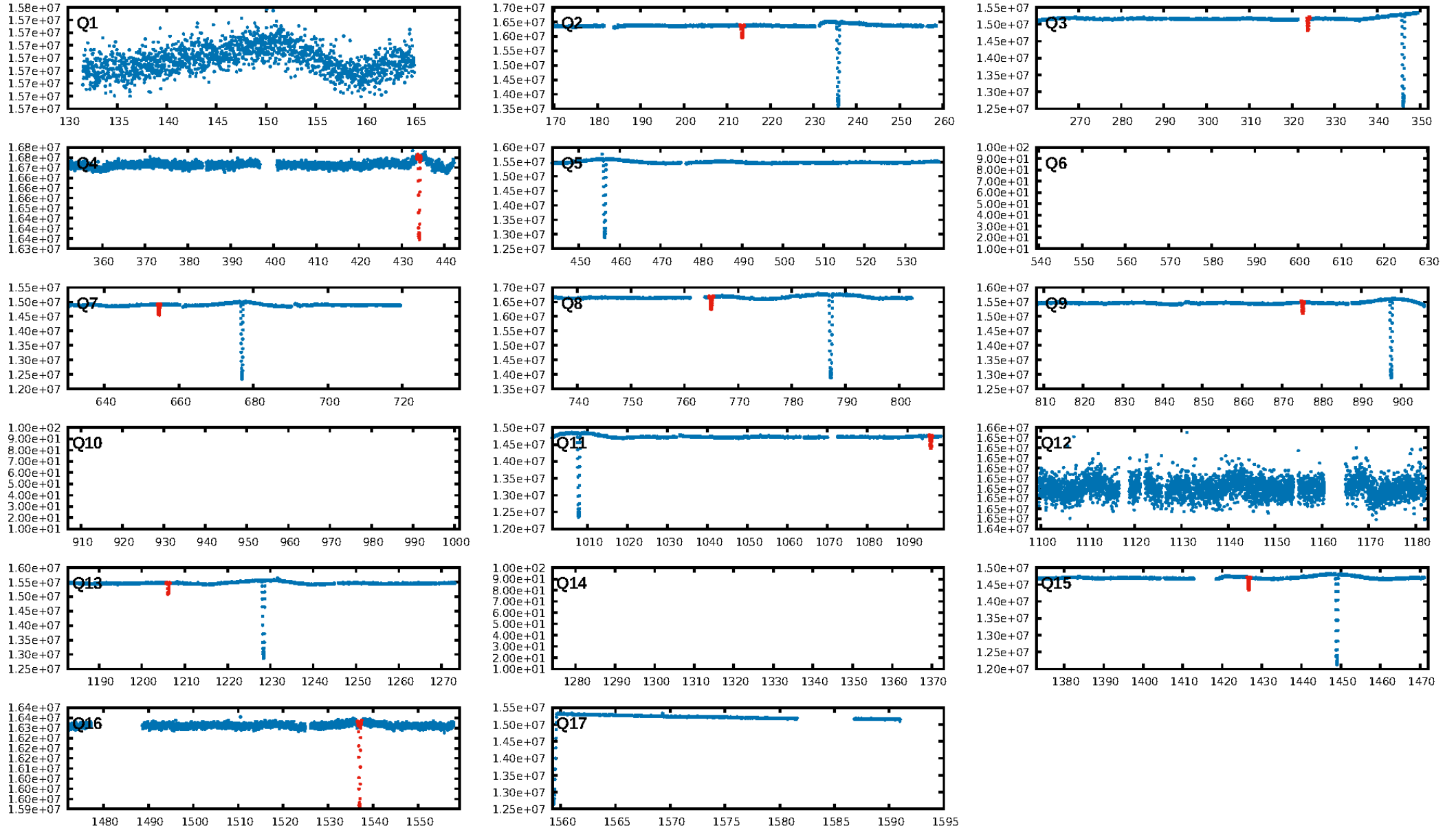
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: 0.4%  
ModelChiSquareGof-sig: 99.1%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [10/10]  
GhostDiagnostic-chr: 3.131  
Centroid-sig: 0.0%  
Centroid-so: 0.407 arcsec [11.61σ]  
OotOffset-rm: 0.202 arcsec [2.80σ]  
KicOffset-rm: 0.088 arcsec [1.21σ]  
OotOffset-st: 1/2/2/0 [5]  
KicOffset-st: 1/2/2/0 [5]  
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DiffImageOverlap-fno: 1.00 [5/5]

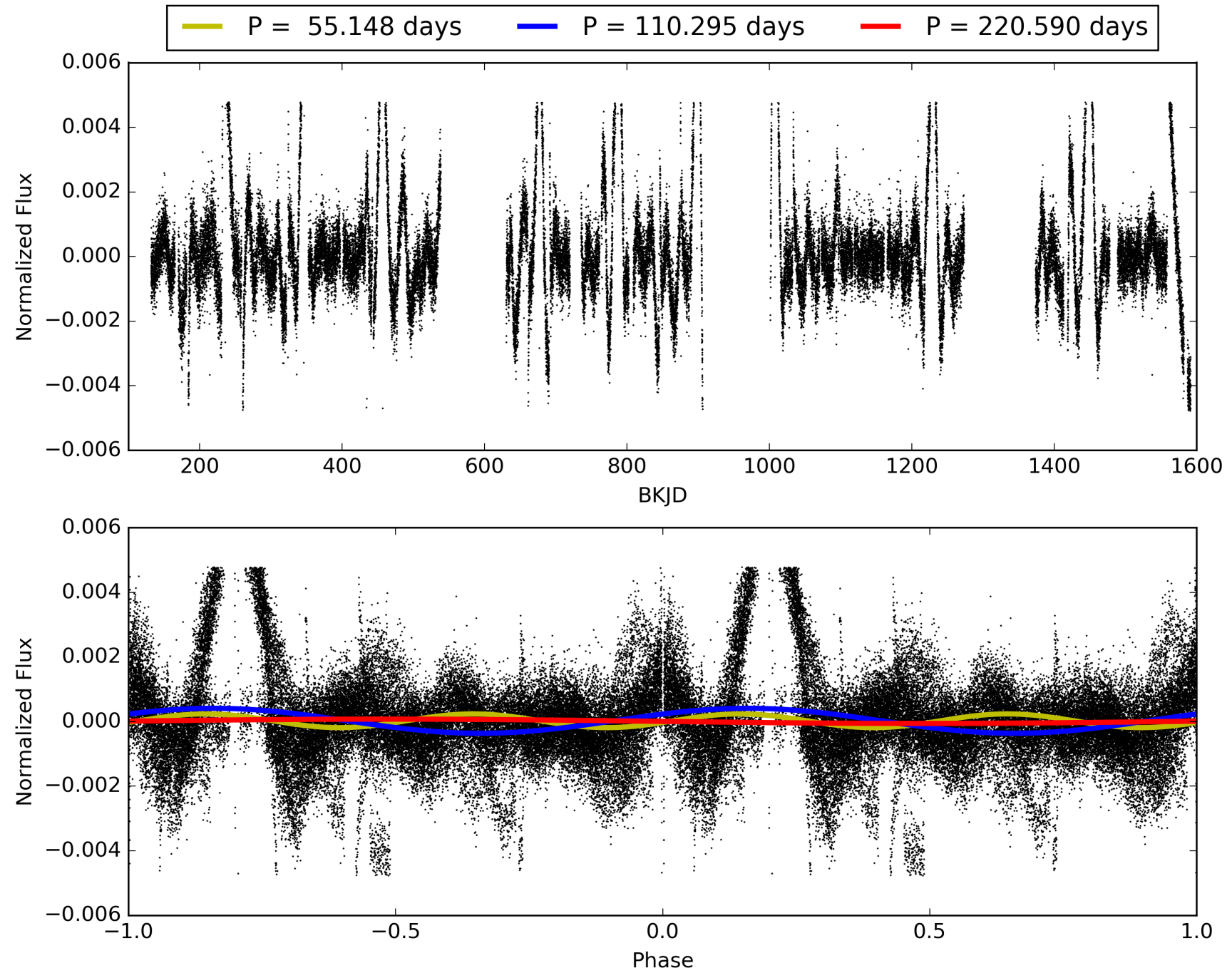
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 03:53:43 Z

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

# TCE 003970117-02, PDC Light Curves



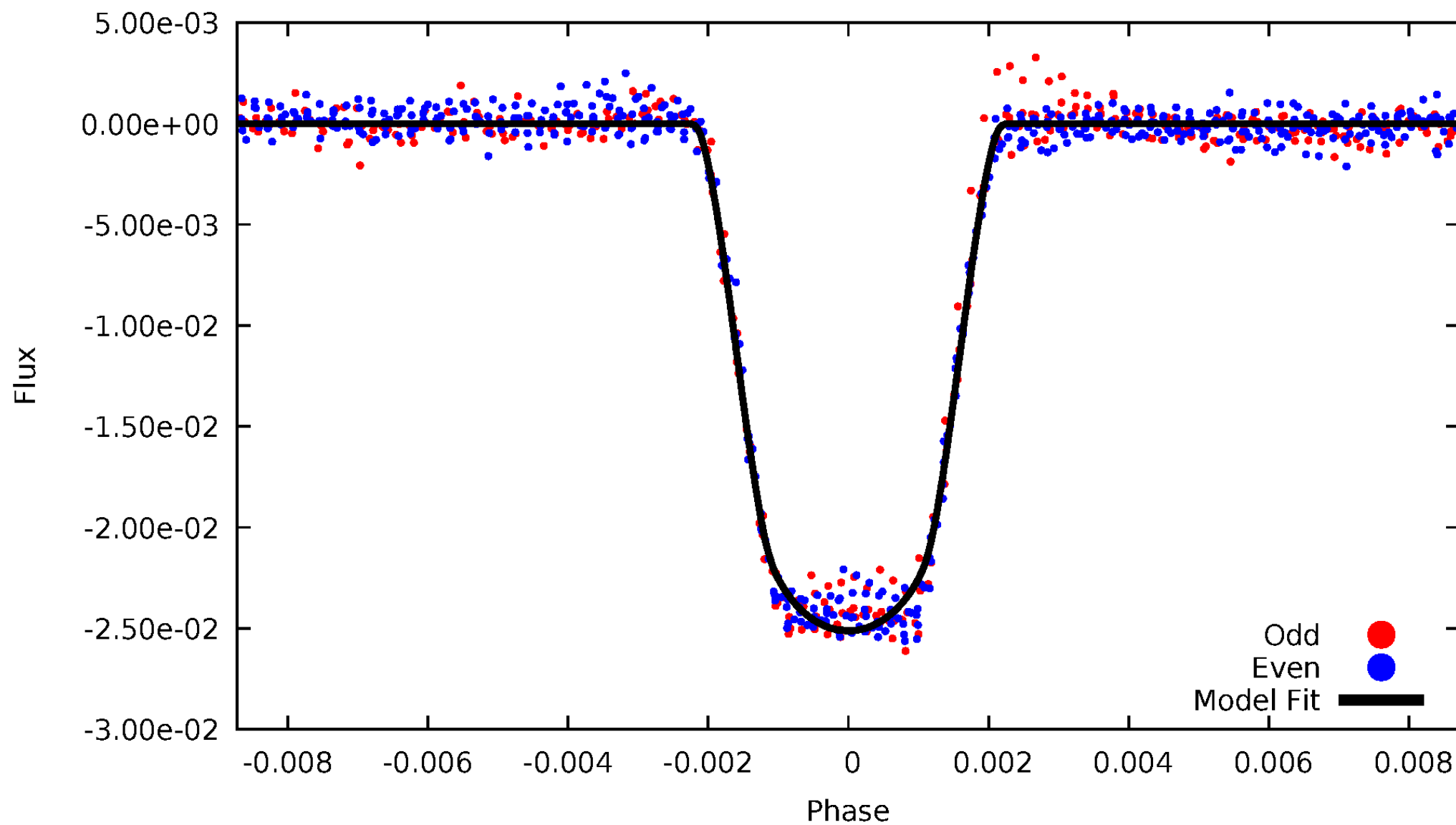
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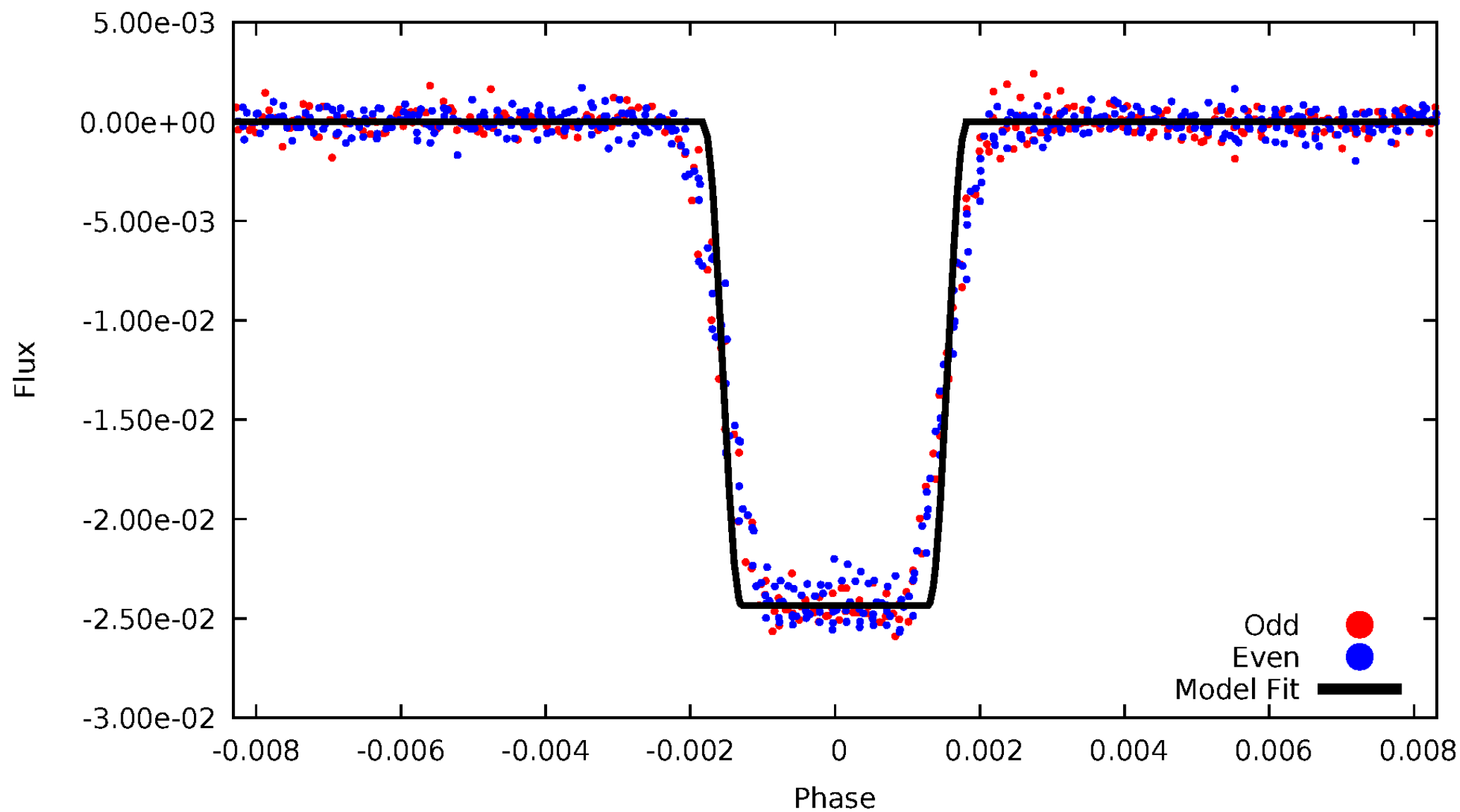
# DV Odd/Even

TCE 003970117-02



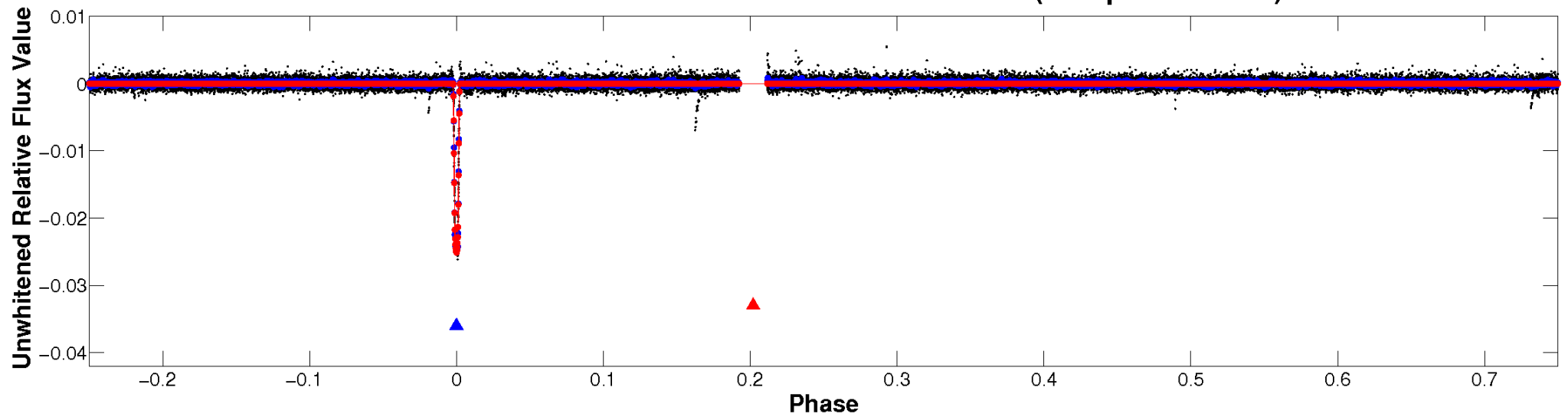
# ALT Odd/Even

TCE 003970117-02

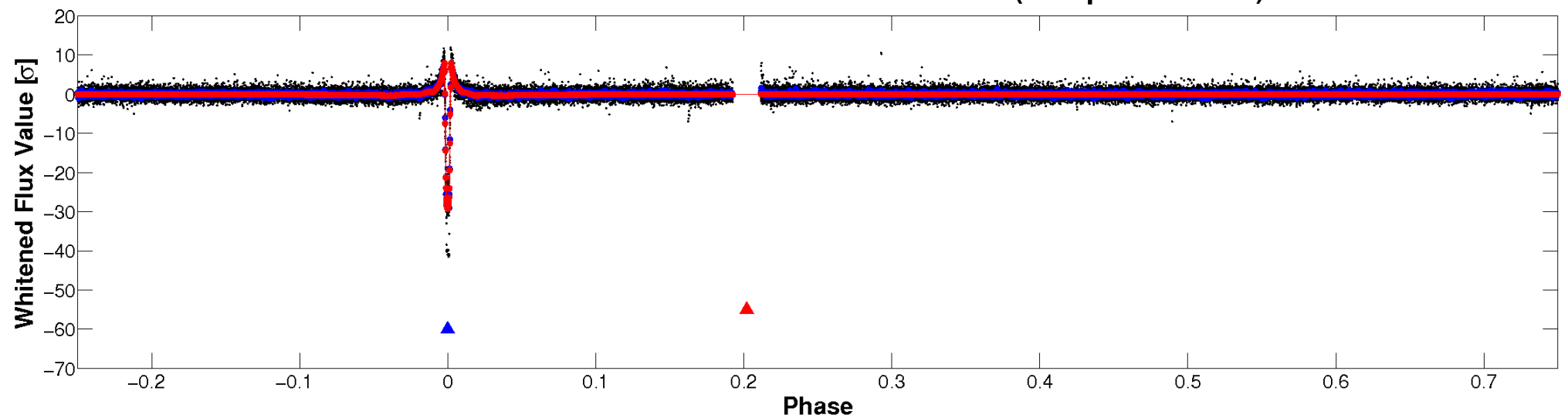


# Non-Whitened Vs. Whitened Light Curve

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

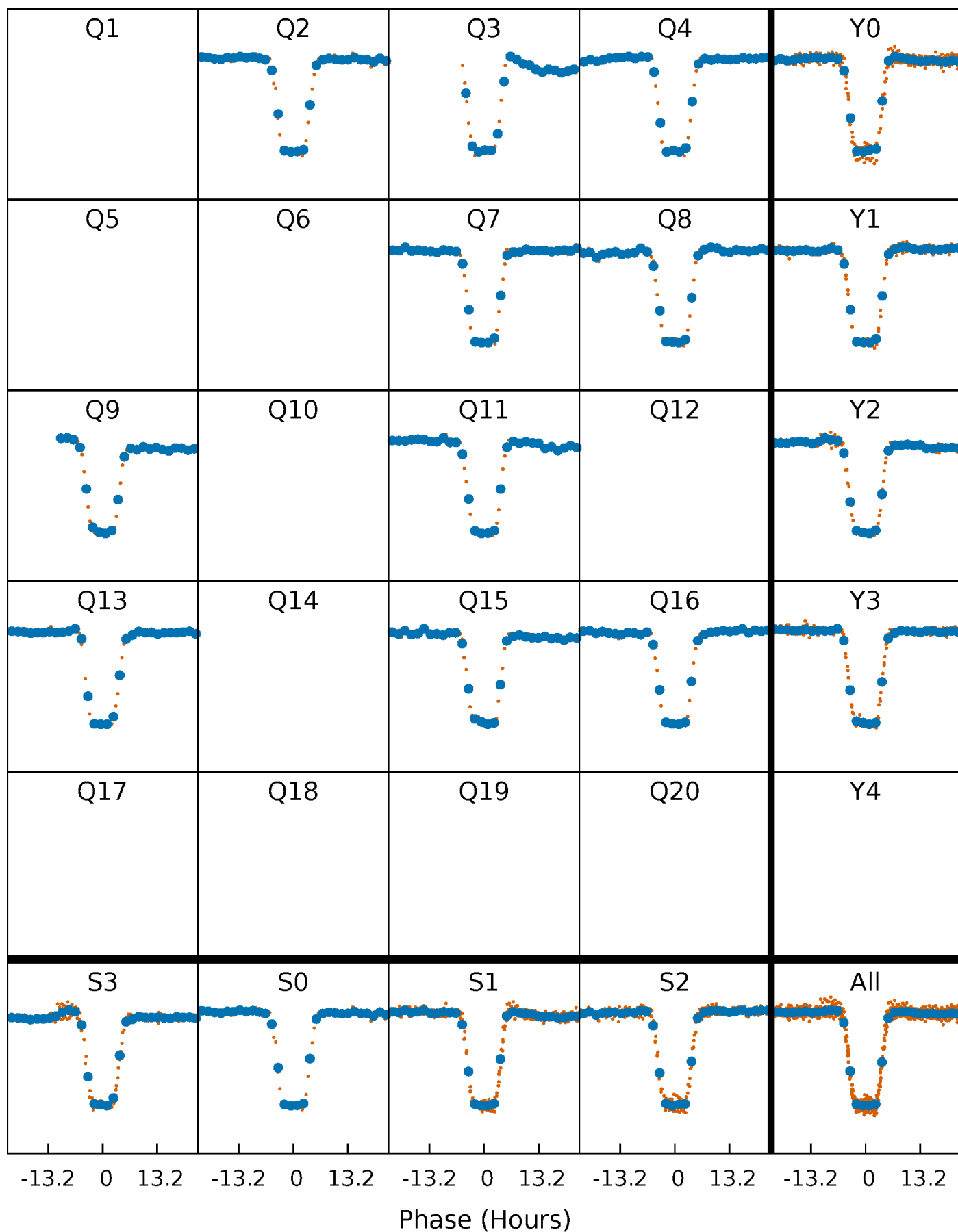


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



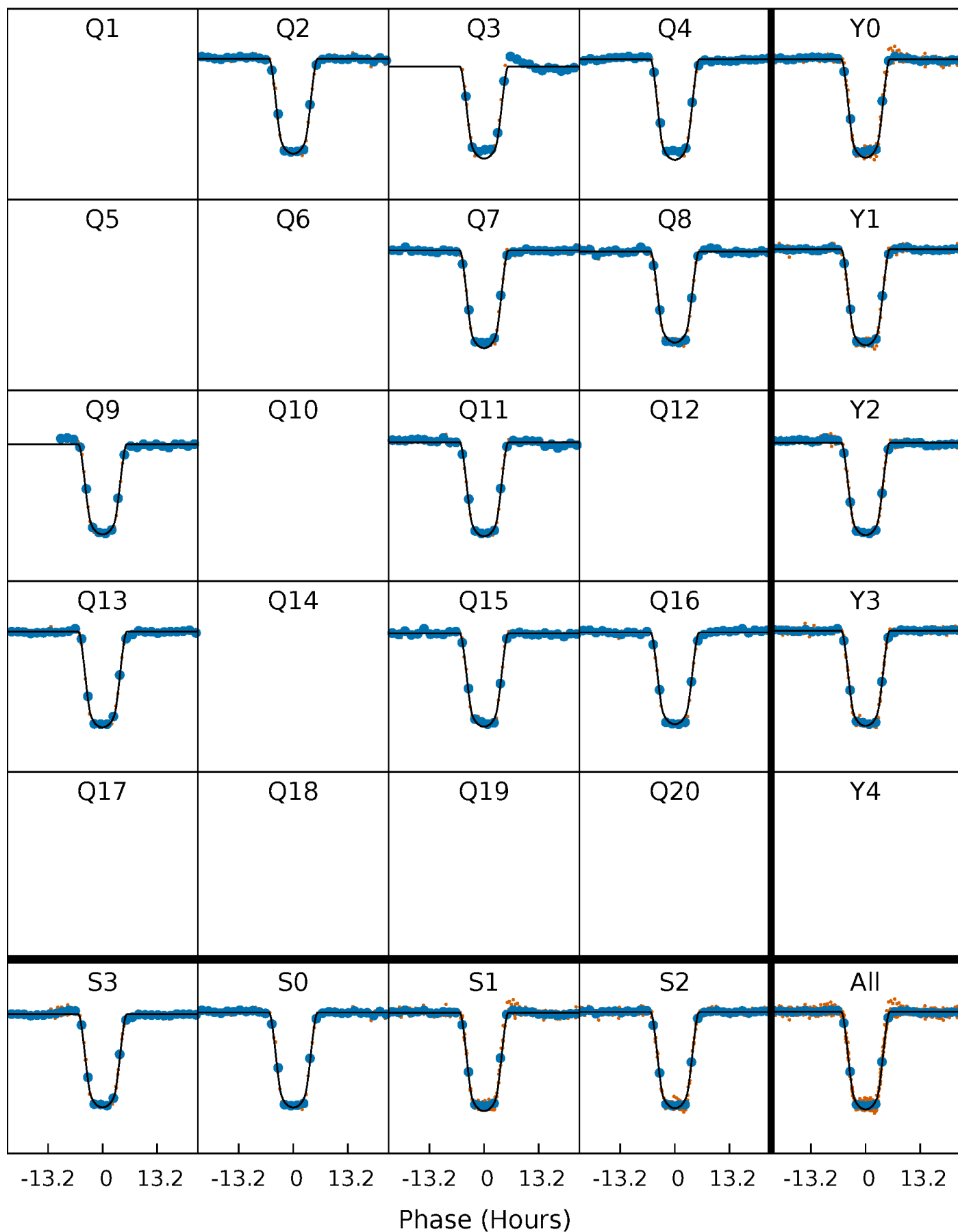
# PDC Quarter-Phased Transit Curves

TCE 003970117-02 P=110.295108 Days  $T_0=213.466598$  (BKJD)



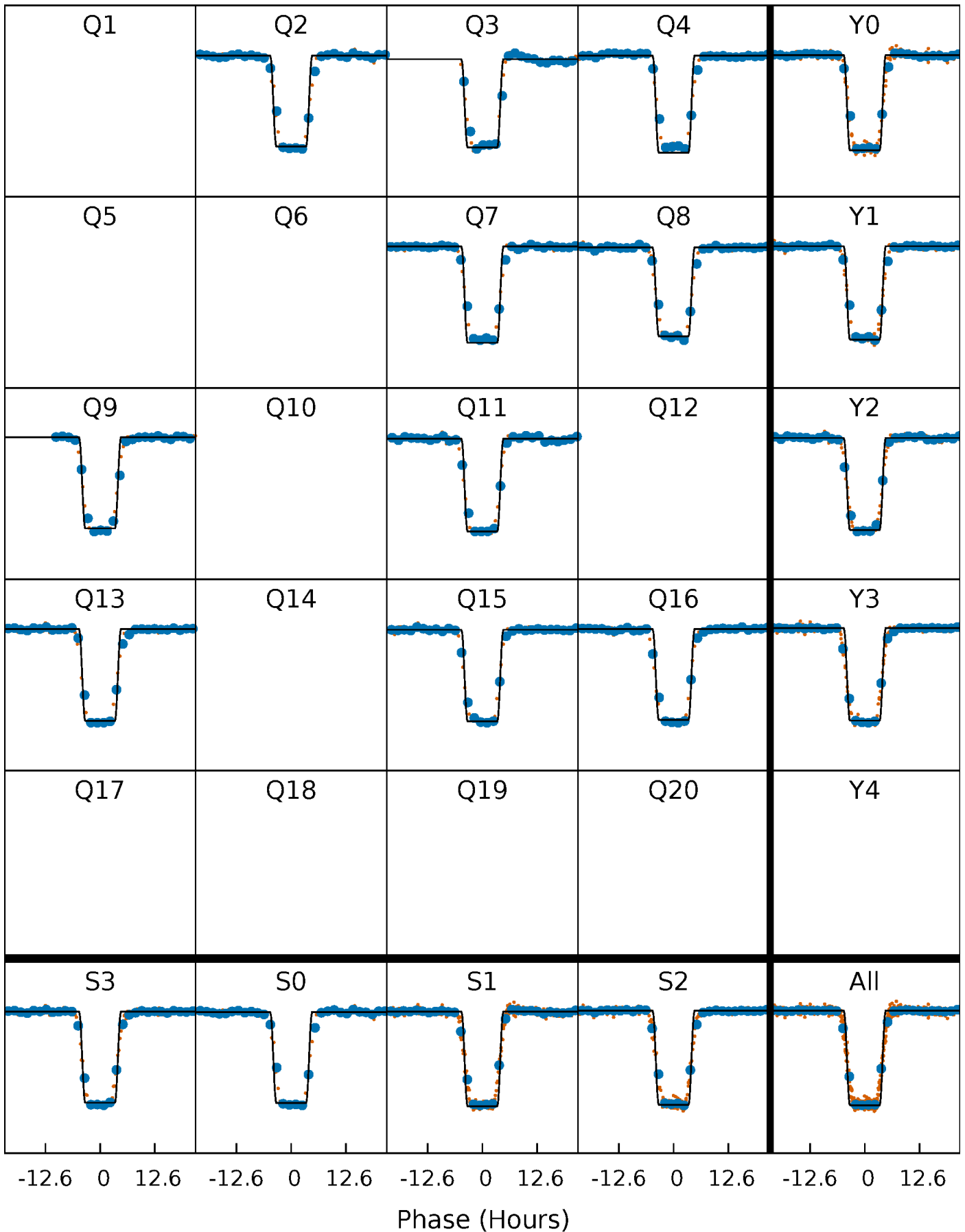
# DV Quarter-Phased Transit Curves

TCE 003970117-02 P=110.295108 Days  $T_0=213.466598$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

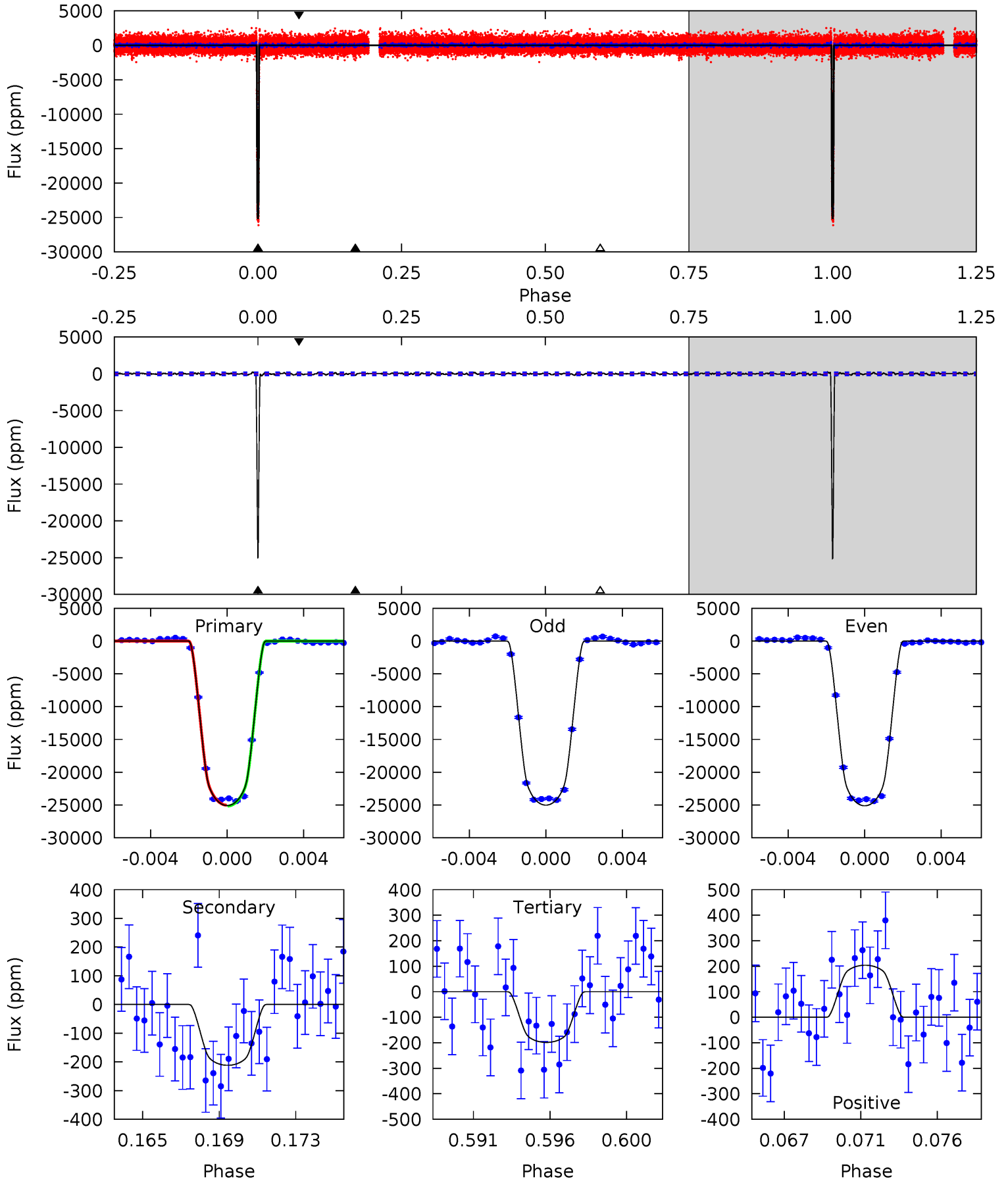
TCE 003970117-02 P=110.296636 Days  $T_0=213.457229$  (BKJD)



# DV Model-Shift Uniqueness Test

003970117-02, P = 110.295108 Days, E = 103.171490 Days

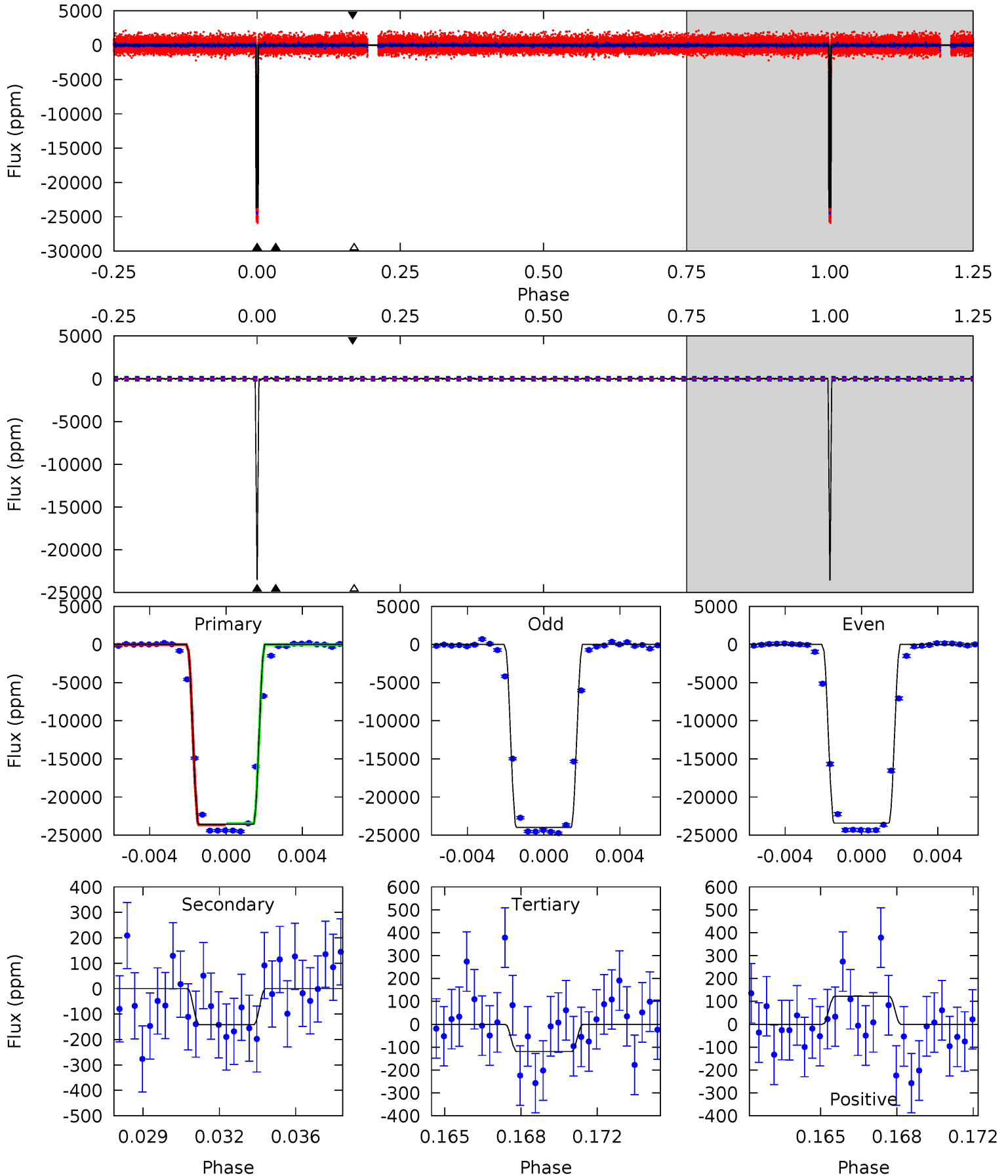
| Pri   | Sec  | Ter  | Pos  | FA <sub>1</sub> | FA <sub>2</sub> | F <sub>Red</sub> | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM  | Shape | TAT  |
|-------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 678.4 | 5.73 | 5.37 | 5.51 | 5.18            | 2.84            | 1.80             | 673.0   | 672.9   | 0.36    | 0.21    | 1.31    | 0.99 | 0.01  | 1.75 |



# Alt Model-Shift Uniqueness Test

003970117-02, P = 110.296636 Days, E = 103.160593 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 |
|-------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|-----|
| 604.3 | 3.62 | 3.06 | 3.13 | 5.22            | 2.91            | 0.80             | 601.2   | 601.2   | 0.56    | 0.49    | 6.93    | 0.99 | 0.01  | 0   |





### Stellar Parameters For KIC 003970117

|        | $T_{\text{eff}}(K)$  | $\log(g)$                 | [Fe/H]                     | $R (R_{\odot})$           | $M(M_{\odot})$            | $p_{\star} (\text{g}\cdot\text{cm}^{-3})$ |
|--------|----------------------|---------------------------|----------------------------|---------------------------|---------------------------|---|
|        | $5753^{+155}_{-172}$ | $4.503^{+0.062}_{-0.188}$ | $-0.140^{+0.300}_{-0.300}$ | $0.895^{+0.249}_{-0.107}$ | $0.931^{+0.111}_{-0.100}$ | $1.828^{+0.479}_{-0.923}$                 |
|        | +3%/-3%              | +1%/-4%                   | +214%/-214%                | +28%/-12%                 | +12%/-11%                 | +26%/-50%                                 |
| 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 003970117-02 / KOI

| Detrend | Depth (ppm)   | $R_p (R_{\oplus})$      | $T_{\text{max}} (K)$ | $T_{\text{obs}} (K)$ | $A_{\text{obs}}$ |
|---------|---------------|-------------------------|----------------------|----------------------|------------------|
| DV      | $-212 \pm 37$ | $15.76^{+2.27}_{-1.30}$ | $516^{+33}_{-26}$    | $2579^{+65}_{-74}$   | $88^{+26}_{-24}$ |
| Alt.    | $-141 \pm 39$ | $15.66^{+2.18}_{-1.24}$ | $515^{+31}_{-24}$    | $2460^{+76}_{-107}$  | $59^{+21}_{-19}$ |

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

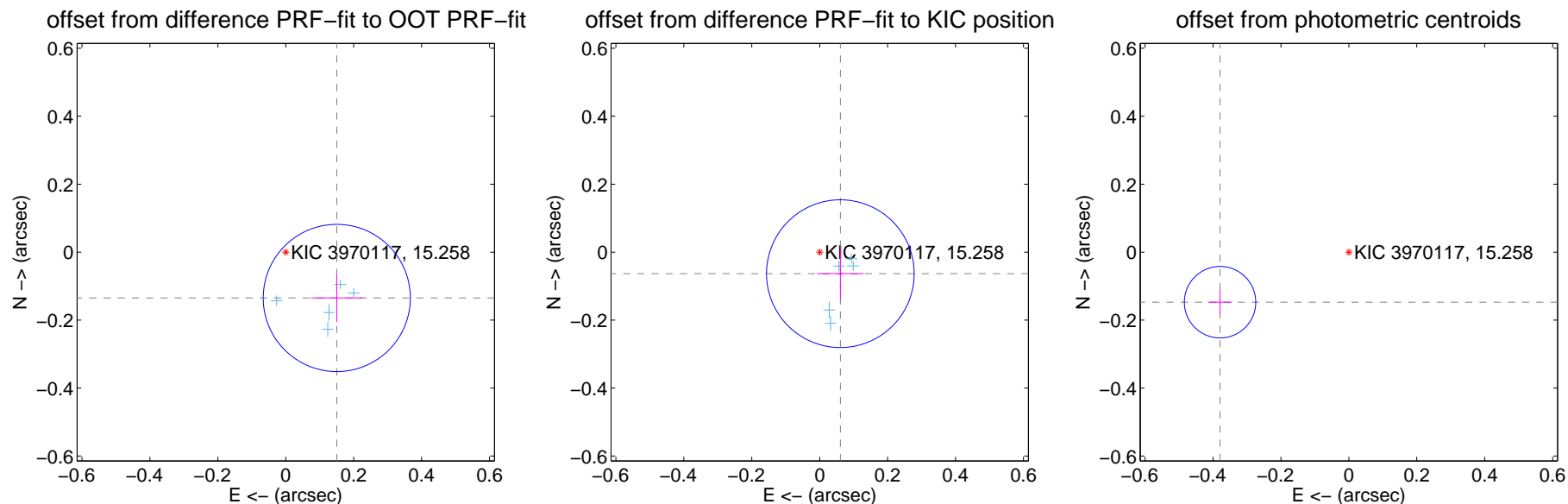
## DV Centroid Data

Supplemental centroid analysis for 003970117-02. Kepler magnitude: 15.26. Transit SNR 315.67

There are 5 quarters with good PRF difference image offsets

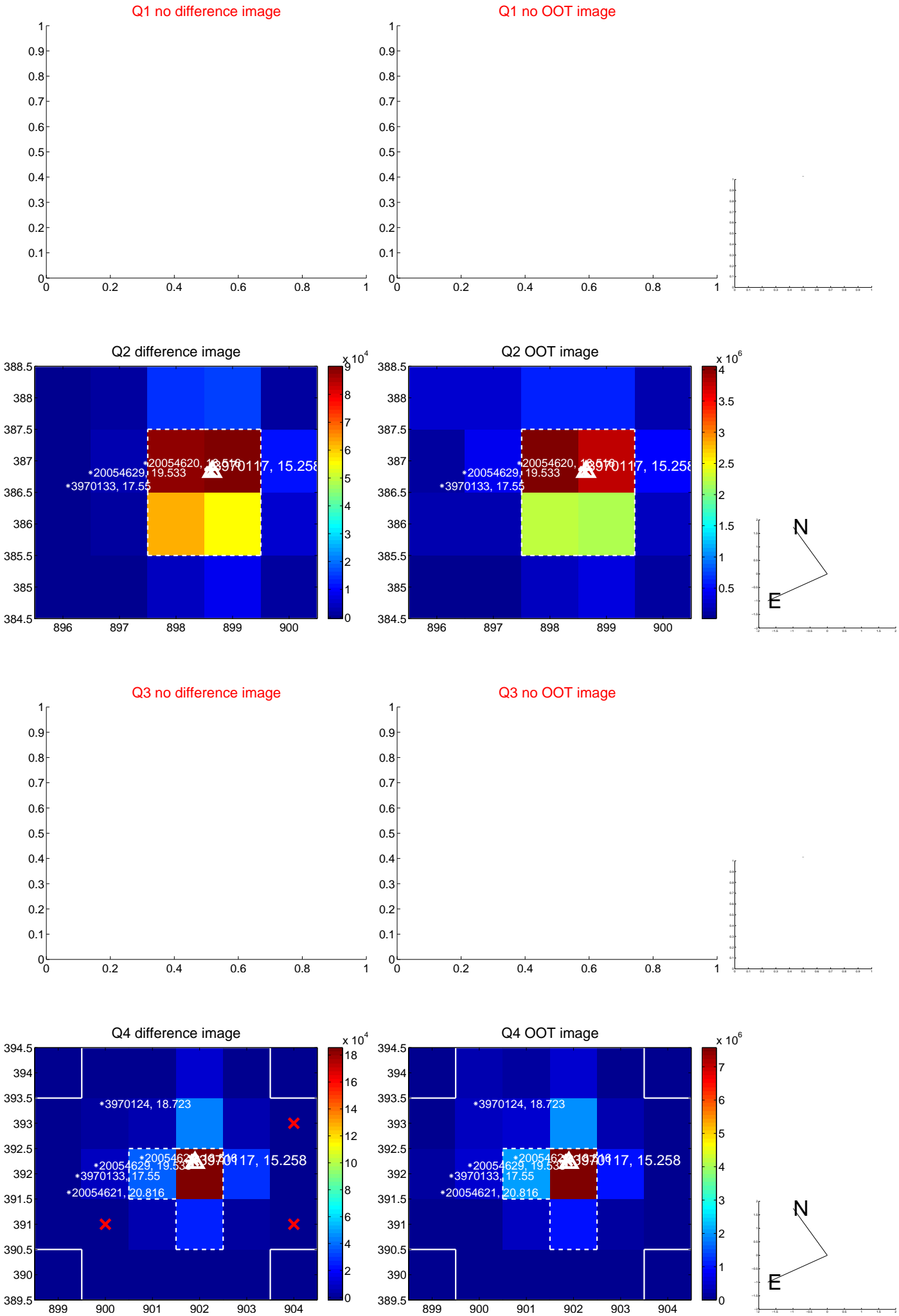
The direct PRF centroid is offset from the target star catalog position by about 0.10 arcsec

|   | Distance in arcsec | Distance / $\sigma$ | $\Delta$ RA        | $\Delta$ Dec       |
|---|--------------------|---------------------|--------------------|--------------------|
| PRF-fit source offset from OOT          | $0.202 \pm 0.072$  | 2.80                | $-0.150 \pm 0.076$ | $-0.135 \pm 0.070$ |
| PRF-fit source offset from KIC position | $0.088 \pm 0.072$  | 1.21                | $-0.061 \pm 0.069$ | $-0.063 \pm 0.076$ |
| photometric centroid source offset      | $0.41 \pm 0.04$    | 11.61               | $0.38 \pm 0.03$    | $-0.15 \pm 0.04$   |

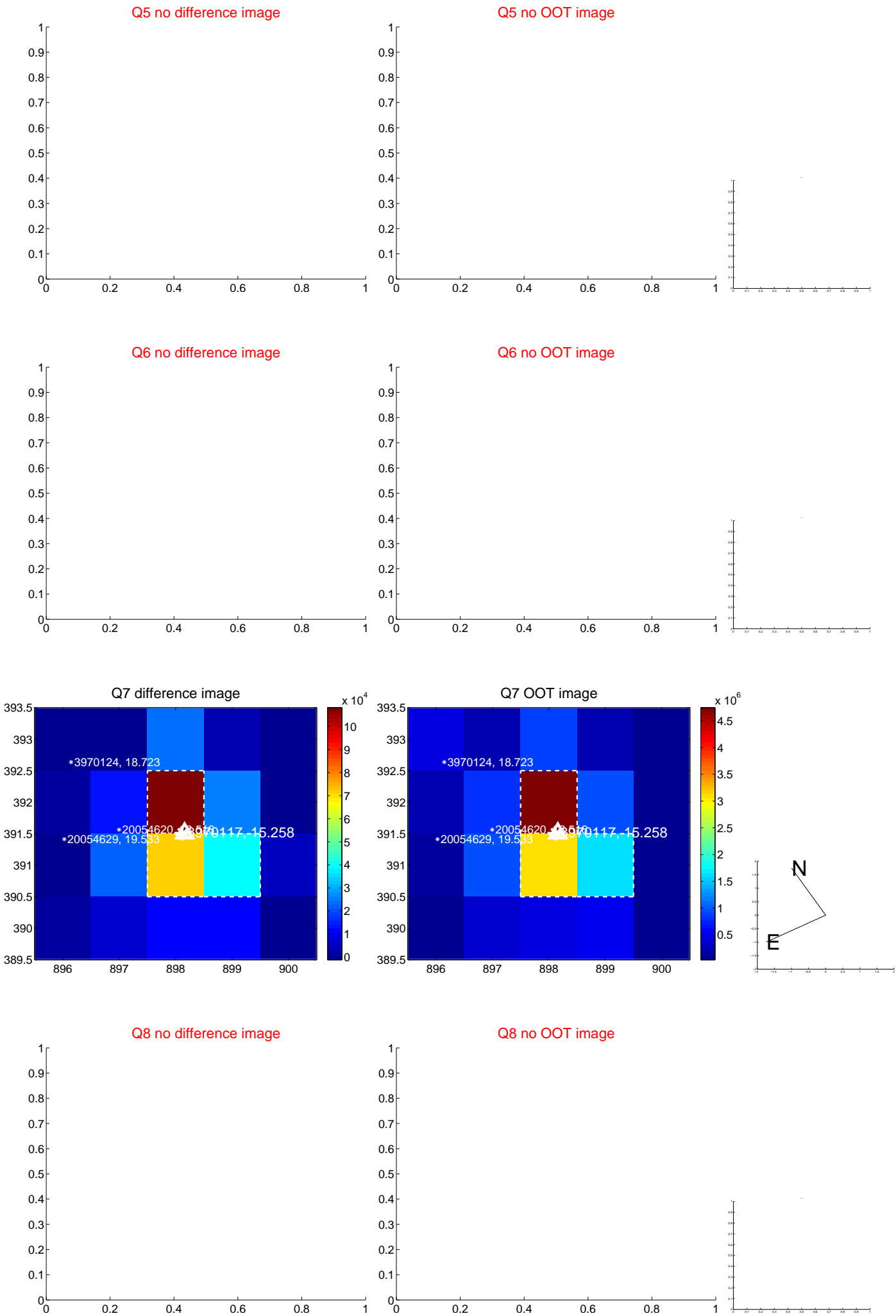


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

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



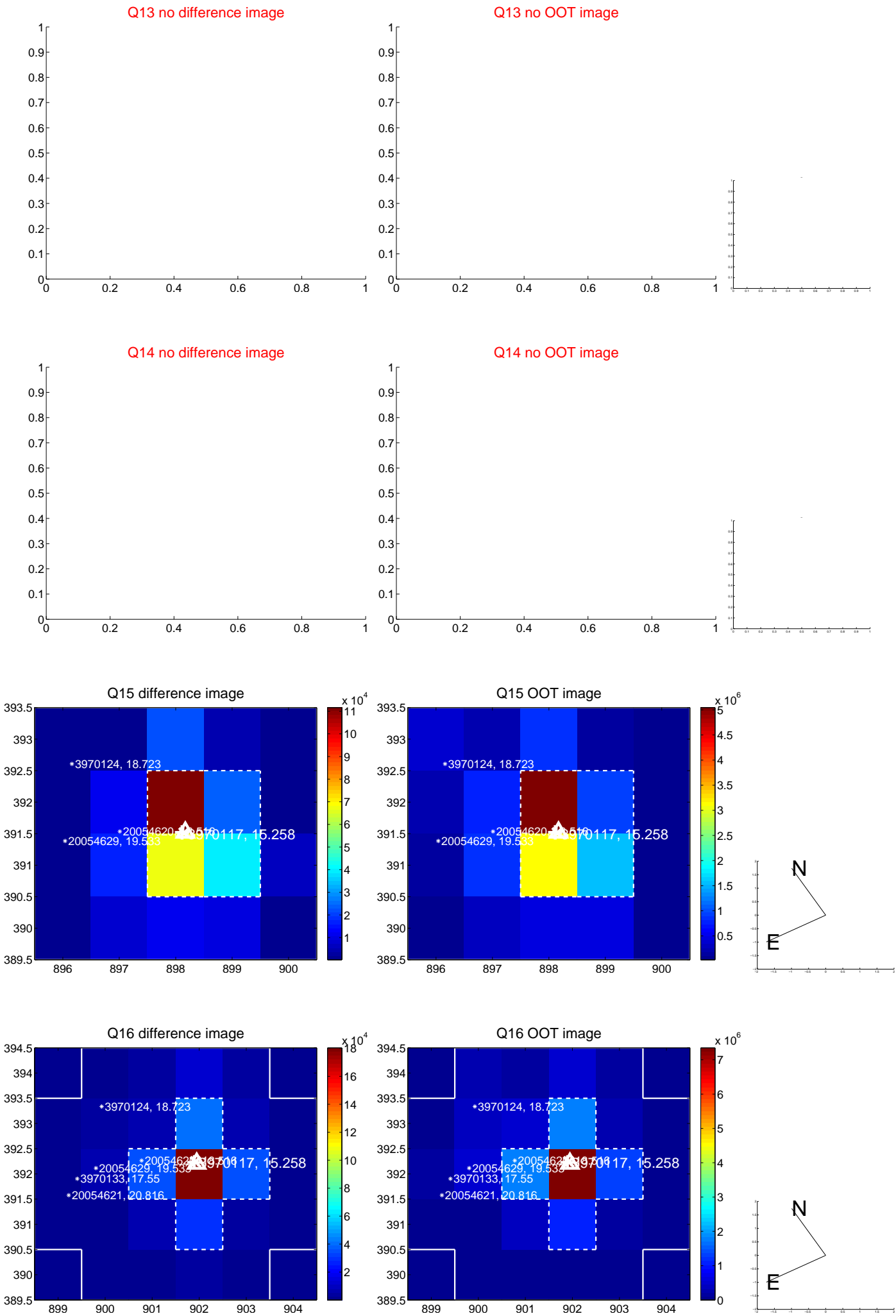
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



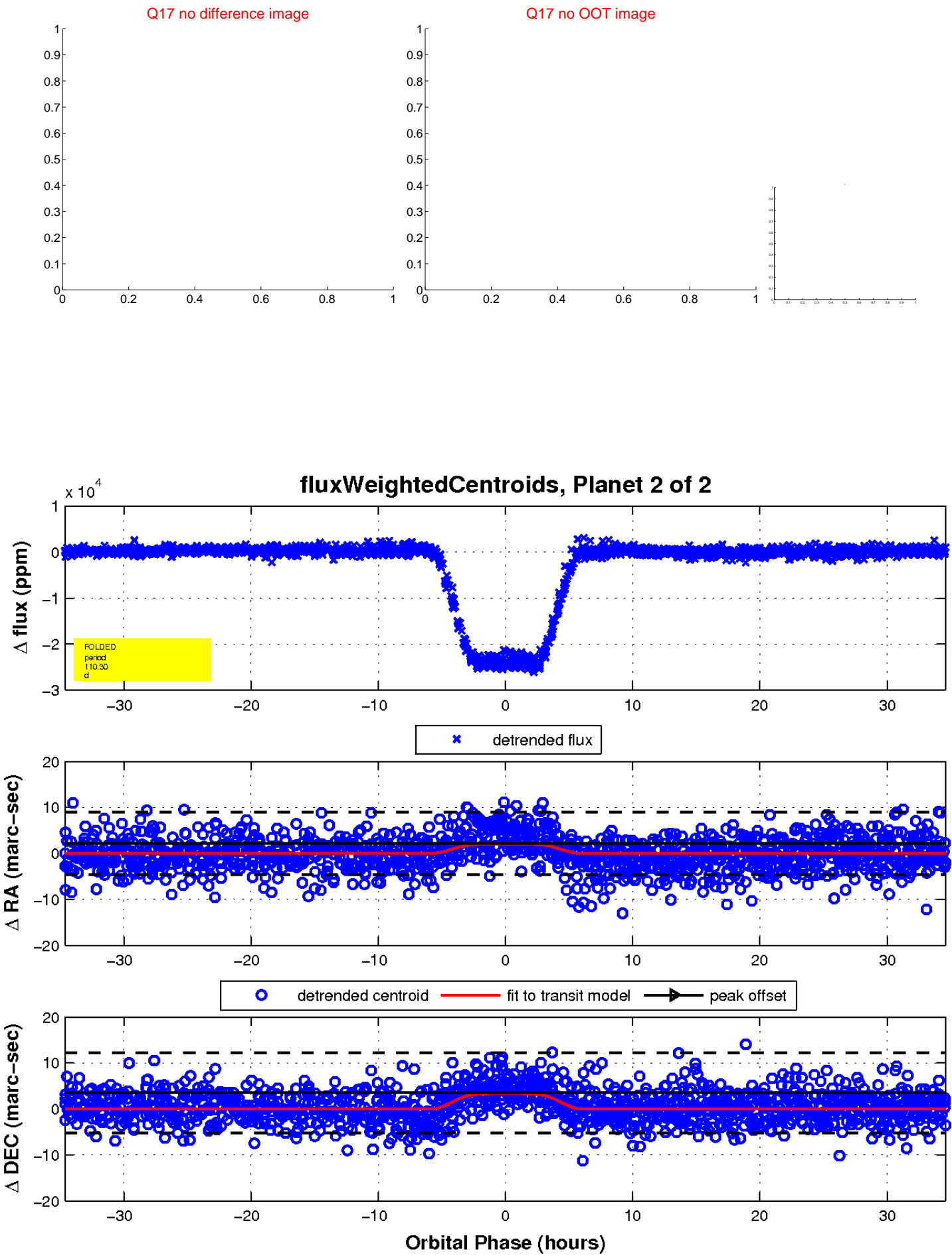
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



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



# UKIRT Image

Declination

