

KIC 004914709

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}) |
|--------------|----------|---------|---------------|--------------|-------------|------------------|------|------|-----------------------------|-----------------|------------------------|------------------------|
| 004914709-01 | OBS | 6470.01 | 8.653031 | 136.668869 | 440.1 | 1.185 | 11.5 | 13.3 | 0.84 | 5301 | 2.21 | 80.59 |
| 004914709-02 | OBS | No | 8.653198 | 134.290403 | 278.1 | 1.648 | 9.0 | 10.2 | 0.84 | 5301 | 1.54 | 80.59 |

Robovetter Results

| TCE | Run Type | Disp | Score | N | S | C | E | Comments |
|--------------|----------|------|-------|---|---|---|---|------------------------------------------------|
| 004914709-01 | OBS | FP | 0.00 | 0 | 1 | 0 | 1 | MOD_SEC_DV—MOD_SEC_ALT—HAS_SEC_TCE—EPHEM_MATCH |
| 004914709-02 | OBS | FP | 0.00 | 1 | 1 | 0 | 1 | IS_SEC_TCE—EPHEM_MATCH |

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 for comment definitions.

Ephemeris Match Information For 004914709-01

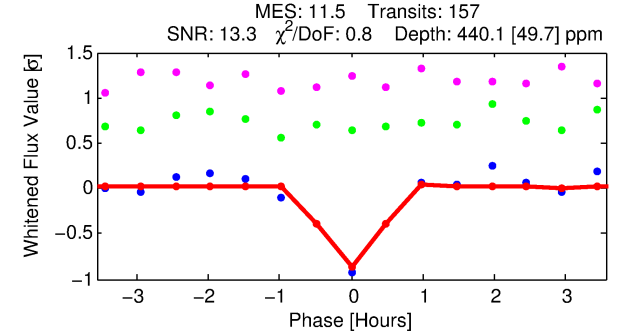
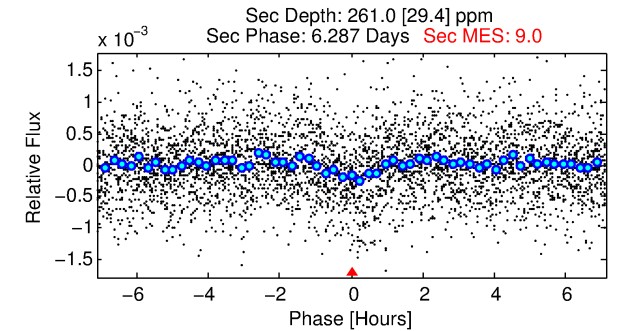
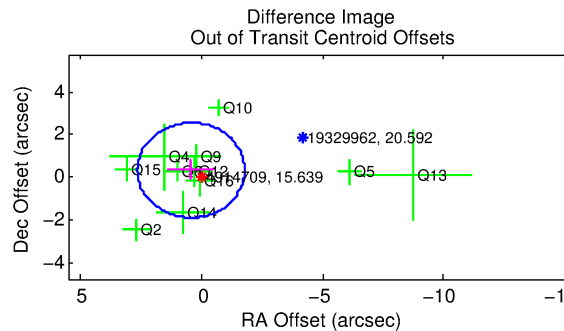
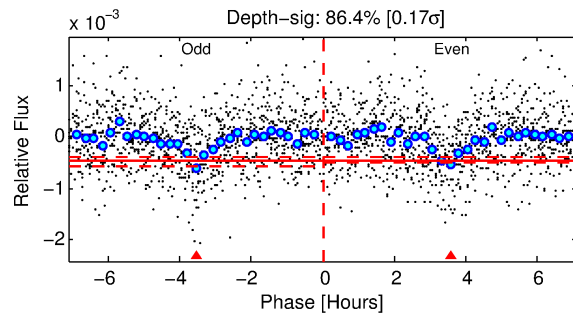
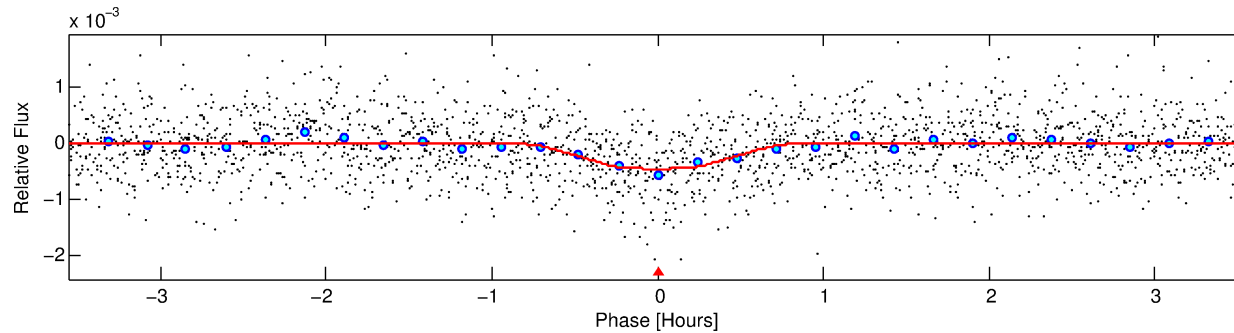
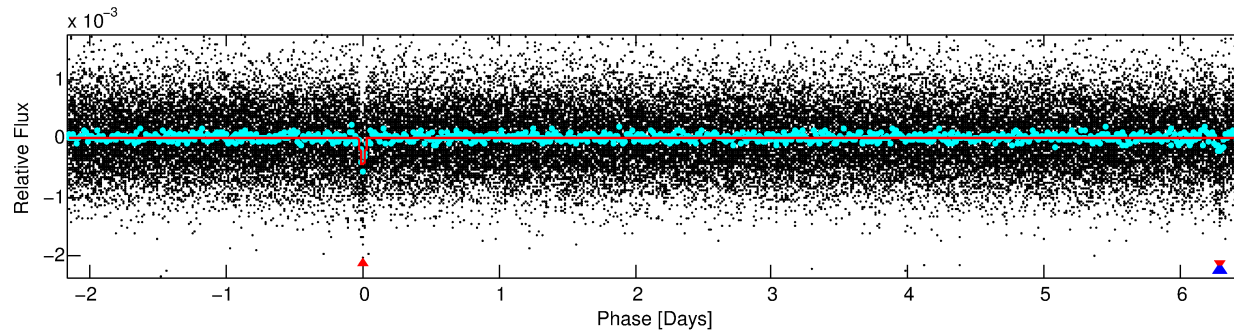
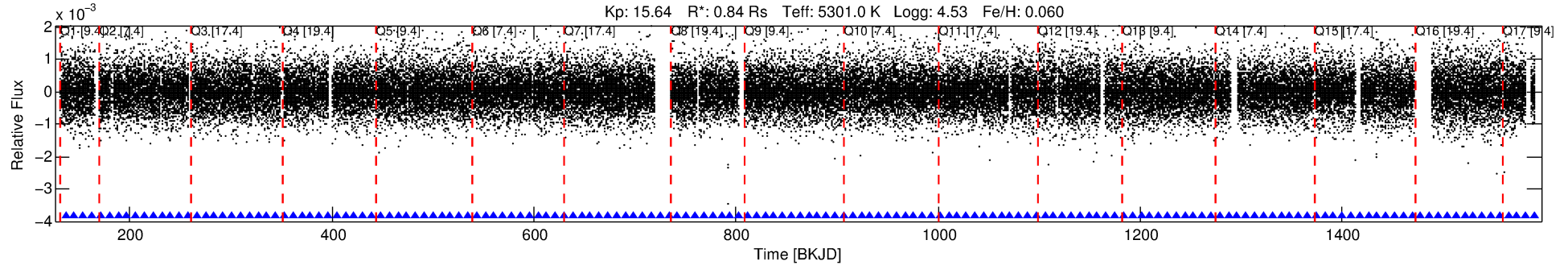
| TCE (1) | KIC | Parent (2) | Parent KIC | $P_1:P_2$ | Dist ($''$) | Δ Row | Δ Col | m_2 | m_1 | D_2/D_1 | Mechanism | Flag | σ_P | σ_T |
|--------------|---------|--------------|------------|-----------|---------------|--------------|--------------|-------|-------|-----------|-------------|------|------------|------------|
| 004914709-01 | 4914709 | 004150611-01 | 4150611 | 1:1 | 3293.4 | 829 | 0 | 7.90 | 15.64 | 131.99 | Col-Anomaly | 0 | 0.48 | 0.45 |

Notes: $P_1:P_2$ is the period ratio. Dist is the distance in arcseconds. Δ Row and Δ Col are the number of pixels apart in row and column. m_2 and m_1 are the magnitudes of the parent and child. D_2/D_1 is the parent's transit depth divided by the child's. σ_P and σ_T are the significance of the match in period and epoch. For a match to be considered significant $\sigma_P < 5.0$ and $\sigma_T < 5.0$. Matches which have σ_P and σ_T very close to this cutoff should receive extra scrutiny, especially if the period ratio is very large.

DV One-Page Summary

KIC: 4914709 Candidate: 1 of 2 Period: 8.653 d
KOI: K06470.01 Corr: 0.943

Kp: 15.64 R*: 0.84 Rs Teff: 5301.0 K Logg: 4.53 Fe/H: 0.060



DV Fit Results:

Period = 8.65303 [0.00003] d
Epoch = 136.6689 [0.0024] BKJD
Rp/R* = 0.0241 [0.0120]
a/R* = 24.68 [50.94]
b = 0.92 [0.34]
Seff = 80.59 [19.40]
Teq = 764 [46] K
Rp = 2.21 [1.15] Re
a = 0.0787 [0.0109] AU
Ag = 182.05 [185.31] [0.98σ]
Teff = 4339 [1092] K [3.27σ]

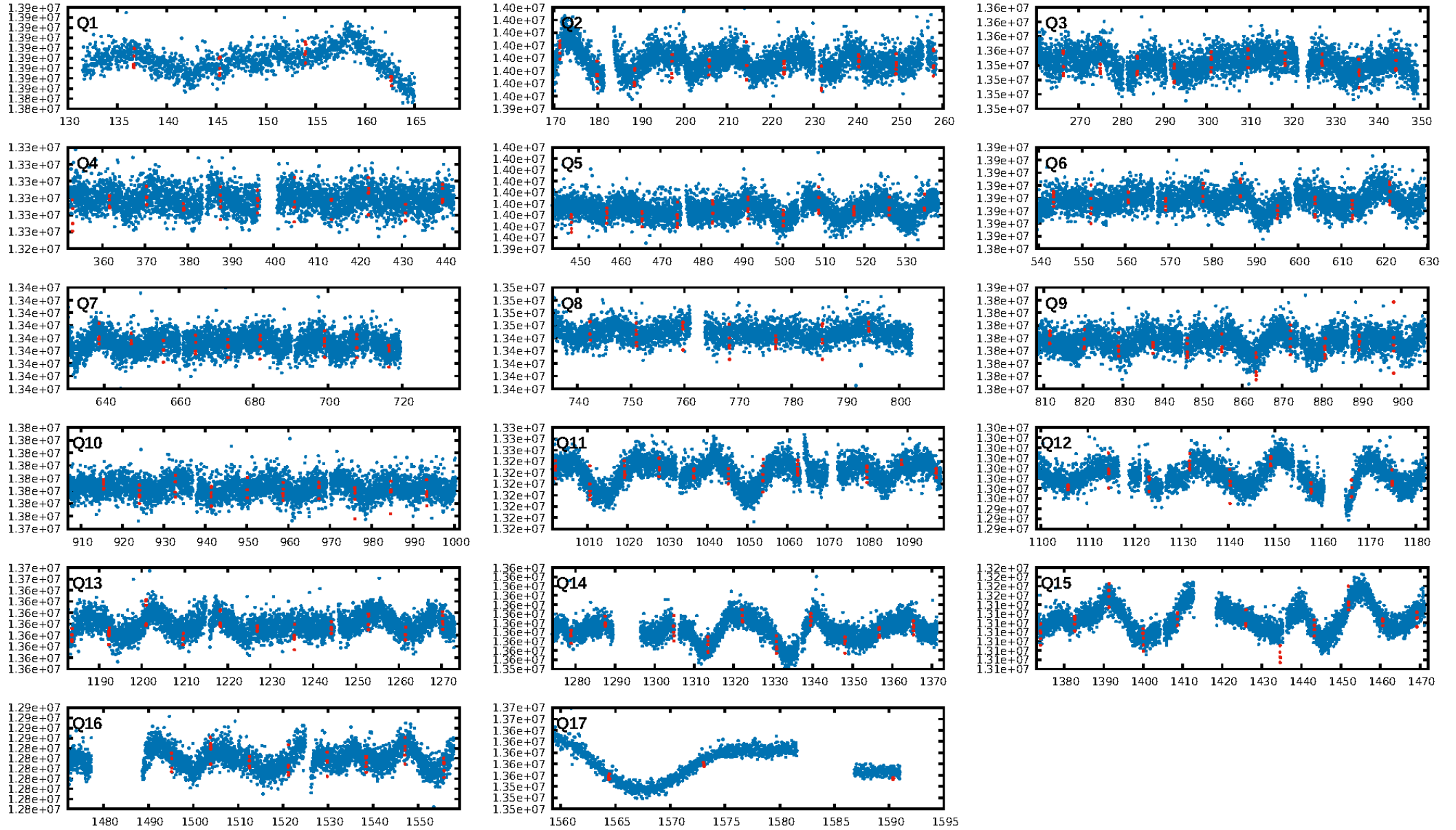
DV Diagnostic Results:

ShortPeriod-sig: N/A
LongPeriod-sig: 0.2% [0.00σ]
ModelChiSquare2-sig: 88.9%
ModelChiSquareGof-sig: 100.0%
Bootstrap-pfa: 2.79e-30
RollingBand-fgt: 1.00 [150/150]
GhostDiagnostic-chr: -5.98
Centroid-sig: 0.0%
Centroid-so: 3.307 arcsec [3.15σ]
OotOffset-rm: 0.543 arcsec [0.74σ]
KicOffset-rm: 0.409 arcsec [0.55σ]
OotOffset-st: 4/1/3/3 [11]
KicOffset-st: 4/1/3/3 [11]
DiffImageQuality-fgm: 0.55 [6/11]
DiffImageOverlap-fno: 1.00 [17/17]

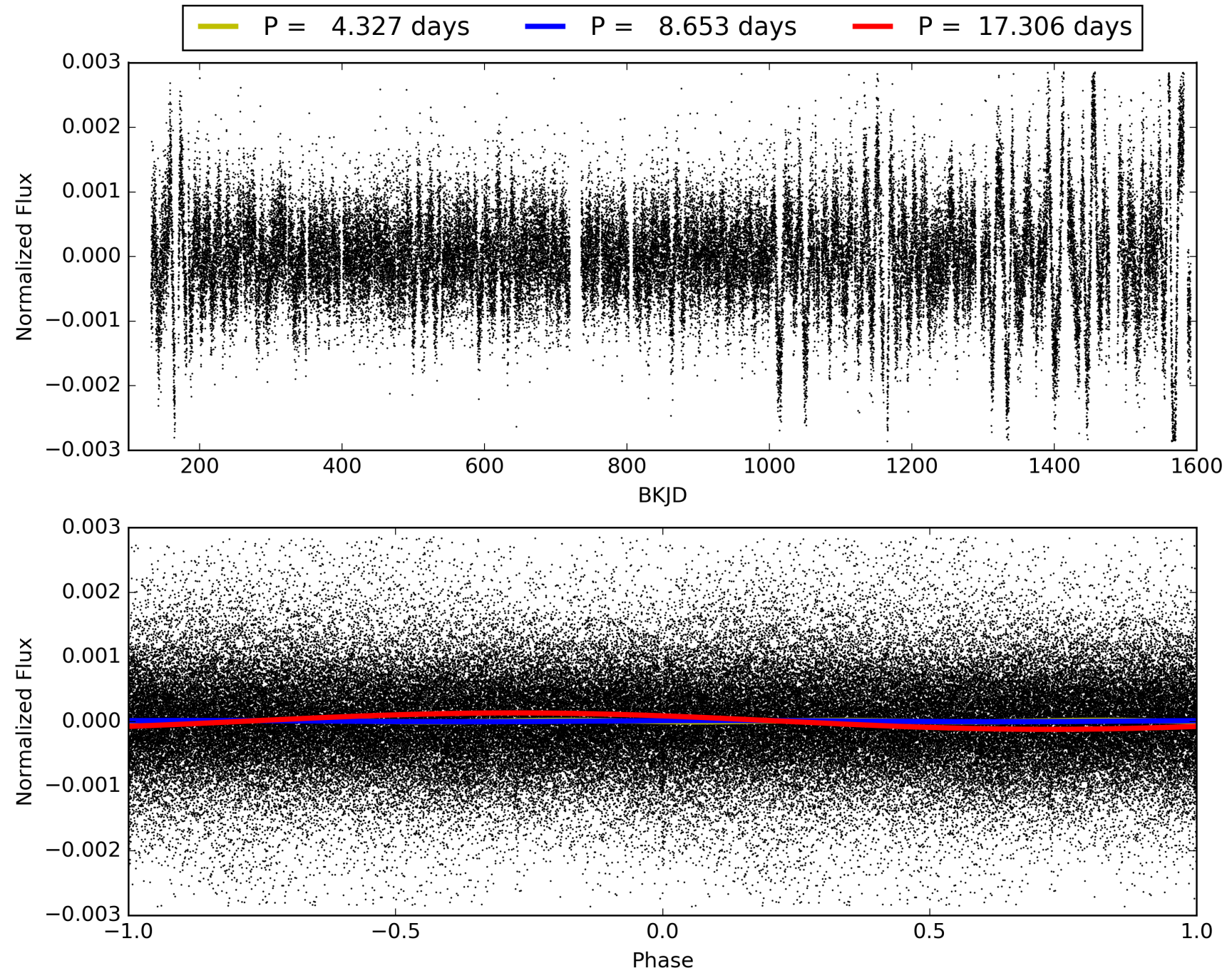
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 19:20:52 Z

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

TCE 004914709-01, PDC Light Curves

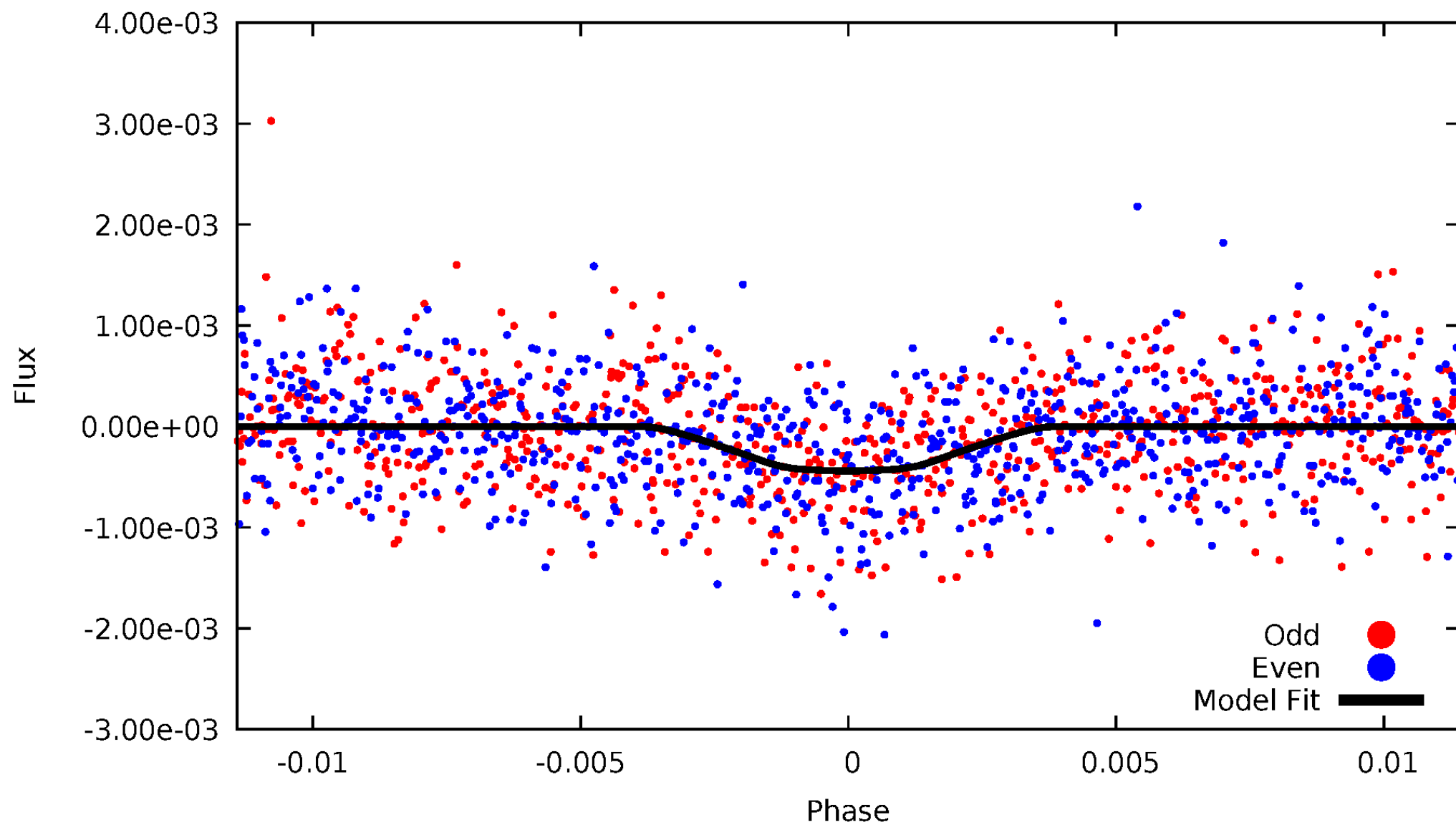


TCE 004914709-01



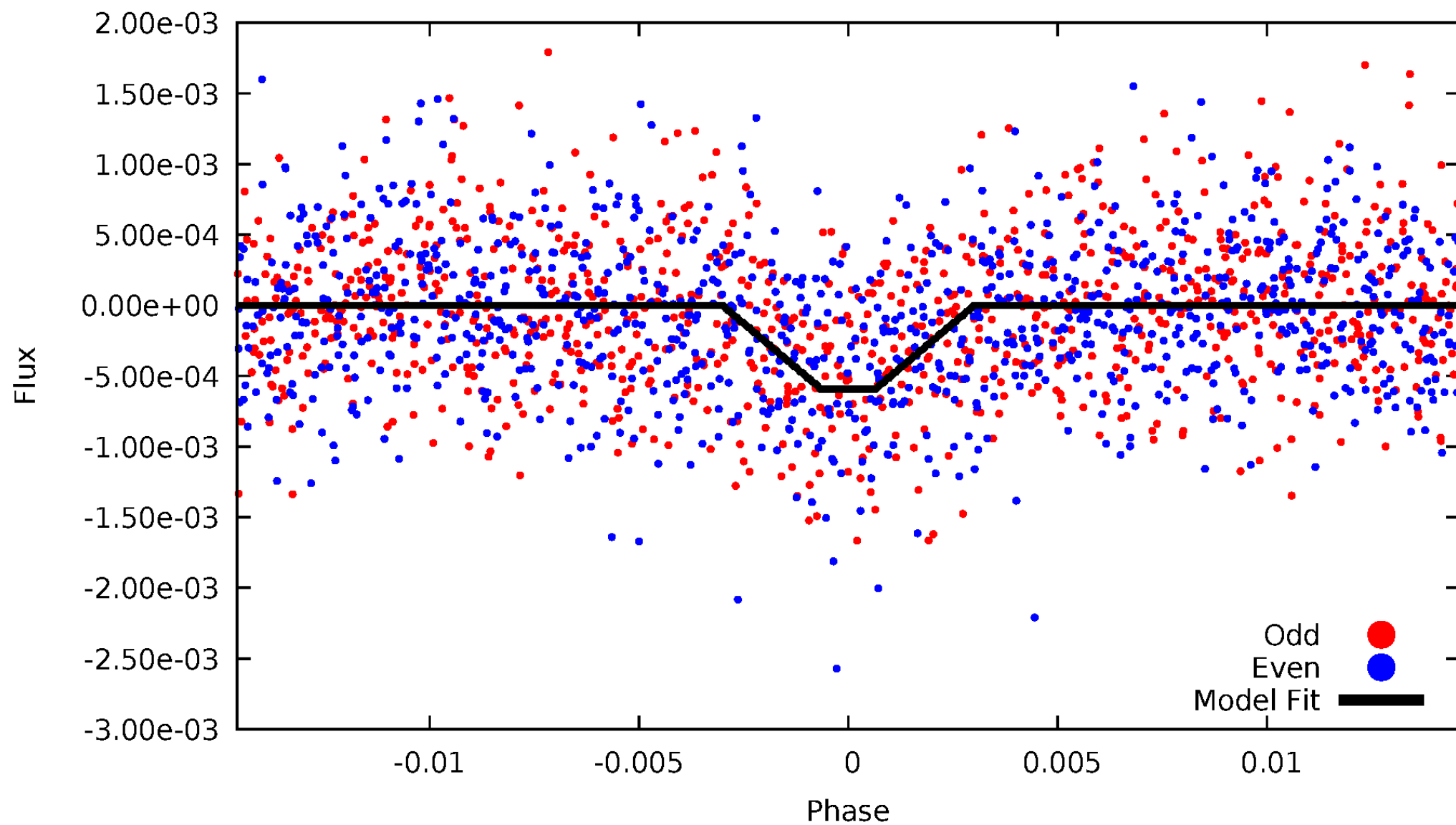
DV Odd/Even

TCE 004914709-01

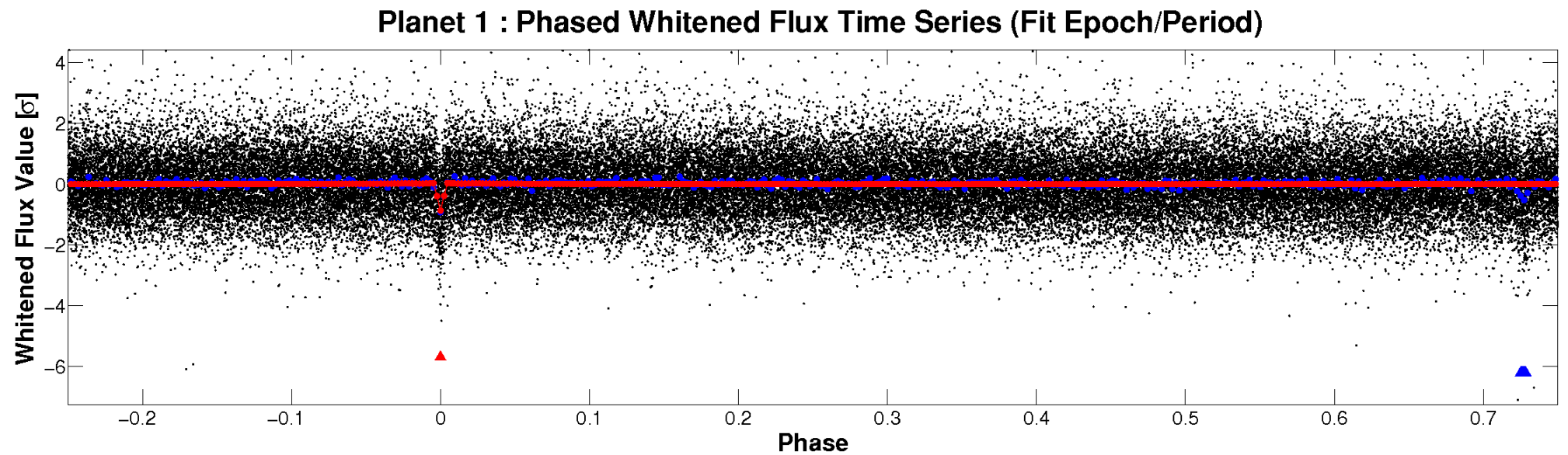
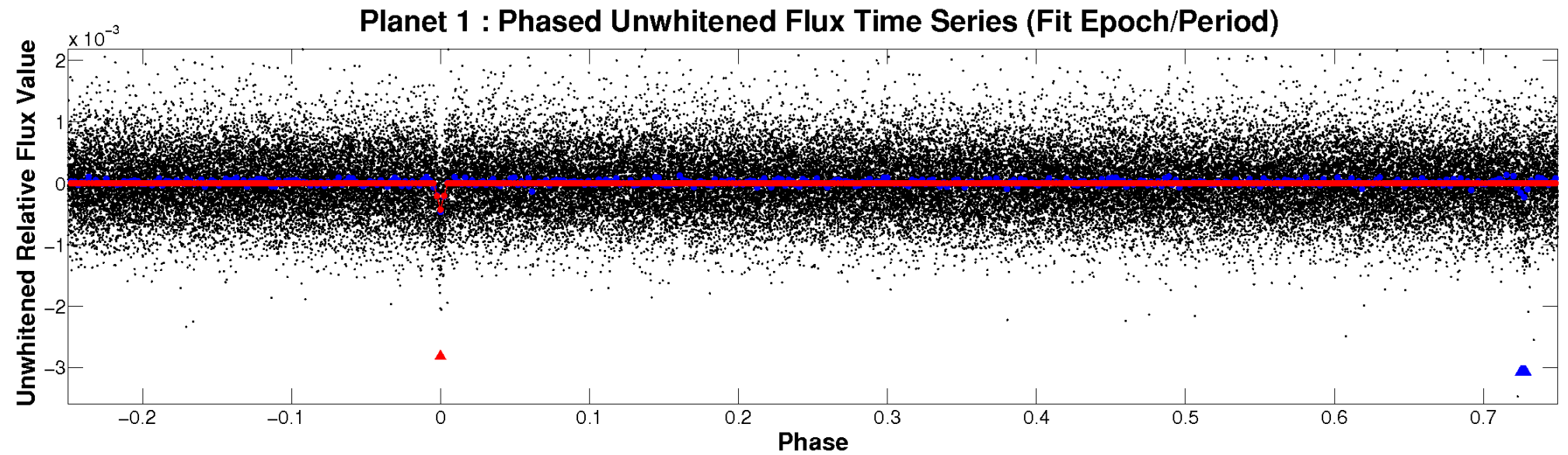


ALT Odd/Even

TCE 004914709-01

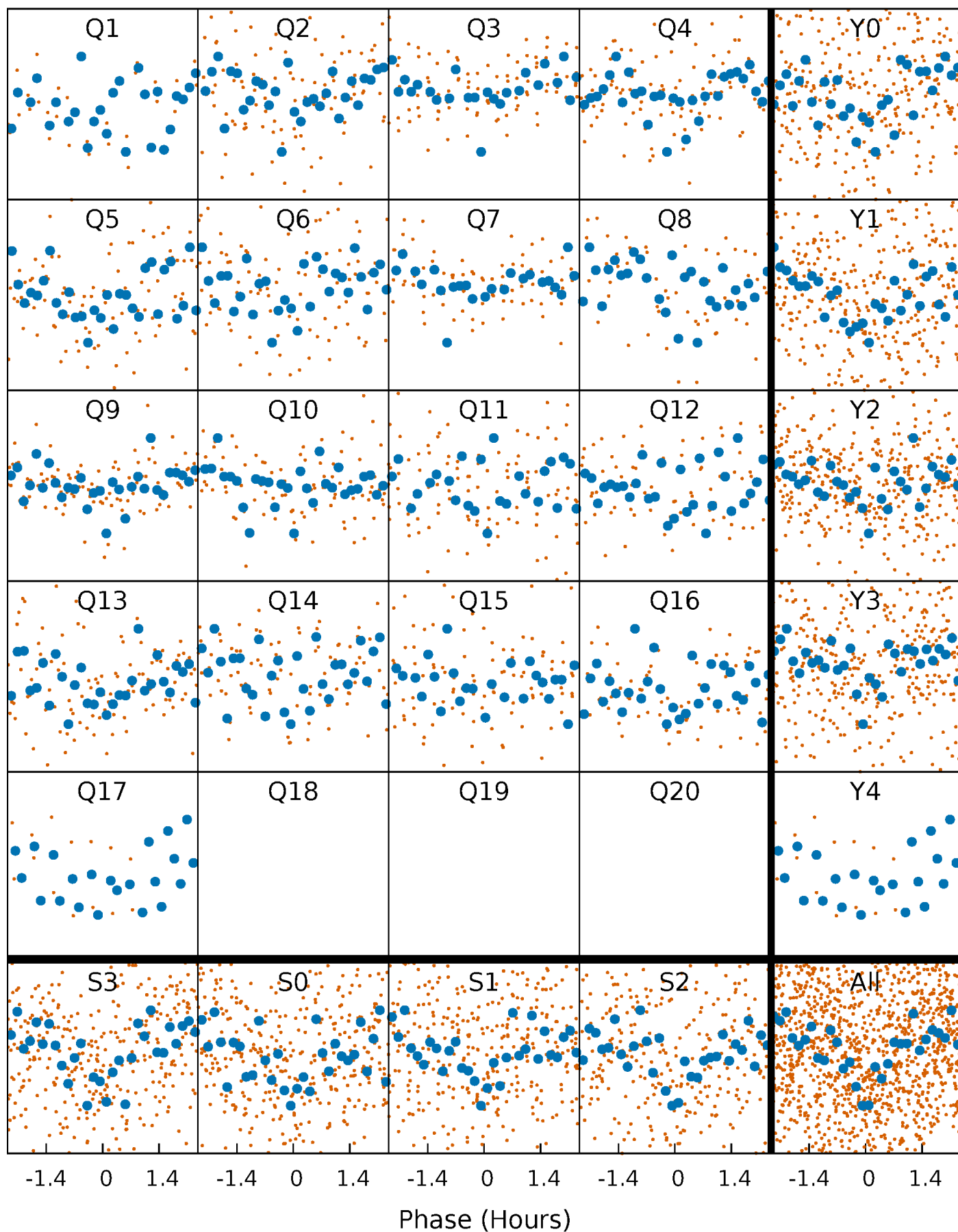


Non-Whitened Vs. Whitened Light Curve



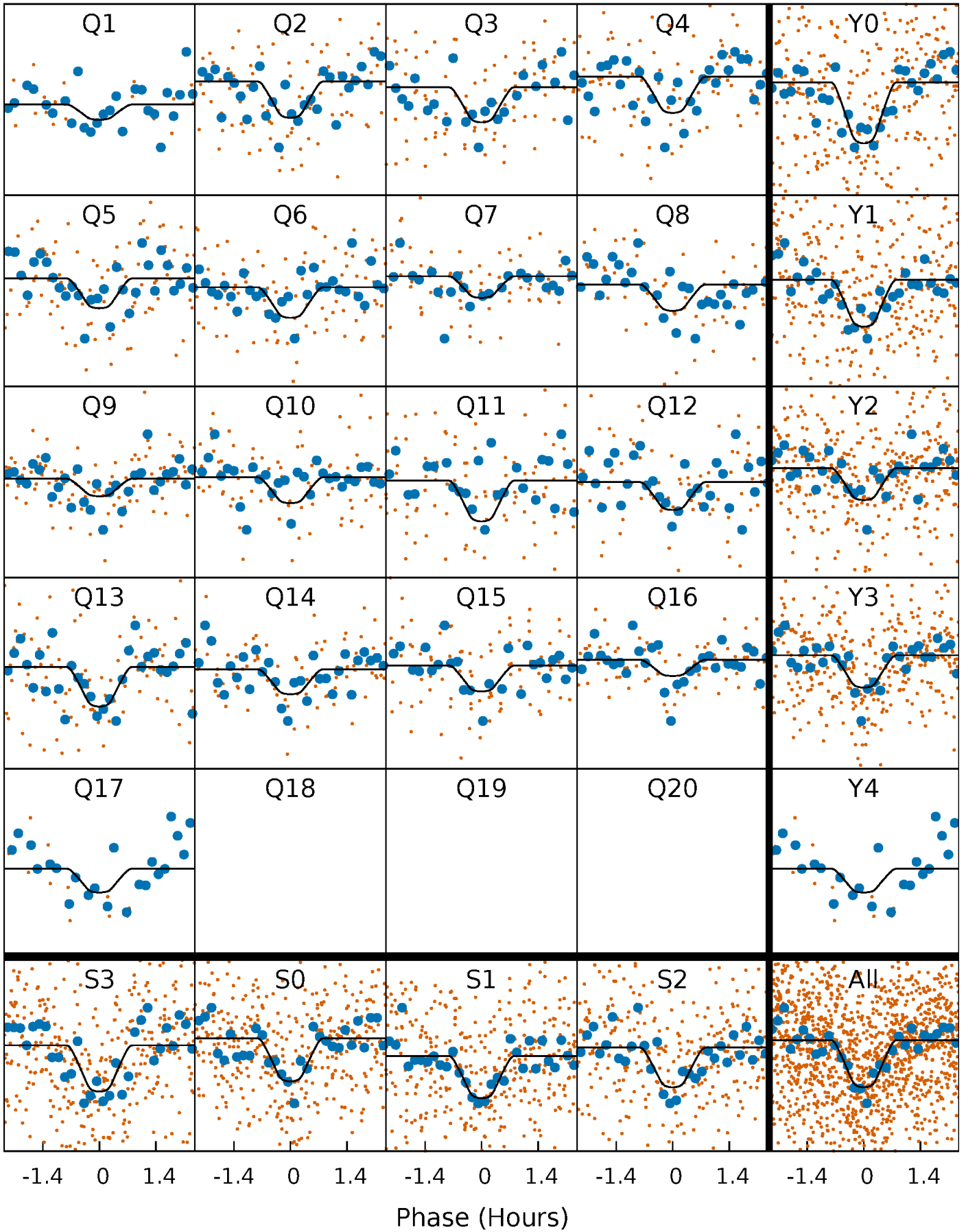
PDC Quarter-Phased Transit Curves

TCE 004914709-01 P= 8.653031 Days $T_0=136.668869$ (BKJD)



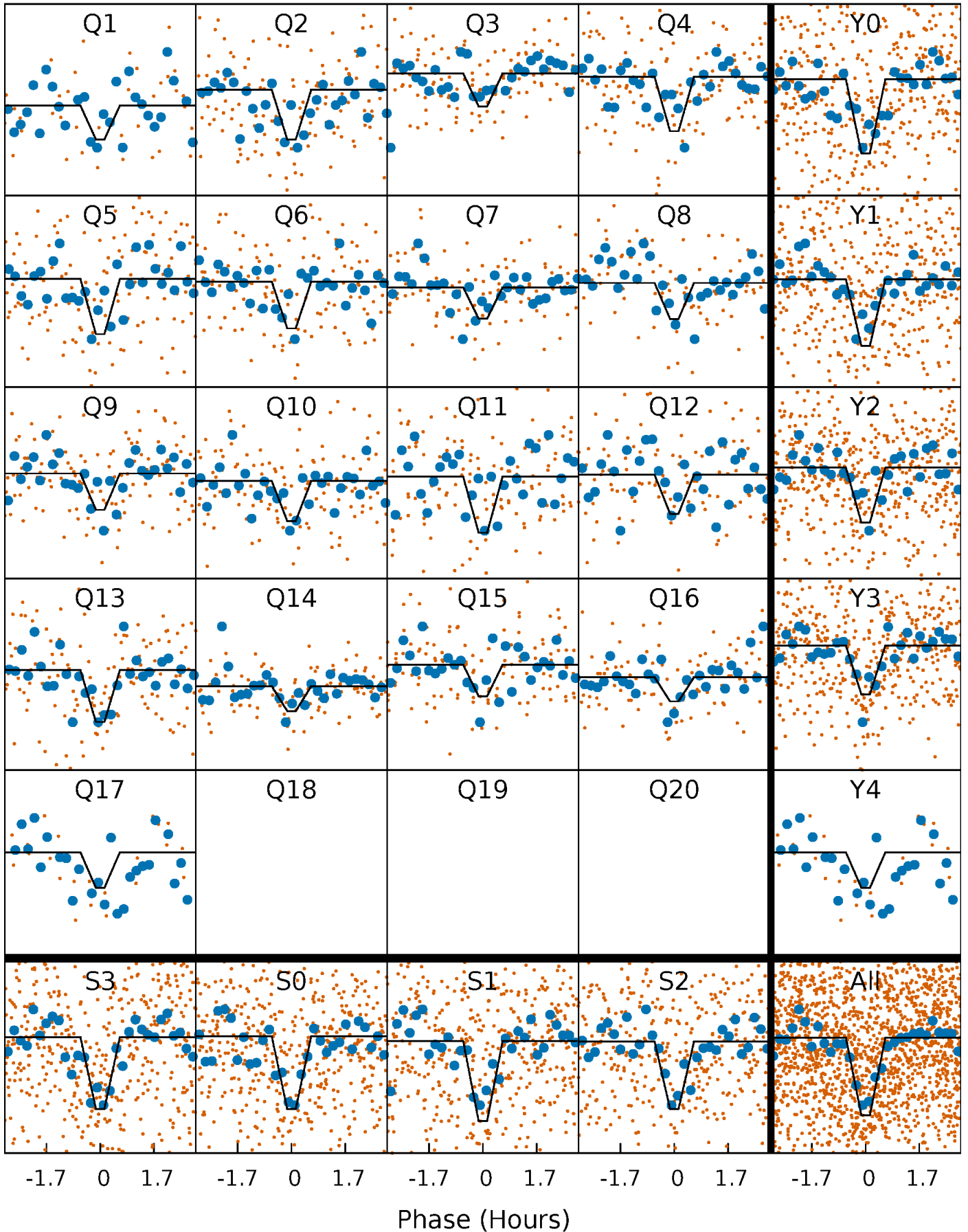
DV Quarter-Phased Transit Curves

TCE 004914709-01 P= 8.653031 Days $T_0=136.668869$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

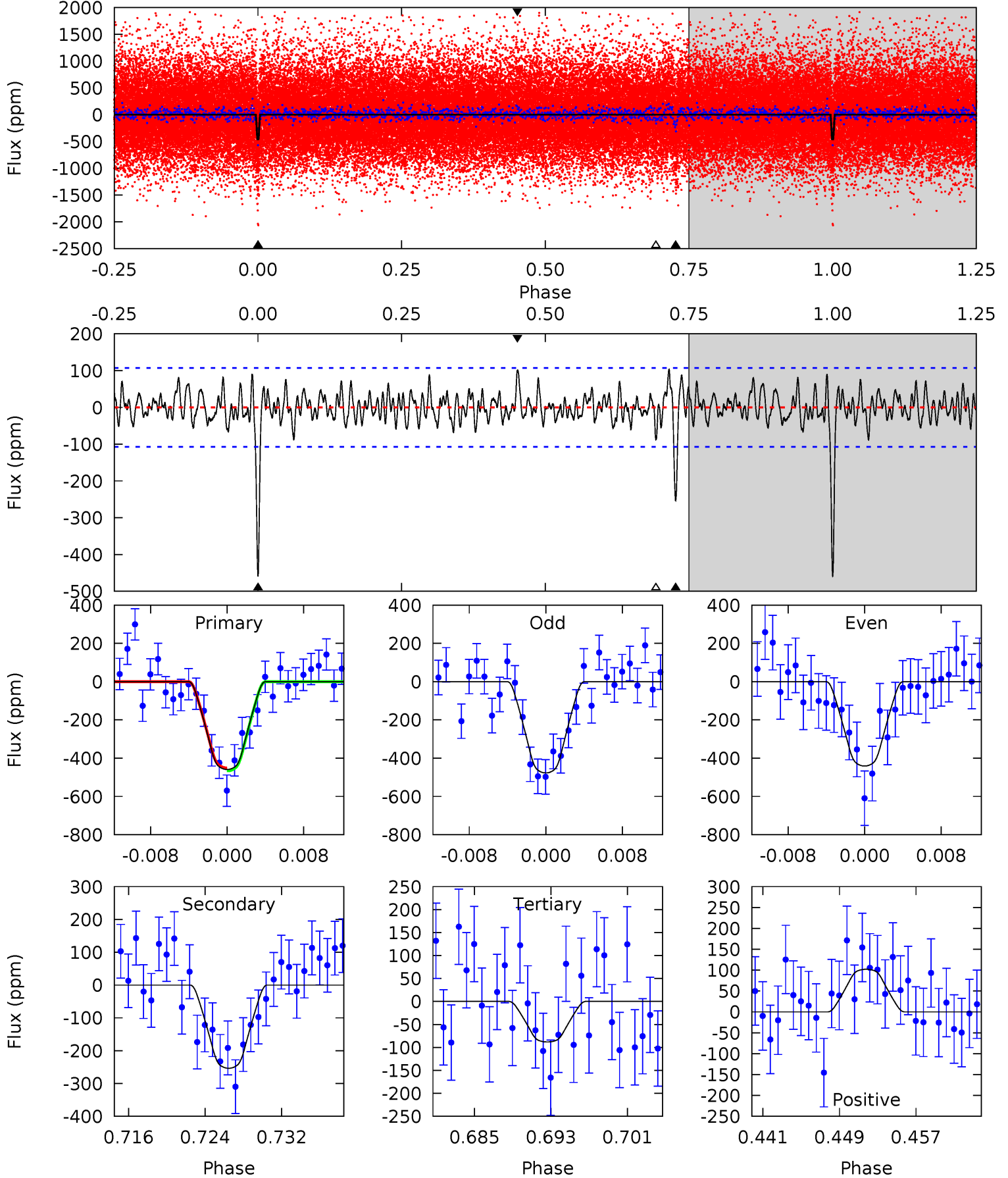
TCE 004914709-01 P= 8.653064 Days $T_0=136.665592$ (BKJD)



DV Model-Shift Uniqueness Test

004914709-01, P = 8.653031 Days, E = 128.015838 Days

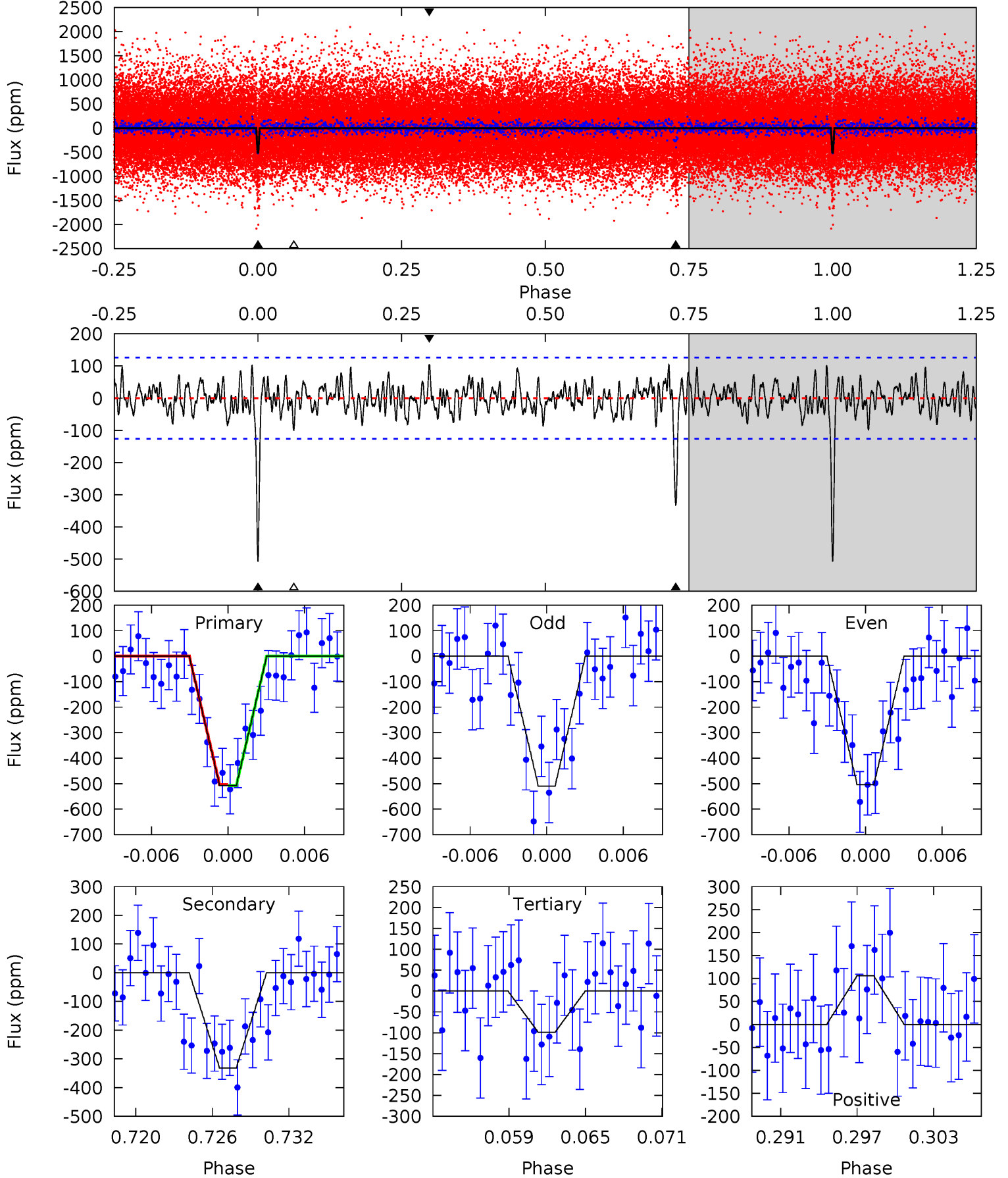
| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 21.7 | 12.0 | 4.17 | 4.82 | 5.07 | 2.66 | 1.51 | 17.5 | 16.9 | 7.82 | 7.16 | 0.86 | 1.11 | 0.18 | 0.35 |



Alt Model-Shift Uniqueness Test

004914709-01, P = 8.653064 Days, E = 128.012528 Days

| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 20.6 | 13.5 | 4.03 | 4.30 | 5.13 | 2.75 | 1.45 | 16.6 | 16.3 | 9.44 | 9.17 | 0.12 | 1.17 | 0.17 | 0.07 |



Stellar Parameters For KIC 004914709

| | $T_{\text{eff}}(K)$ | $\log(g)$ | [Fe/H] | $R (R_{\odot})$ | $M(M_{\odot})$ | $p_{\star} (\text{g}\cdot\text{cm}^{-3})$ |
|--------|----------------------|---------------------------|---------------------------|---------------------------|---------------------------|-------------------------------------------|
| | 5301^{+175}_{-159} | $4.528^{+0.051}_{-0.110}$ | $0.060^{+0.250}_{-0.300}$ | $0.840^{+0.138}_{-0.080}$ | $0.869^{+0.080}_{-0.080}$ | $2.063^{+0.516}_{-0.698}$ |
| | +3%/-3% | +1%/-2% | +417%/-500% | +16%/-10% | +9%/-9% | +25%/-34% |
| 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 004914709-01 / KOI 6470.01

| Detrend | Depth (ppm) | $R_p (R_{\oplus})$ | $T_{max} (K)$ | $T_{obs} (K)$ | A_{obs} |
|---------|---------------|------------------------|--------------------|-----------------------|---------------------|
| DV | -254 ± 21 | $2.21^{+1.21}_{-1.02}$ | 1081^{+50}_{-43} | 4519^{+1358}_{-671} | 175^{+434}_{-103} |
| Alt. | -332 ± 25 | $2.30^{+1.12}_{-1.12}$ | 1079^{+54}_{-44} | 4699^{+1637}_{-706} | 215^{+620}_{-122} |

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 $A_{obs} \gg 1.0$

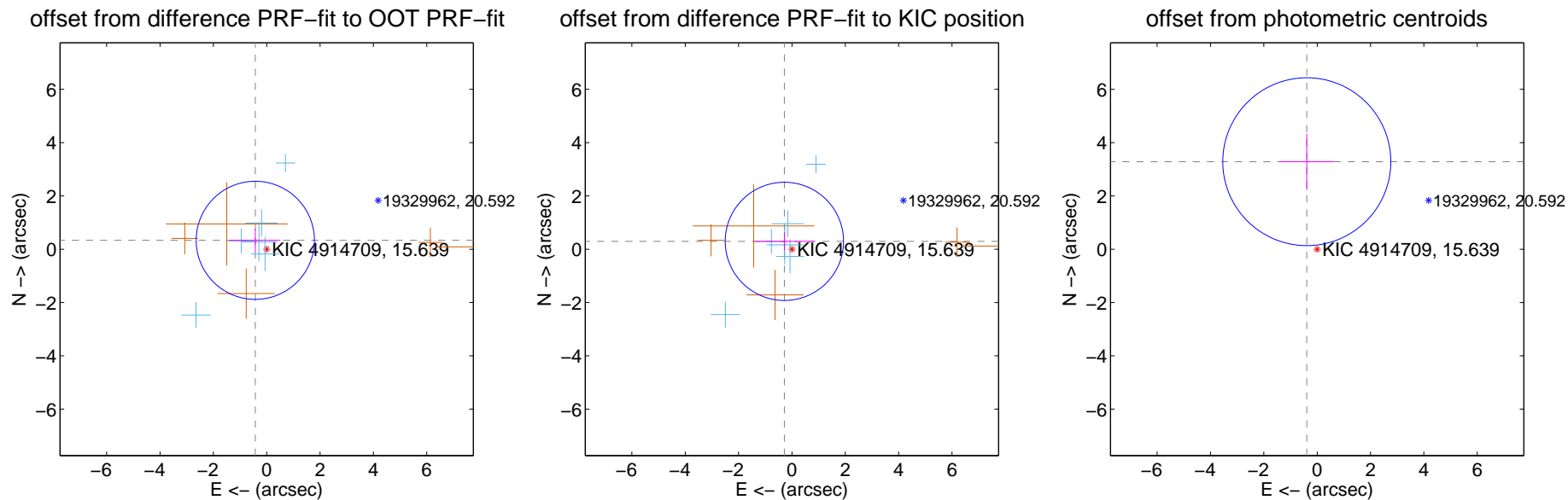
DV Centroid Data

Supplemental centroid analysis for 004914709-01. Kepler magnitude: 15.64. Transit SNR 13.31

There are 6 quarters with good PRF difference image offsets

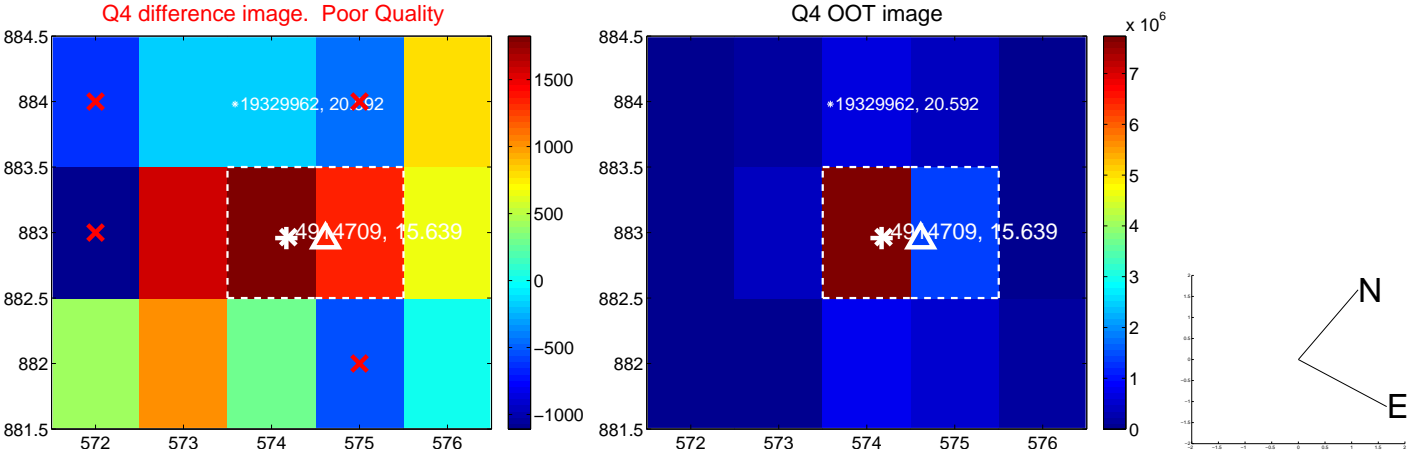
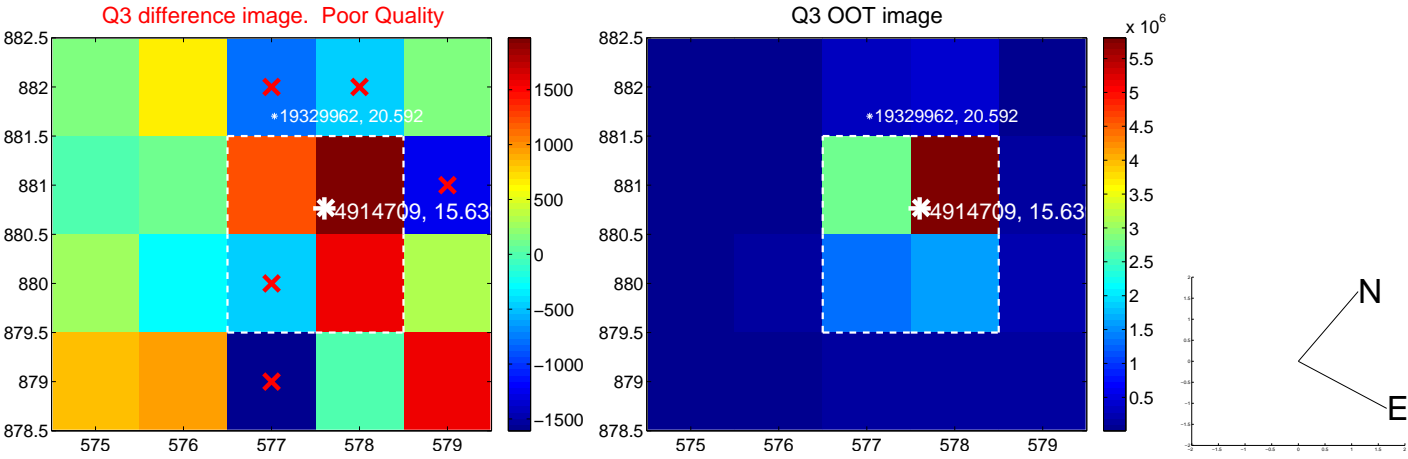
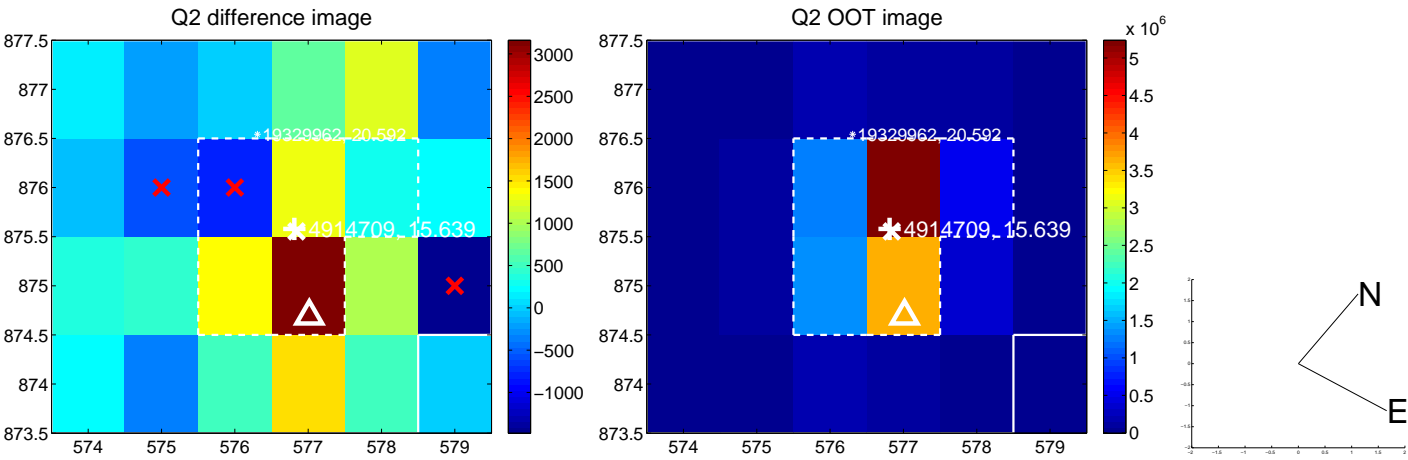
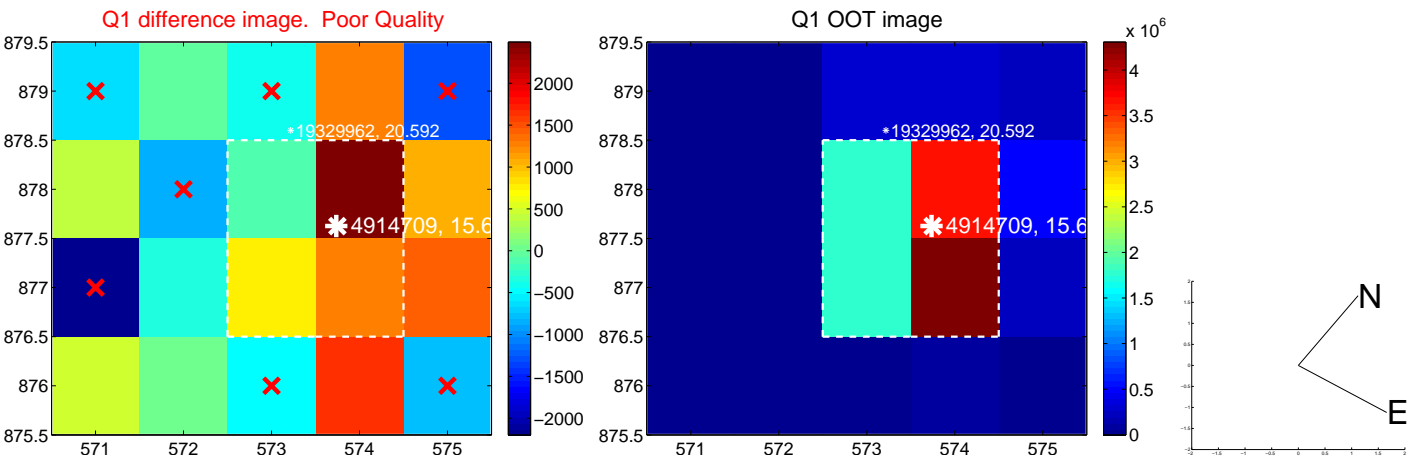
The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

| | Distance in arcsec | Distance / σ | Δ RA | Δ Dec |
|-----------------------------------------|--------------------|---------------------|-------------------|-------------------|
| PRF-fit source offset from OOT | 0.543 ± 0.738 | 0.74 | 0.428 ± 0.944 | 0.334 ± 0.433 |
| PRF-fit source offset from KIC position | 0.409 ± 0.739 | 0.55 | 0.283 ± 1.124 | 0.295 ± 0.352 |
| photometric centroid source offset | 3.31 ± 1.05 | 3.15 | 0.39 ± 1.01 | 3.28 ± 1.05 |

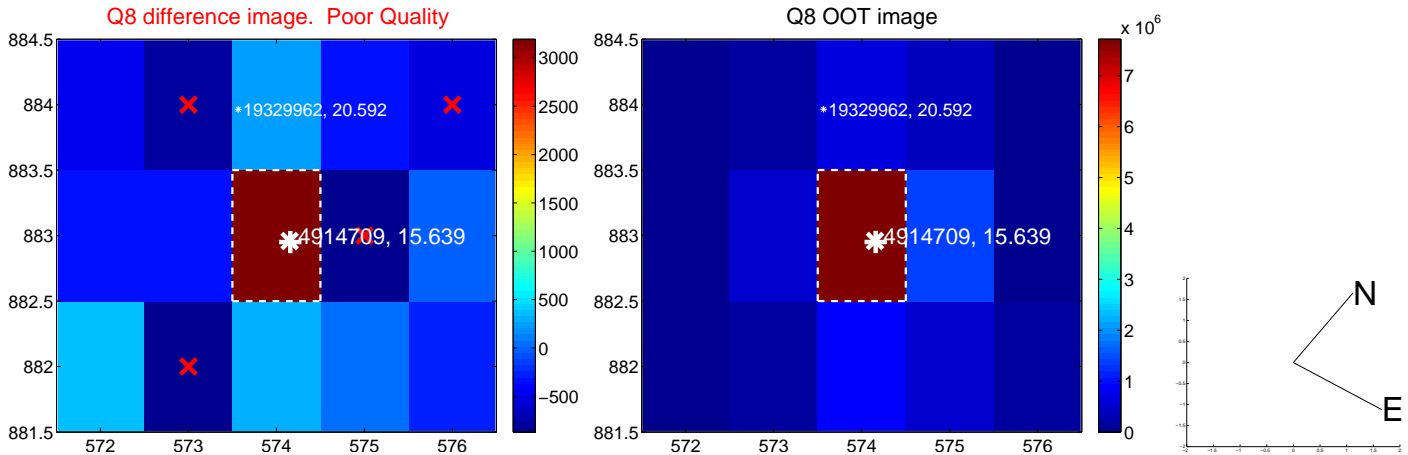
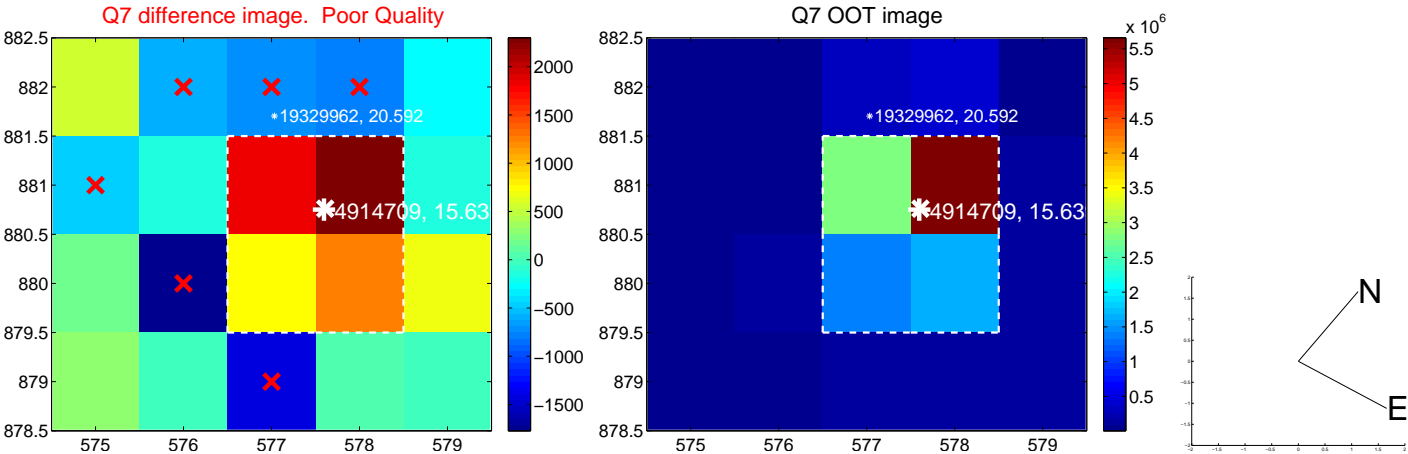
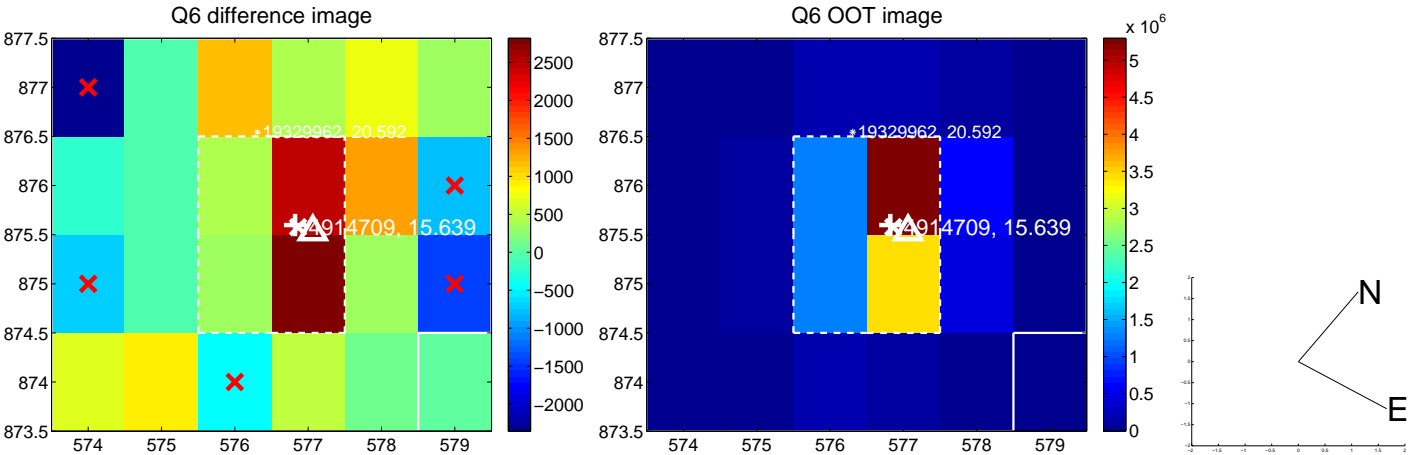
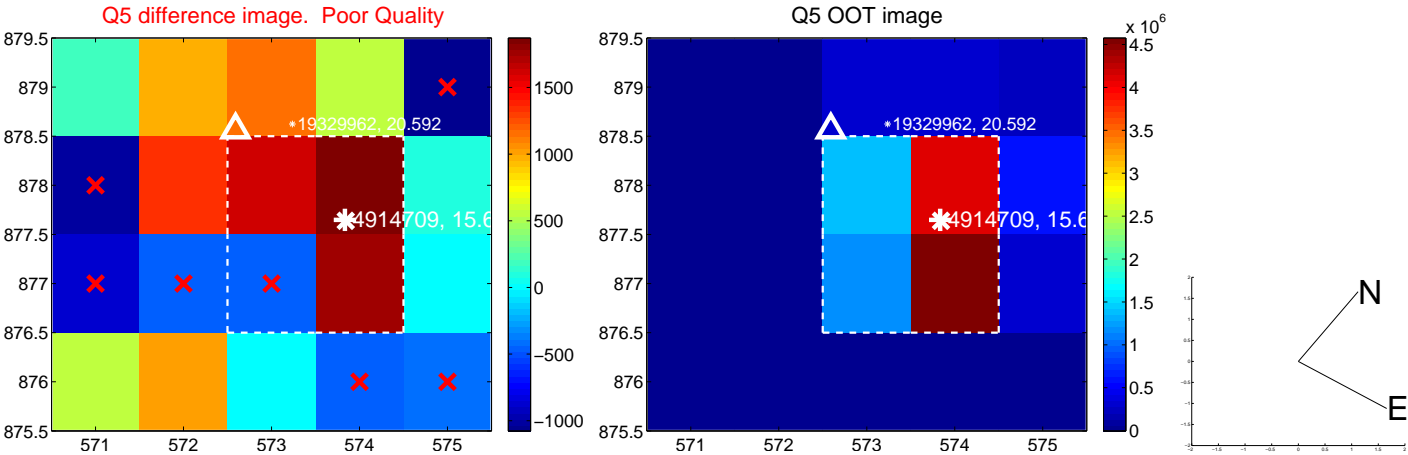


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- σ uncertainty. Blue circle: three-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

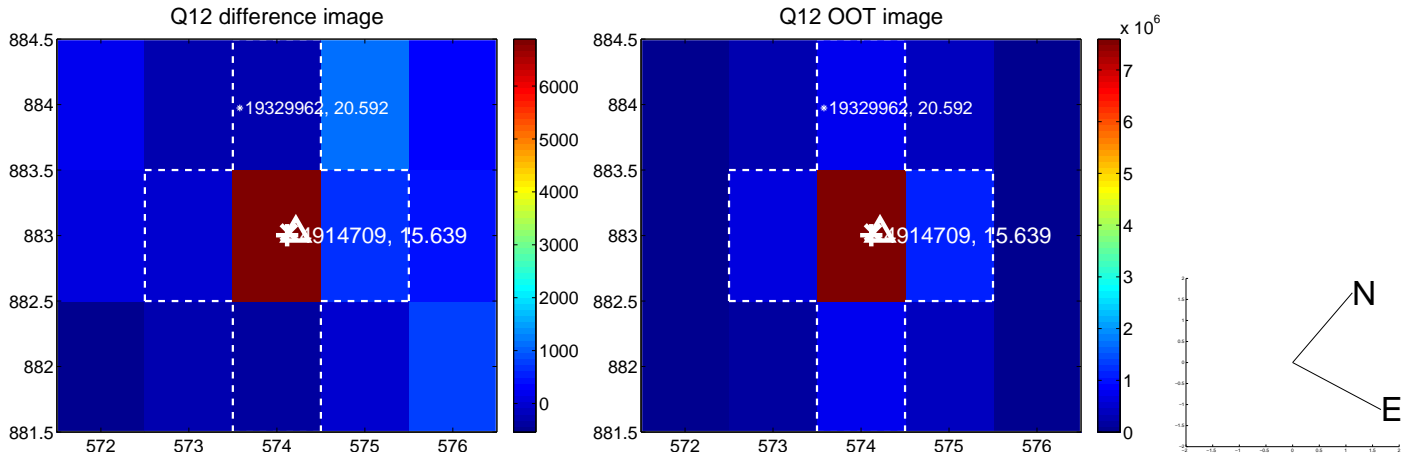
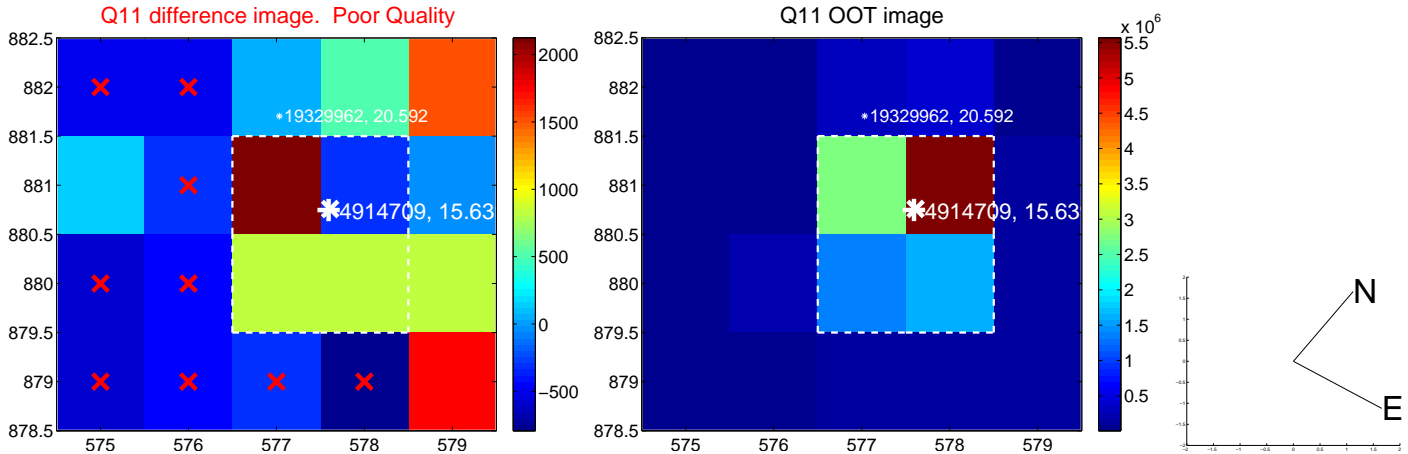
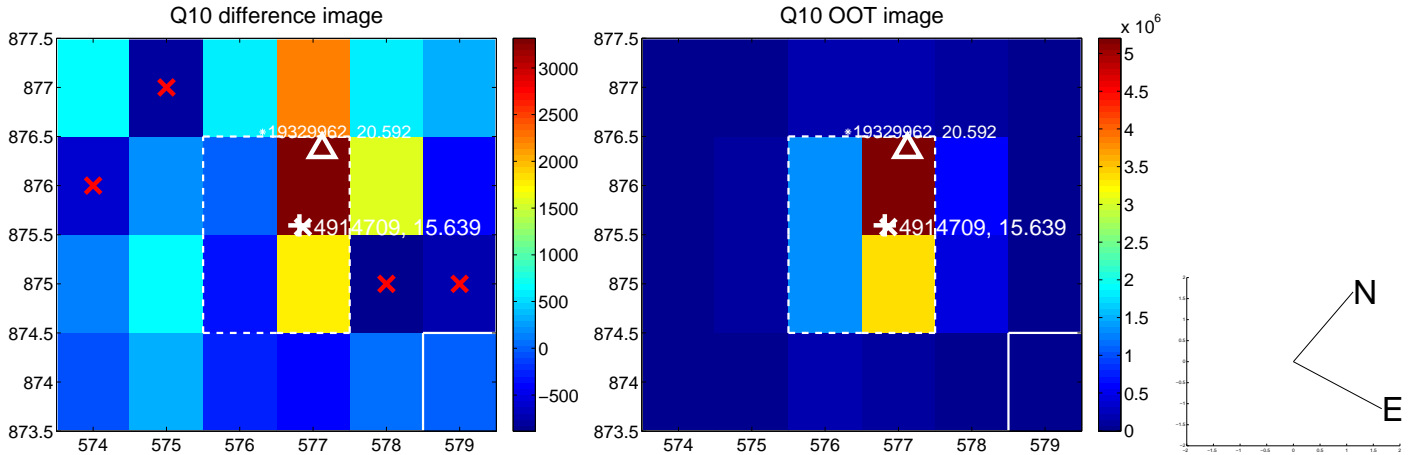
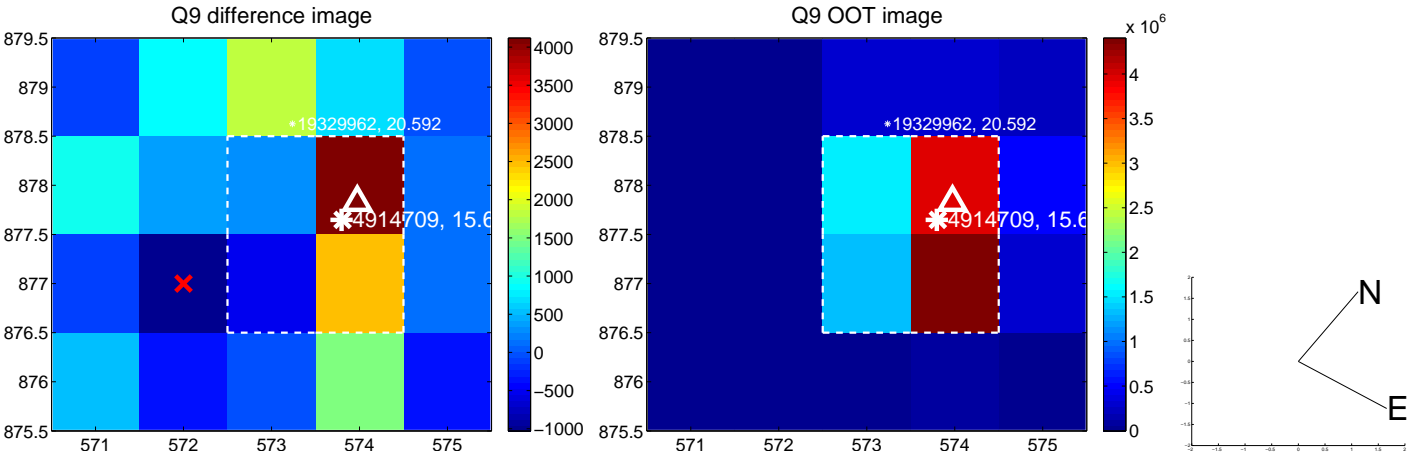
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



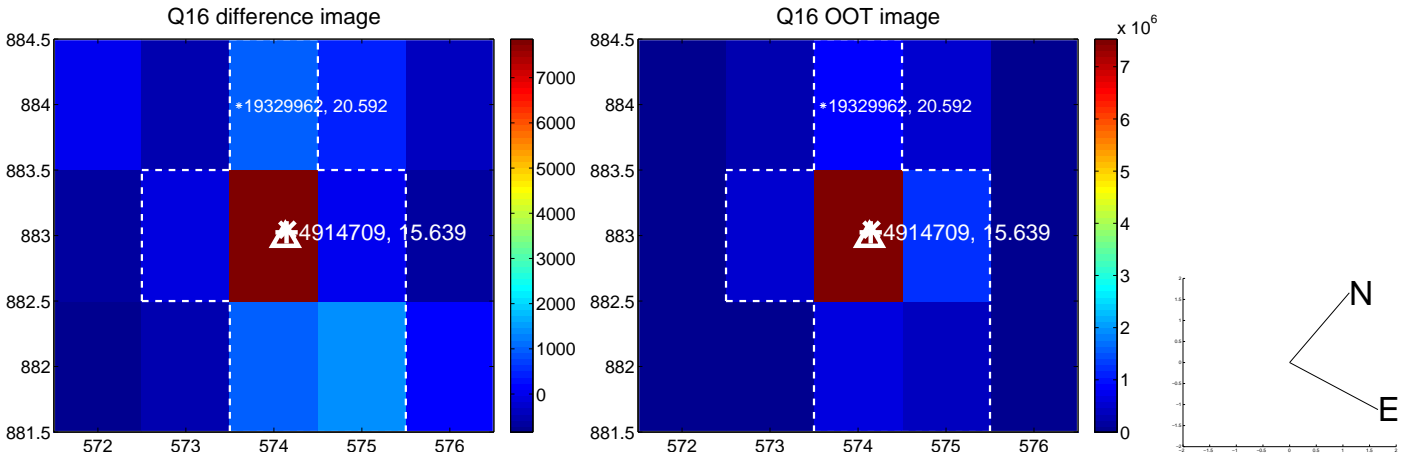
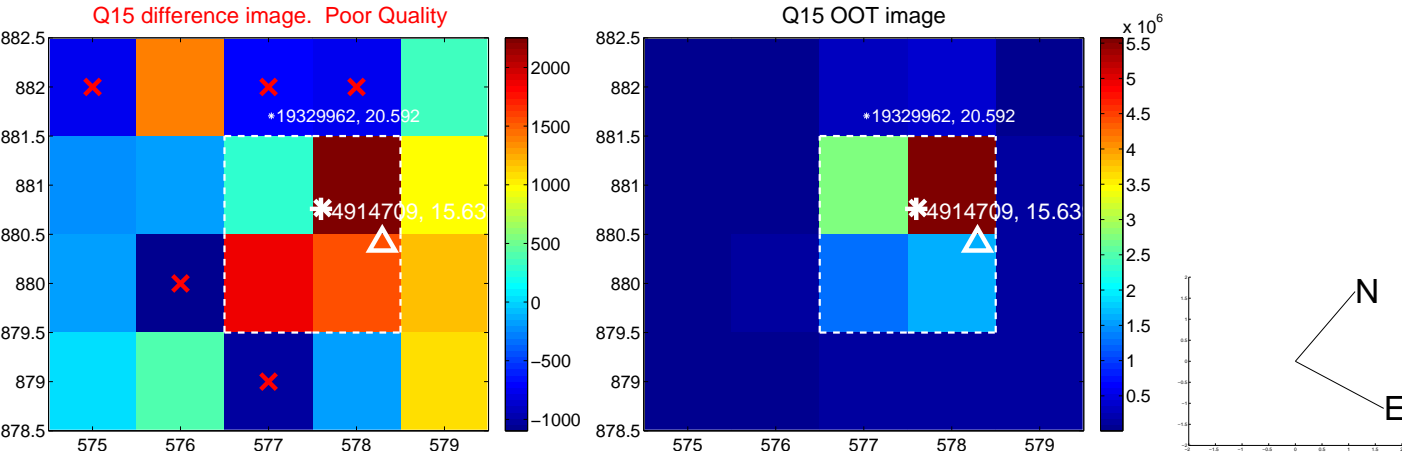
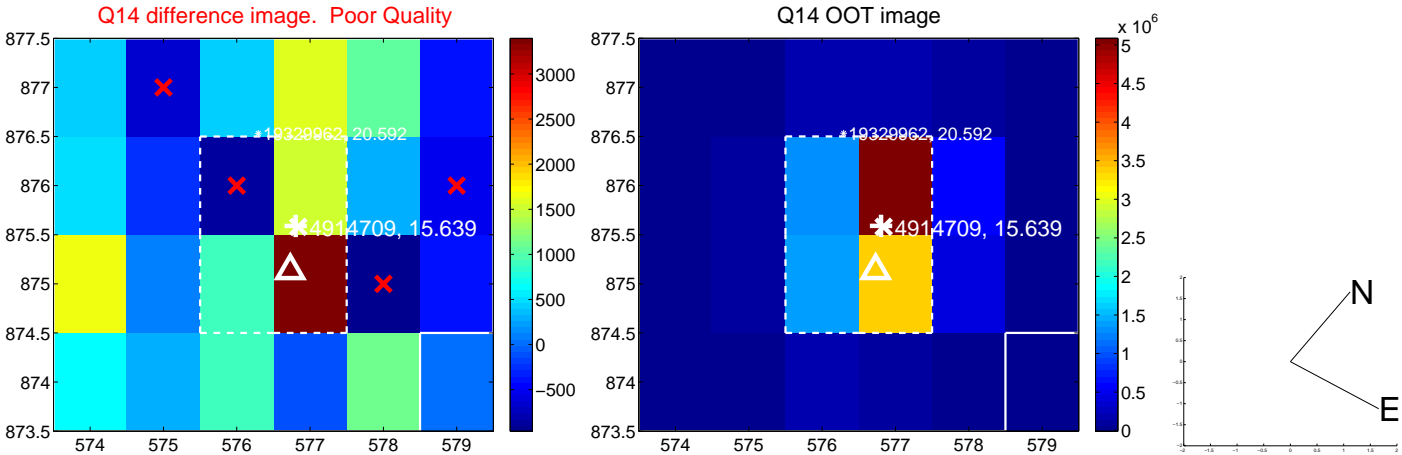
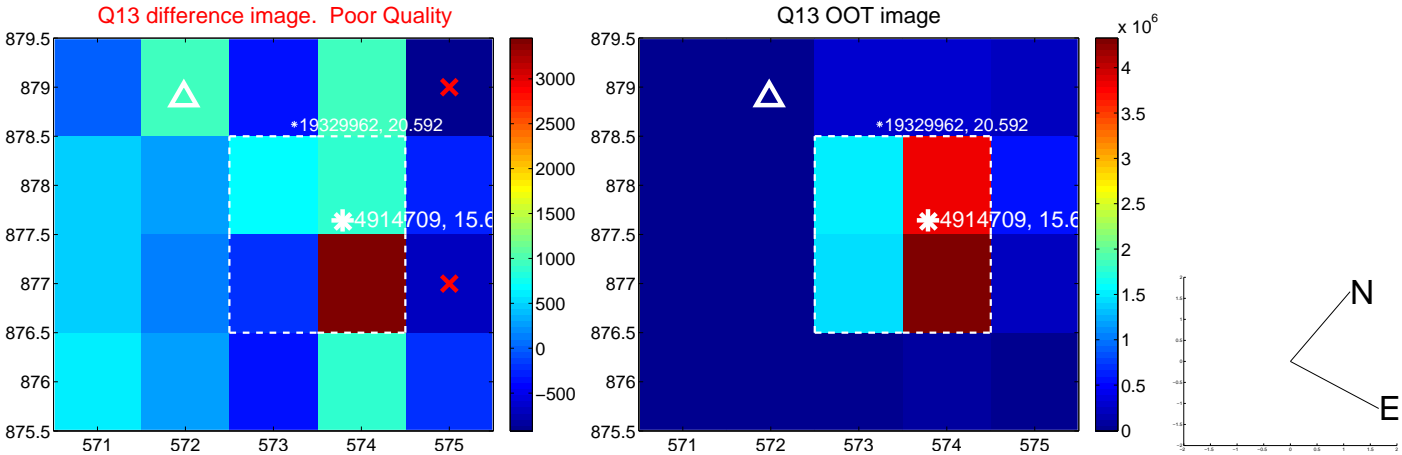
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



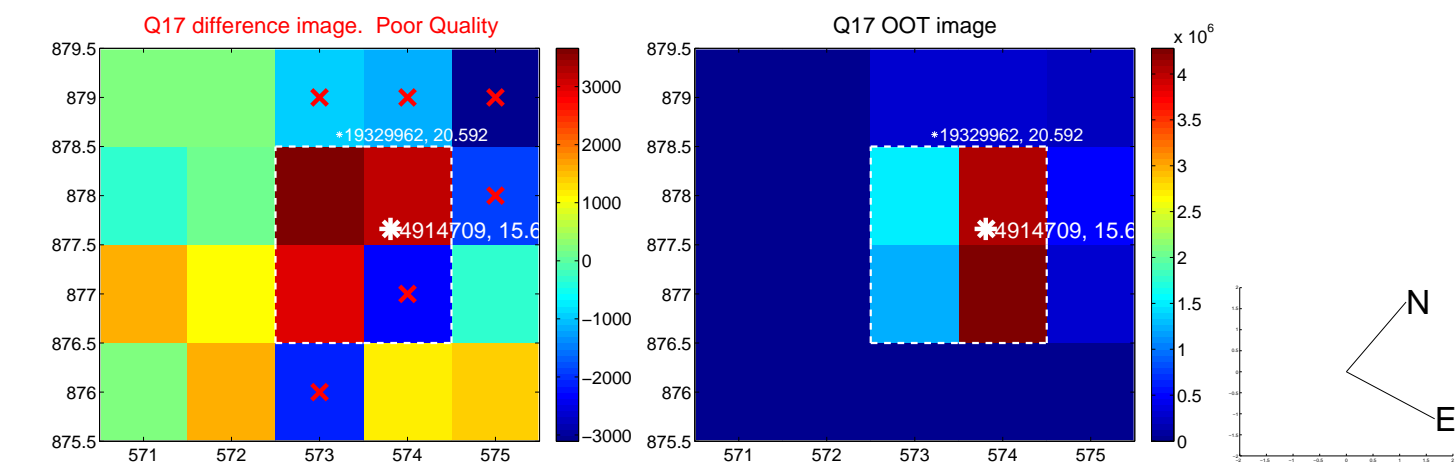
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



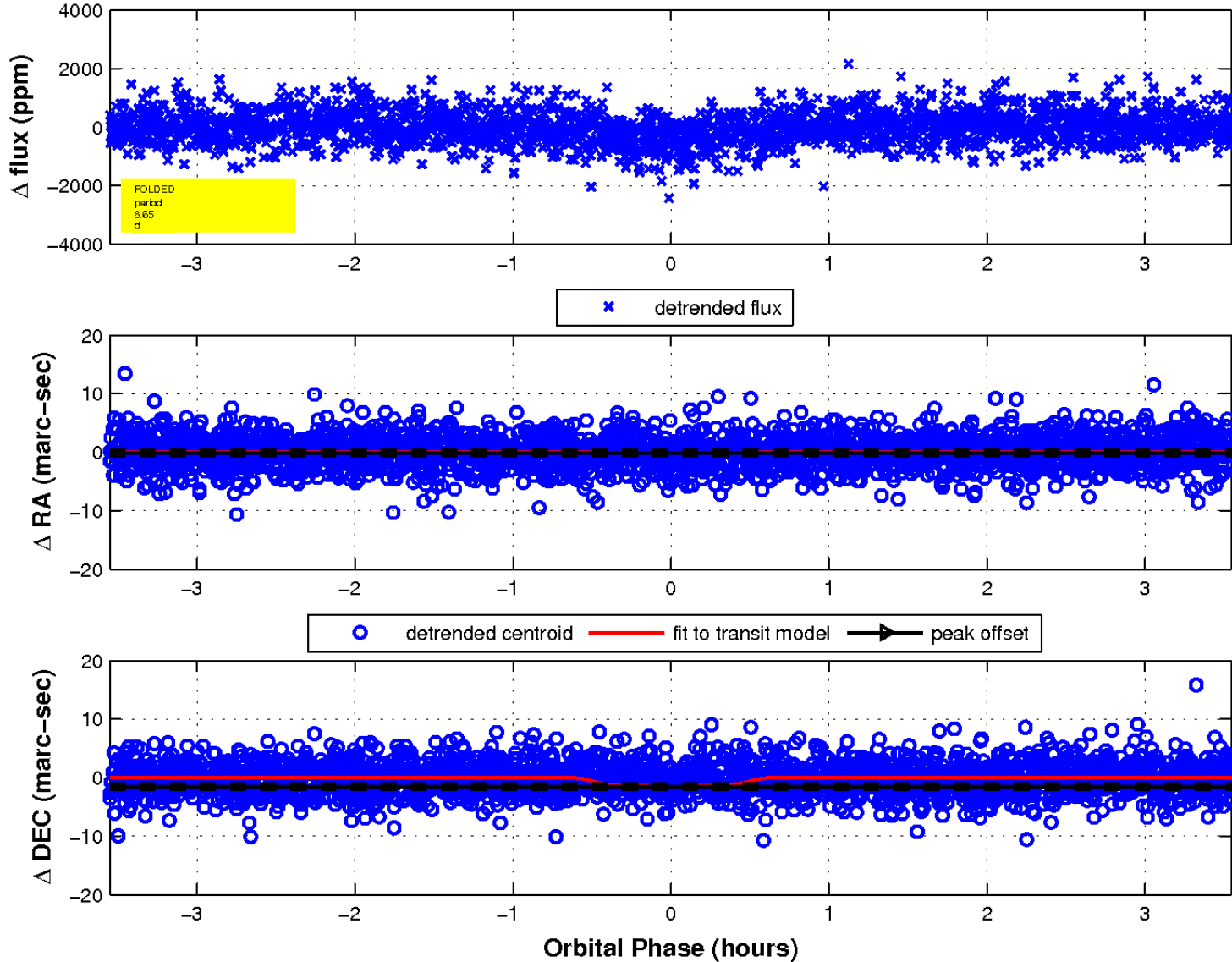
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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

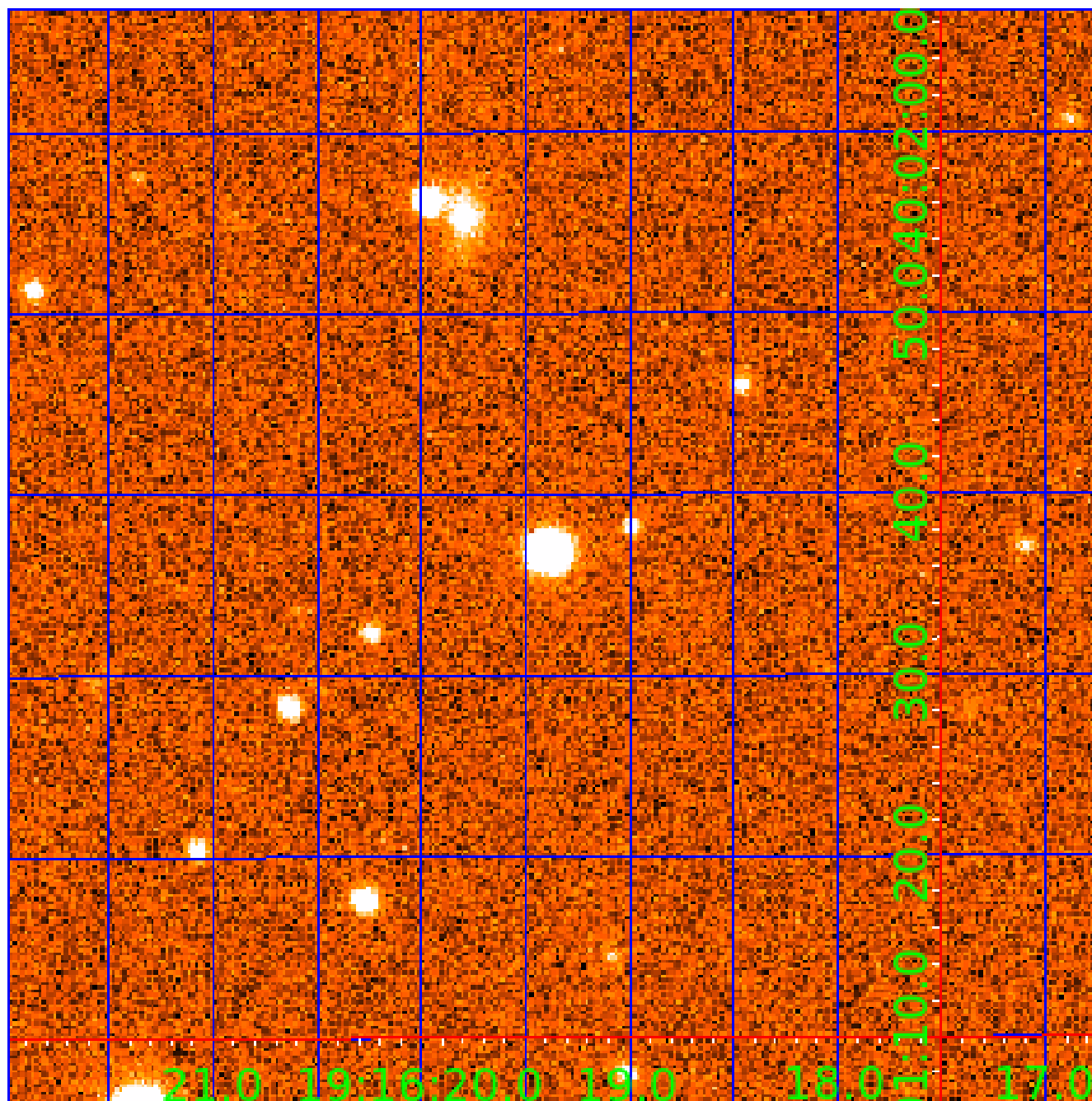


fluxWeightedCentroids, Planet 1 of 2



UKIRT Image

Declination



KIC 004914709

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}) |
|--------------|----------|---------|---------------|--------------|-------------|------------------|------|------|-----------------------------|-----------------|------------------------|------------------------|
| 004914709-01 | OBS | 6470.01 | 8.653031 | 136.668869 | 440.1 | 1.185 | 11.5 | 13.3 | 0.84 | 5301 | 2.21 | 80.59 |
| 004914709-02 | OBS | No | 8.653198 | 134.290403 | 278.1 | 1.648 | 9.0 | 10.2 | 0.84 | 5301 | 1.54 | 80.59 |

Robovetter Results

| TCE | Run Type | Disp | Score | N | S | C | E | Comments |
|--------------|----------|------|-------|---|---|---|---|------------------------------------------------|
| 004914709-01 | OBS | FP | 0.00 | 0 | 1 | 0 | 1 | MOD_SEC_DV—MOD_SEC_ALT—HAS_SEC_TCE—EPHEM_MATCH |
| 004914709-02 | OBS | FP | 0.00 | 1 | 1 | 0 | 1 | IS_SEC_TCE—EPHEM_MATCH |

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 for comment definitions.

Ephemeris Match Information For 004914709-02

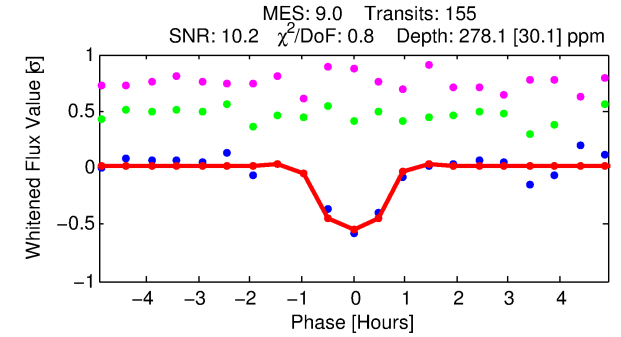
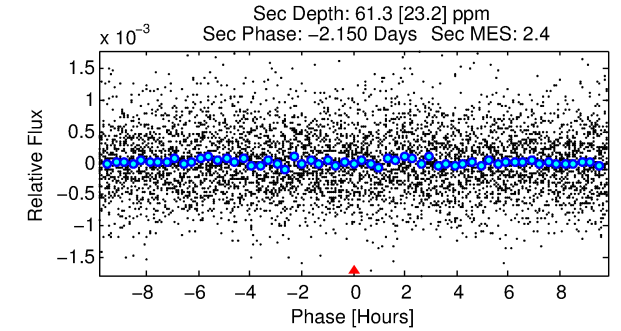
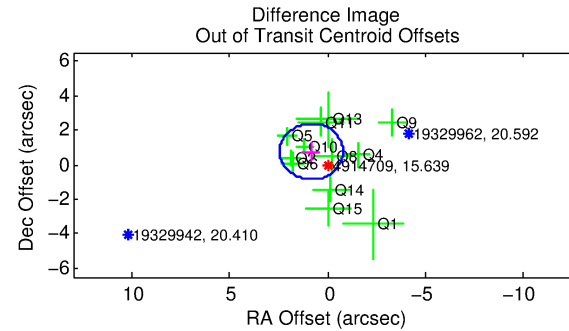
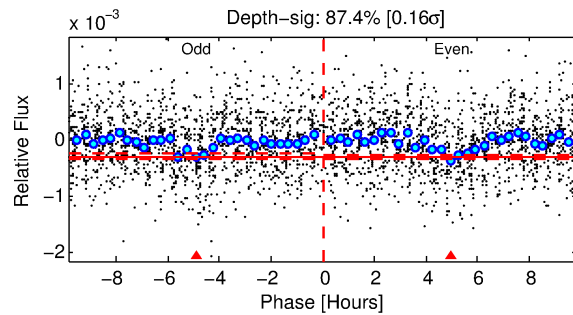
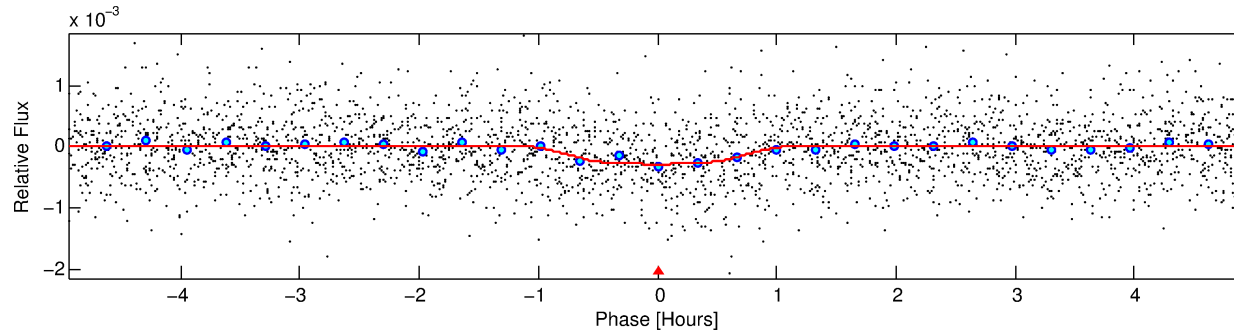
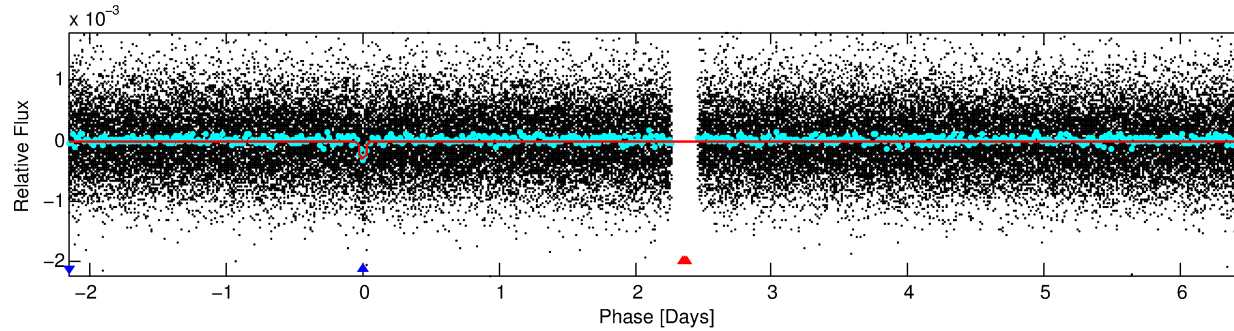
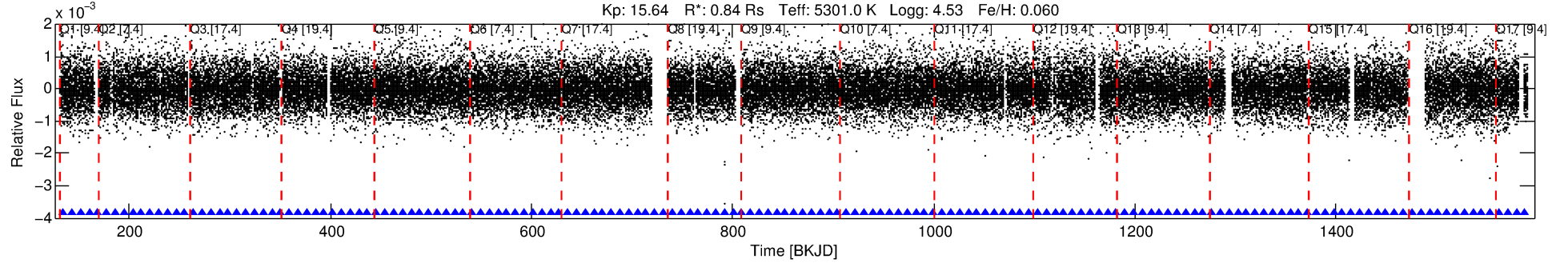
| TCE (1) | KIC | Parent (2) | Parent KIC | $P_1:P_2$ | Dist ($''$) | Δ Row | Δ Col | m_2 | m_1 | D_2/D_1 | Mechanism | Flag | σ_P | σ_T |
|--------------|---------|--------------|------------|-----------|---------------|--------------|--------------|-------|-------|-----------|-------------|------|------------|------------|
| 004914709-02 | 4914709 | 004150611-02 | 4150611 | 1:1 | 3293.4 | 829 | 0 | 7.90 | 15.64 | 194.77 | Col-Anomaly | 0 | 0.42 | 0.41 |

Notes: $P_1:P_2$ is the period ratio. Dist is the distance in arcseconds. Δ Row and Δ Col are the number of pixels apart in row and column. m_2 and m_1 are the magnitudes of the parent and child. D_2/D_1 is the parent's transit depth divided by the child's. σ_P and σ_T are the significance of the match in period and epoch. For a match to be considered significant $\sigma_P < 5.0$ and $\sigma_T < 5.0$. Matches which have σ_P and σ_T very close to this cutoff should receive extra scrutiny, especially if the period ratio is very large.

DV One-Page Summary

KIC: 4914709 Candidate: 2 of 2 Period: 8.653 d
KOI: K06470 Corr: No Ephemeris Match

Kp: 15.64 R*: 0.84 Rs Teff: 5301.0 K Logg: 4.53 Fe/H: 0.060



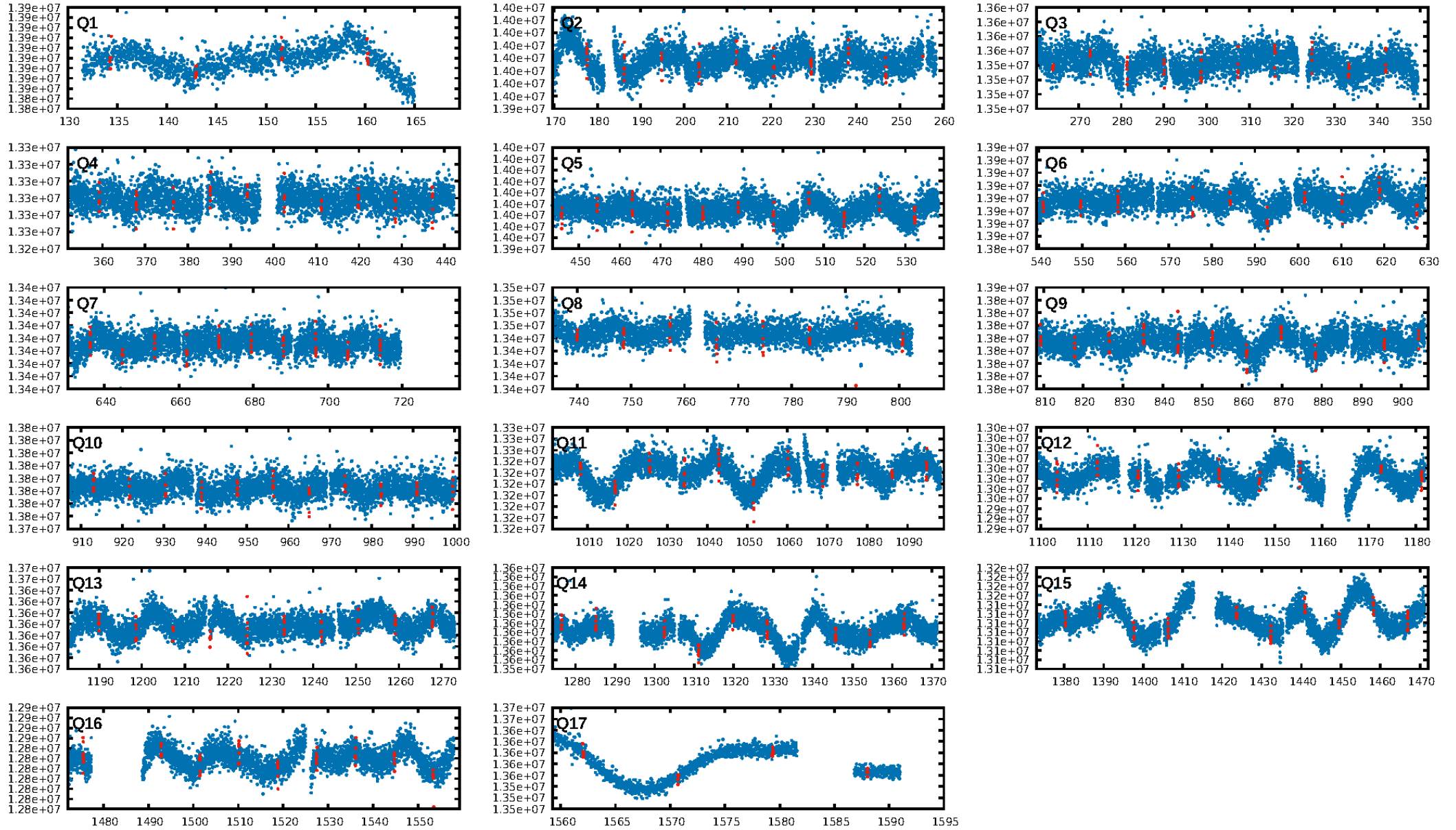
DV Fit Results:

Period = 8.65320 [0.00005] d
Epoch = 134.2904 [0.0041] BKJD
Rp/R* = 0.0168 [0.0230]
a/R* = 27.14 [141.18]
b = 0.76 [2.99]
Seff = 80.59 [19.40]
Teq = 764 [46] K
Rp = 1.54 [2.12] Re
a = 0.0787 [0.0109] AU
Ag = 88.50 [245.62] [0.36σ]
Teffp = 3623 [2510] K [1.14σ]

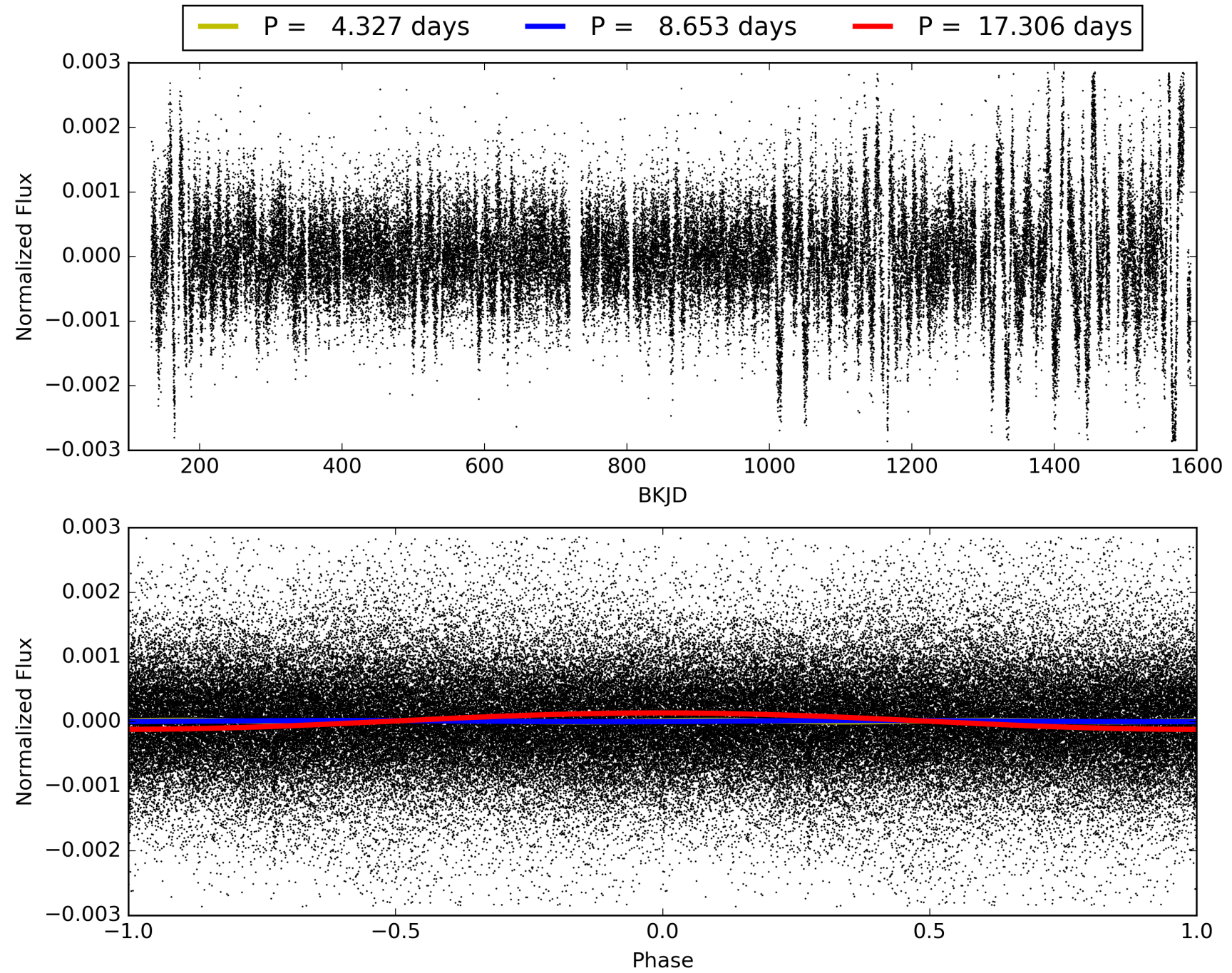
DV Diagnostic Results:

ShortPeriod-sig: 0.2% [0.00σ]
LongPeriod-sig: N/A
ModelChiSquare2-sig: 93.5%
ModelChiSquareGof-sig: 100.0%
Bootstrap-pfa: 2.05e-19
RollingBand-fgt: 1.00 [147/147]
GhostDiagnostic-chr: 0.9242
Centroid-sig: 90.3%
Centroid-so: 0.380 arcsec [0.28σ]
OotOffset-rm: 1.125 arcsec [2.09σ]
KicOffset-rm: 1.032 arcsec [1.80σ]
OotOffset-st: 4/2/2/4 [12]
KicOffset-st: 4/2/2/4 [12]
DiffImageQuality-fgm: 0.33 [4/12]
DiffImageOverlap-fno: 1.00 [17/17]

TCE 004914709-02, PDC Light Curves

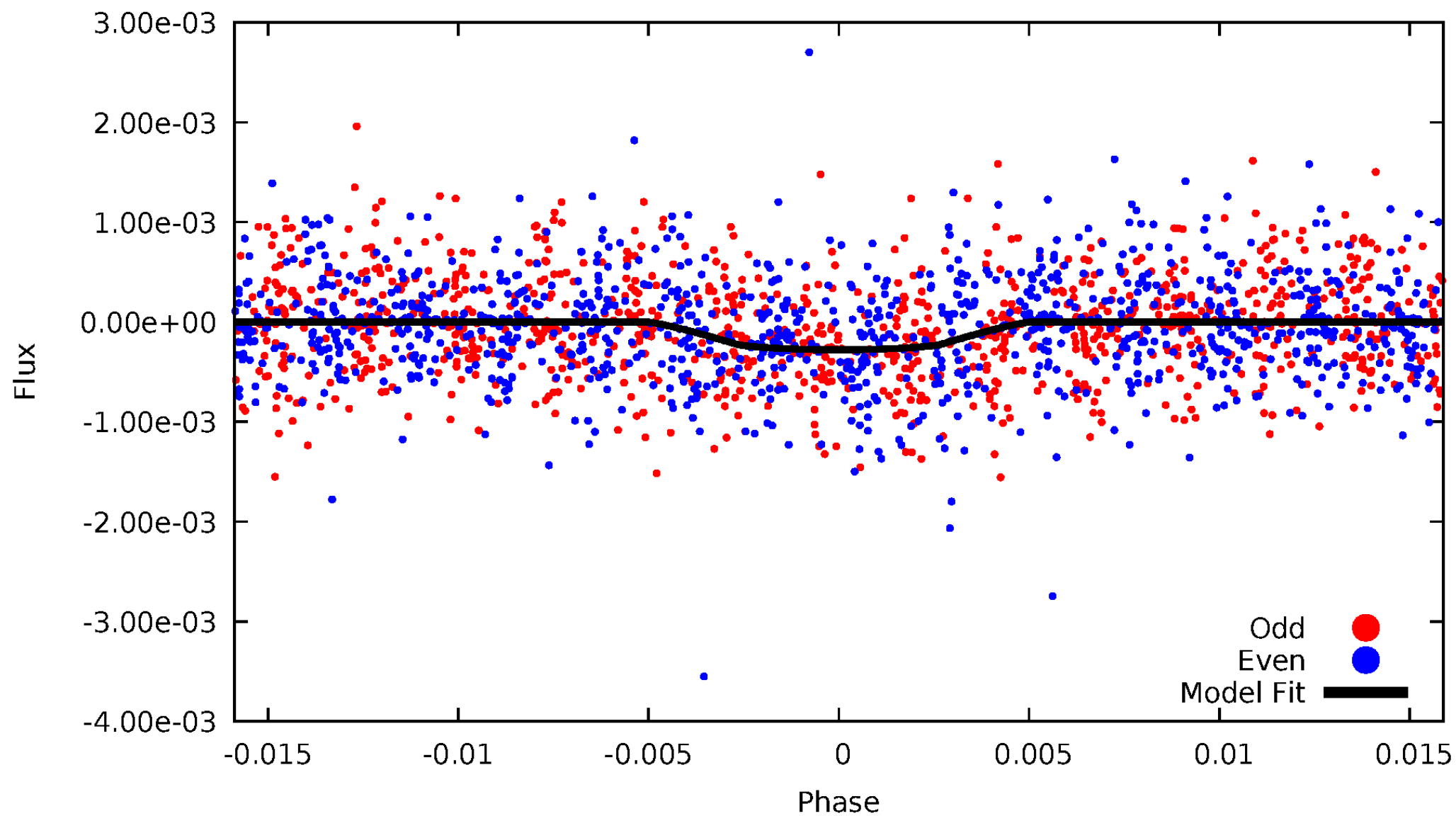


TCE 004914709-02



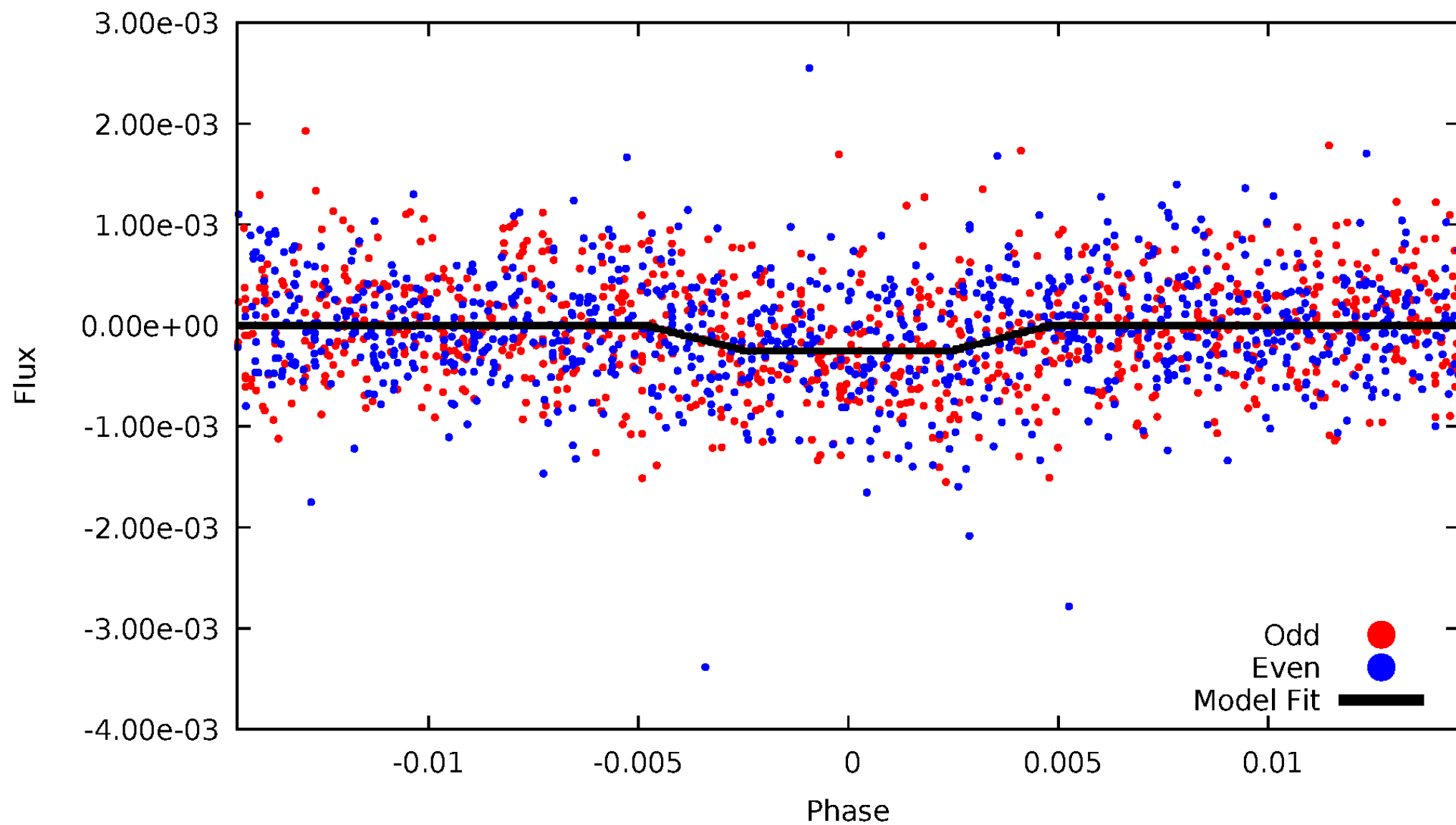
DV Odd/Even

TCE 004914709-02



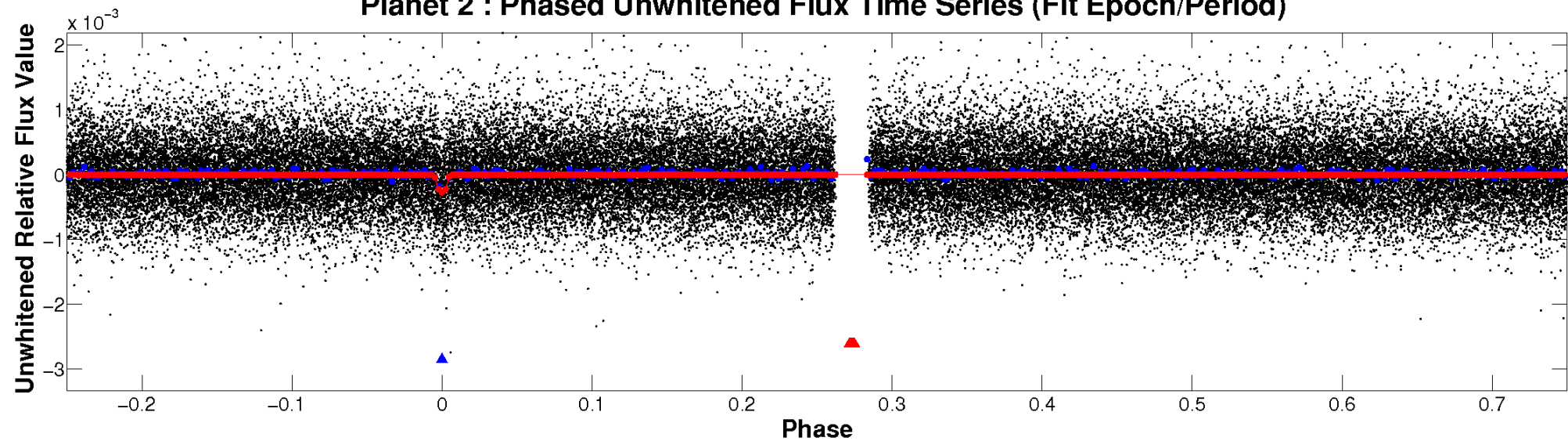
ALT Odd/Even

TCE 004914709-02

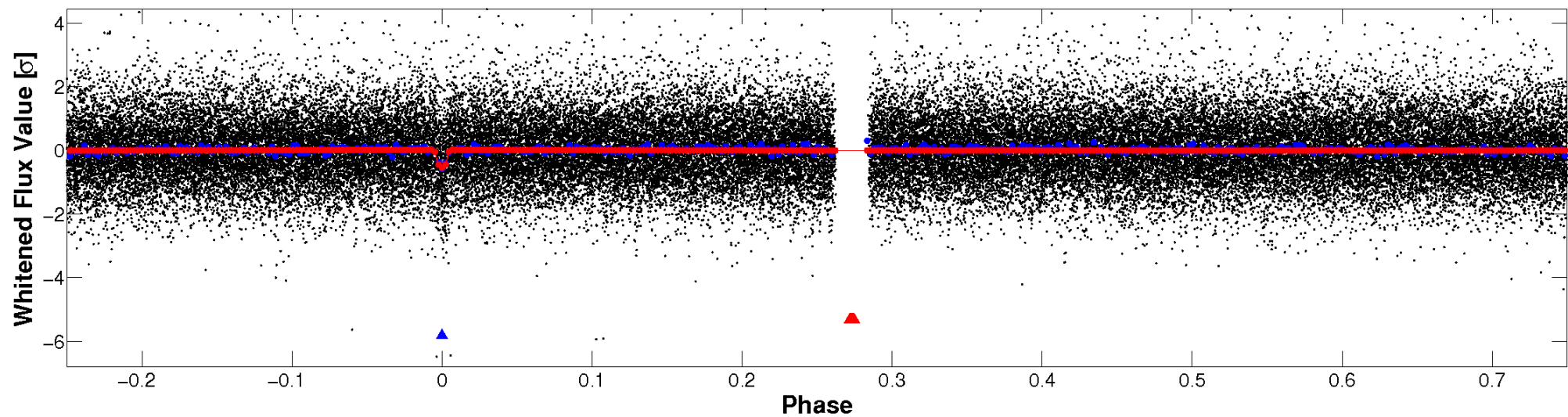


Non-Whitened Vs. Whitened Light Curve

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

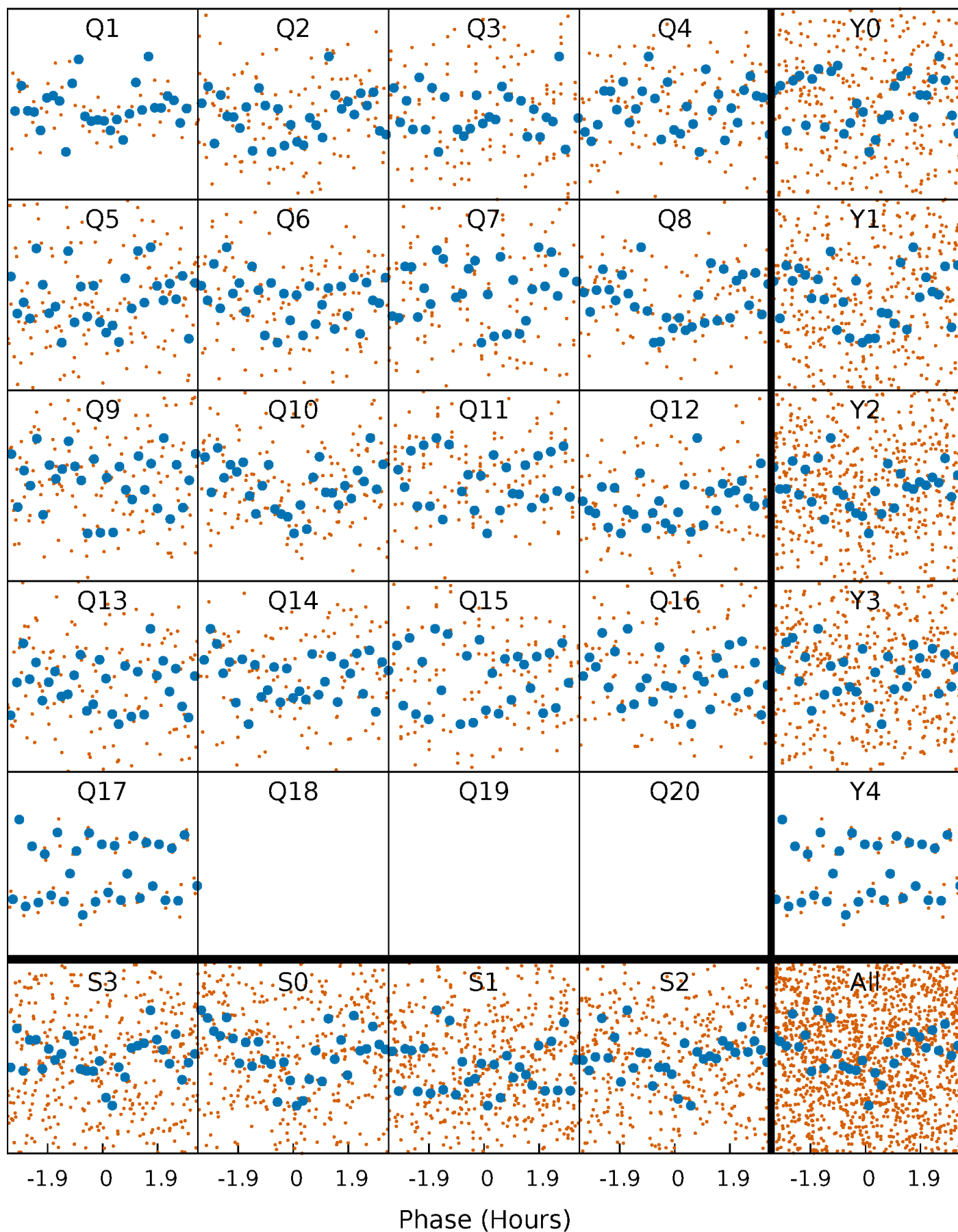


Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



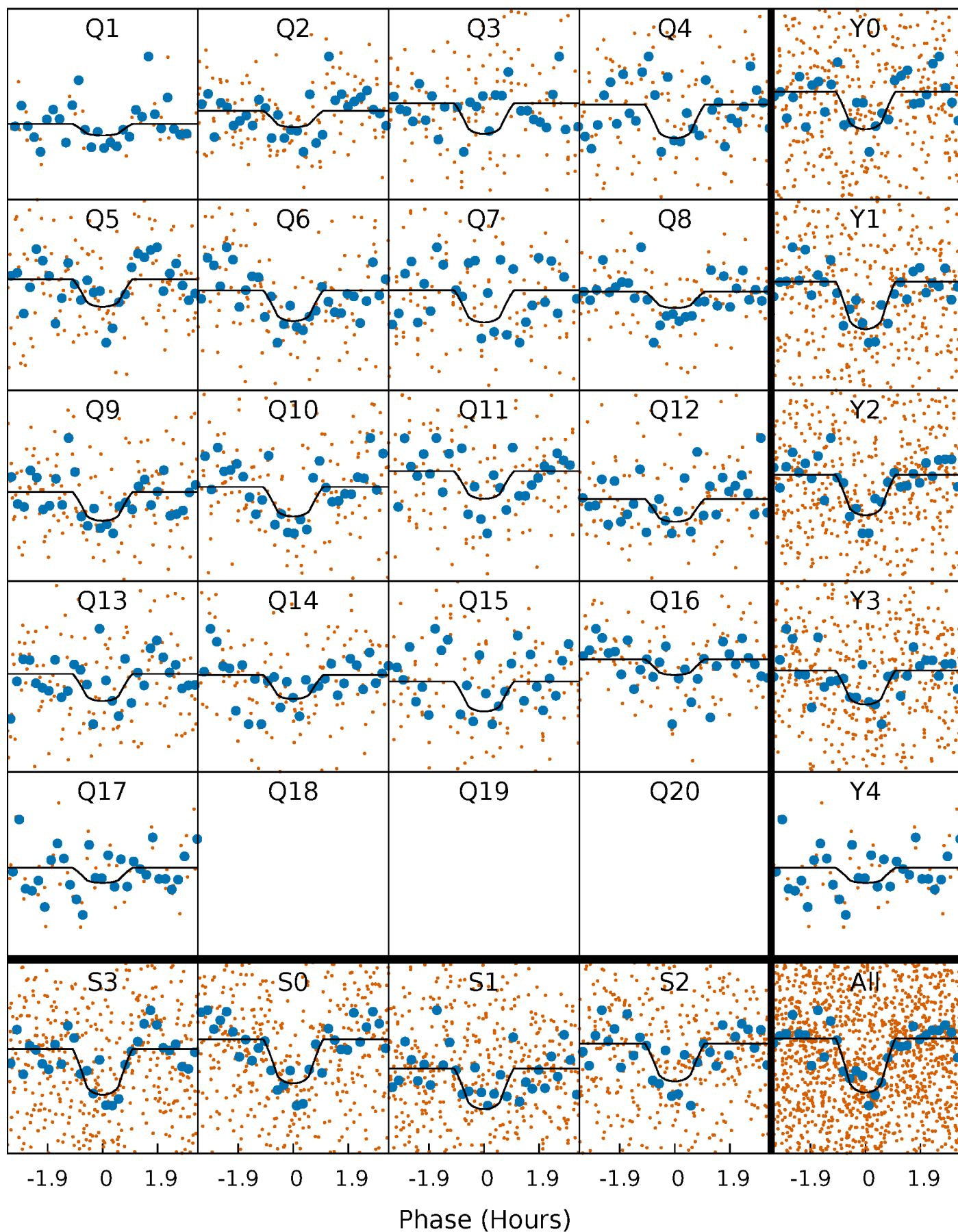
PDC Quarter-Phased Transit Curves

TCE 004914709-02 P= 8.653198 Days $T_0=134.290403$ (BKJD)



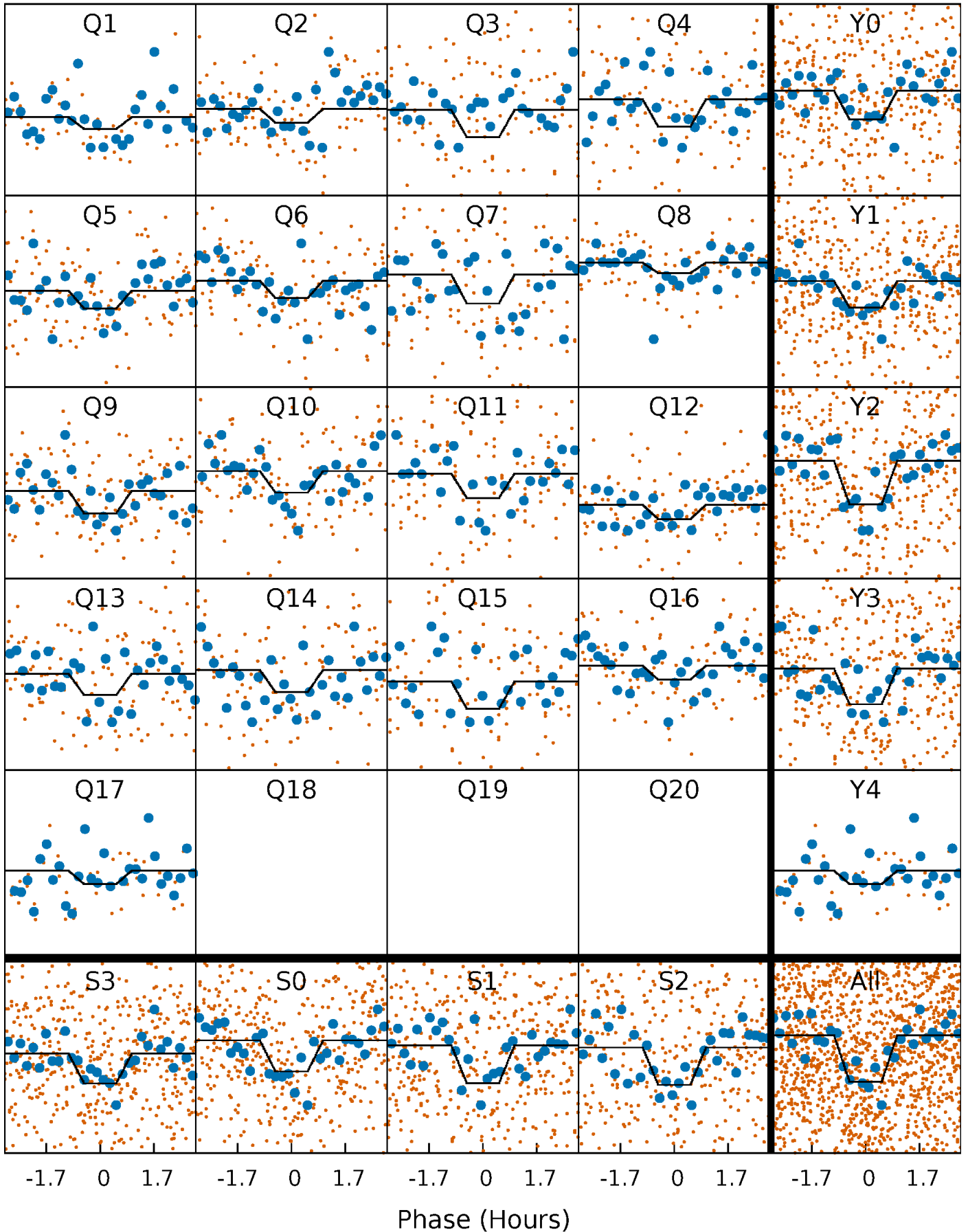
DV Quarter-Phased Transit Curves

TCE 004914709-02 P= 8.653198 Days $T_0=134.290403$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

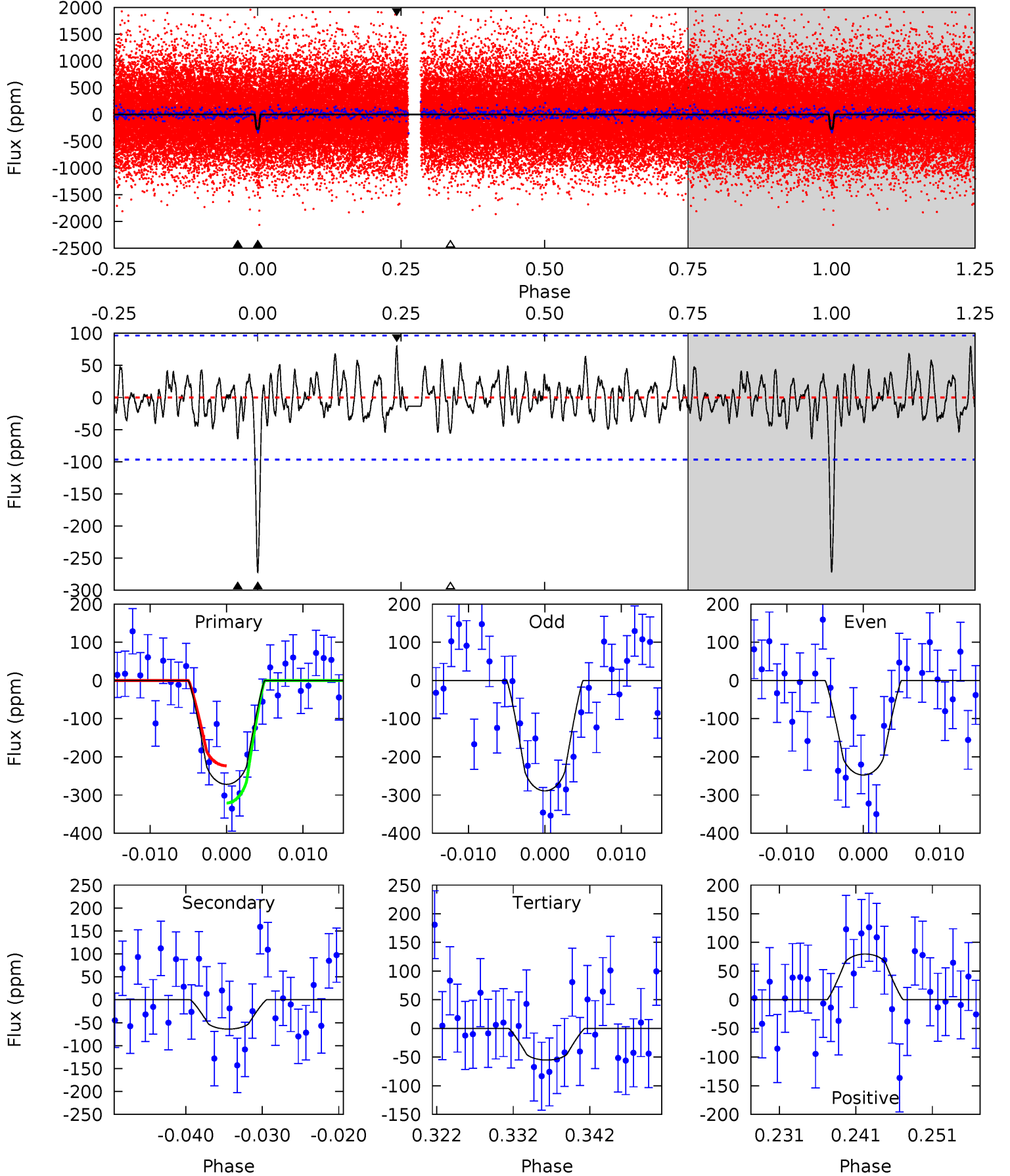
TCE 004914709-02 P= 8.653248 Days $T_0=134.285436$ (BKJD)



DV Model-Shift Uniqueness Test

004914709-02, P = 8.653198 Days, E = 125.637205 Days

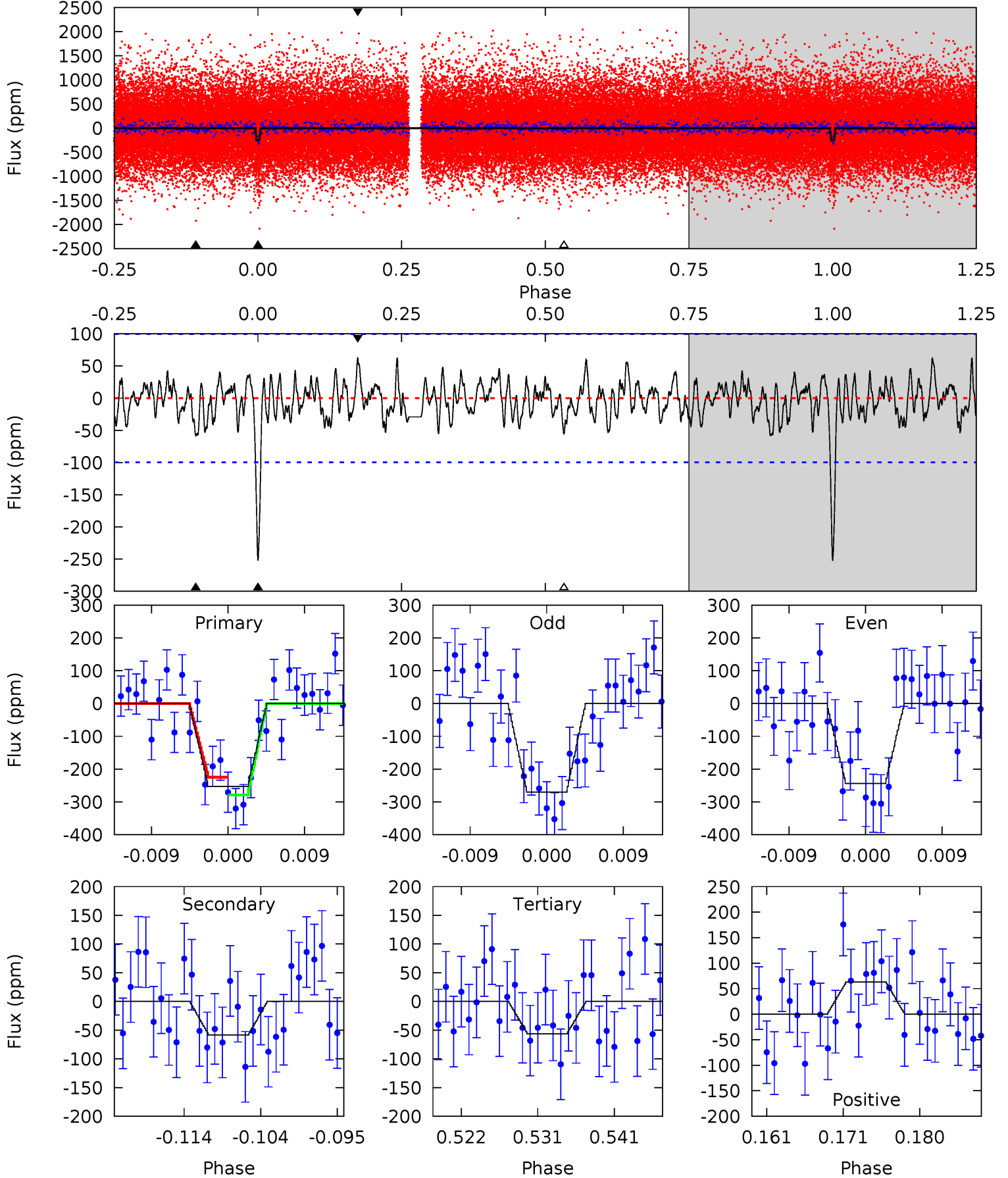
| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 14.2 | 3.33 | 2.87 | 4.15 | 5.03 | 2.57 | 1.23 | 11.3 | 10.0 | 0.46 | -0.82 | 1.09 | 0.95 | 0.23 | 2.54 |



Alt Model-Shift Uniqueness Test

004914709-02, P = 8.653248 Days, E = 125.632188 Days

| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 12.8 | 2.95 | 2.84 | 3.19 | 5.04 | 2.59 | 1.16 | 9.92 | 9.57 | 0.11 | -0.24 | 0.68 | 0.95 | 0.20 | 1.37 |



Stellar Parameters For KIC 004914709

| | $T_{\text{eff}}(K)$ | $\log(g)$ | [Fe/H] | $R (R_{\odot})$ | $M(M_{\odot})$ | $p_{\star} (\text{g}\cdot\text{cm}^{-3})$ |
|--------|----------------------|---------------------------|---------------------------|---------------------------|---------------------------|-------------------------------------------|
| | 5301^{+175}_{-159} | $4.528^{+0.051}_{-0.110}$ | $0.060^{+0.250}_{-0.300}$ | $0.840^{+0.138}_{-0.080}$ | $0.869^{+0.080}_{-0.080}$ | $2.063^{+0.516}_{-0.698}$ |
| | +3%/-3% | +1%/-2% | +417%/-500% | +16%/-10% | +9%/-9% | +25%/-34% |
| 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 004914709-02 / KOI

| Detrend | Depth (ppm) | $R_p (R_{\oplus})$ | $T_{\text{max}} (K)$ | $T_{\text{obs}} (K)$ | A_{obs} |
|---------|--------------|------------------------|----------------------|-----------------------|-------------------|
| DV | -64 ± 19 | $2.25^{+1.93}_{-1.45}$ | 1078^{+52}_{-42} | 3483^{+1624}_{-602} | 41^{+311}_{-30} |
| Alt. | -58 ± 20 | $2.17^{+1.81}_{-1.42}$ | 1077^{+51}_{-47} | 3489^{+1687}_{-600} | 41^{+314}_{-29} |

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

DV Centroid Data

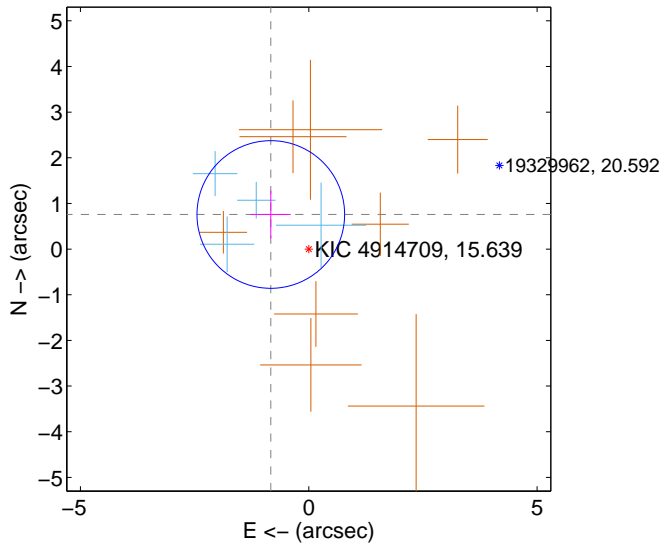
Supplemental centroid analysis for 004914709-02. Kepler magnitude: 15.64. Transit SNR 10.19

There are 4 quarters with good PRF difference image offsets

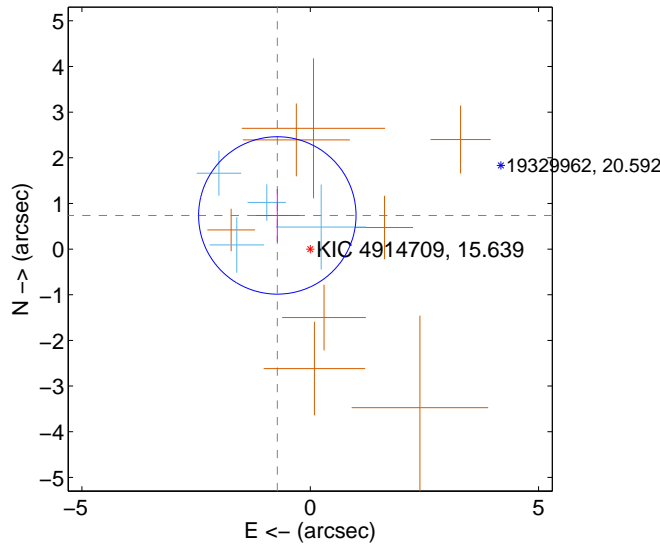
The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

| | Distance in arcsec | Distance / σ | Δ RA | Δ Dec |
|-----------------------------------------|--------------------|---------------------|-------------------|-------------------|
| PRF-fit source offset from OOT | 1.125 ± 0.539 | 2.09 | 0.831 ± 0.437 | 0.758 ± 0.523 |
| PRF-fit source offset from KIC position | 1.032 ± 0.575 | 1.80 | 0.721 ± 0.485 | 0.737 ± 0.577 |
| photometric centroid source offset | 0.38 ± 1.35 | 0.28 | -0.05 ± 1.28 | -0.38 ± 1.35 |

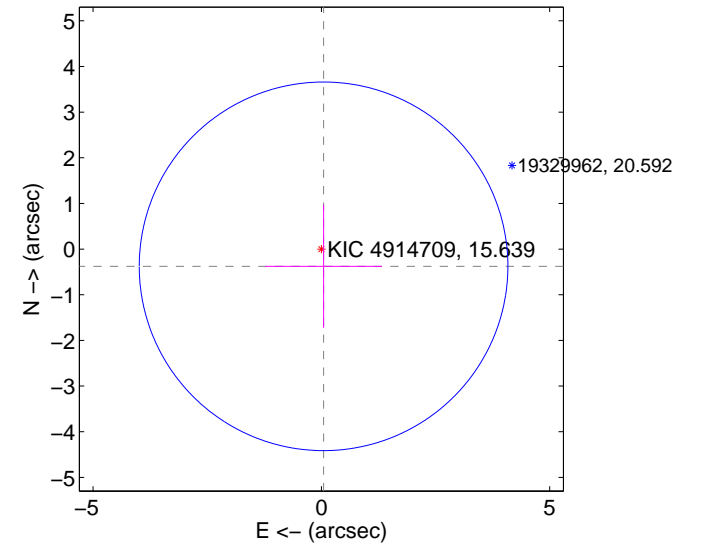
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

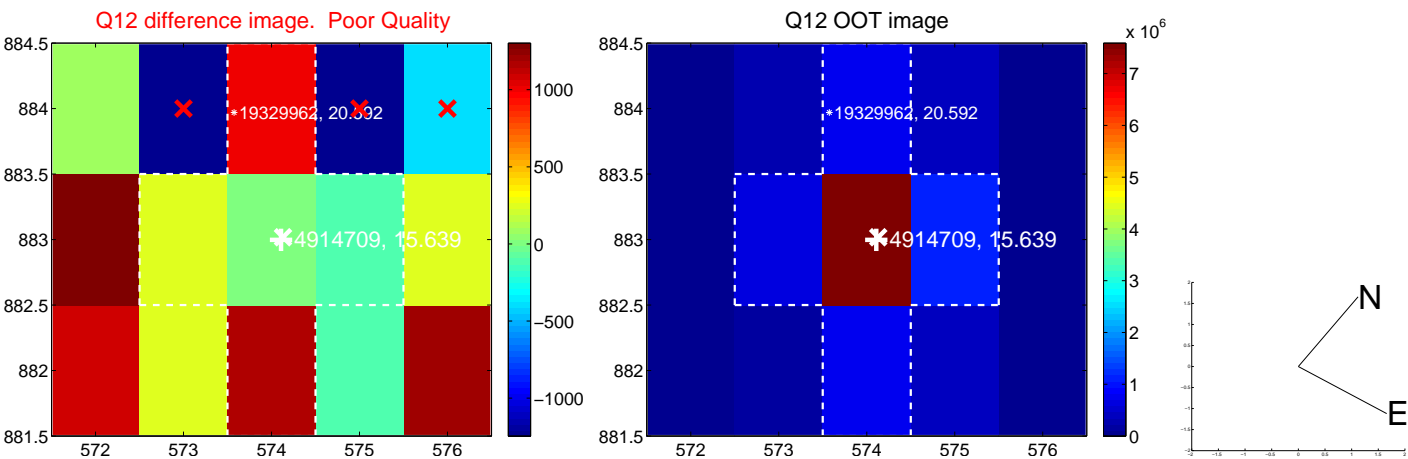
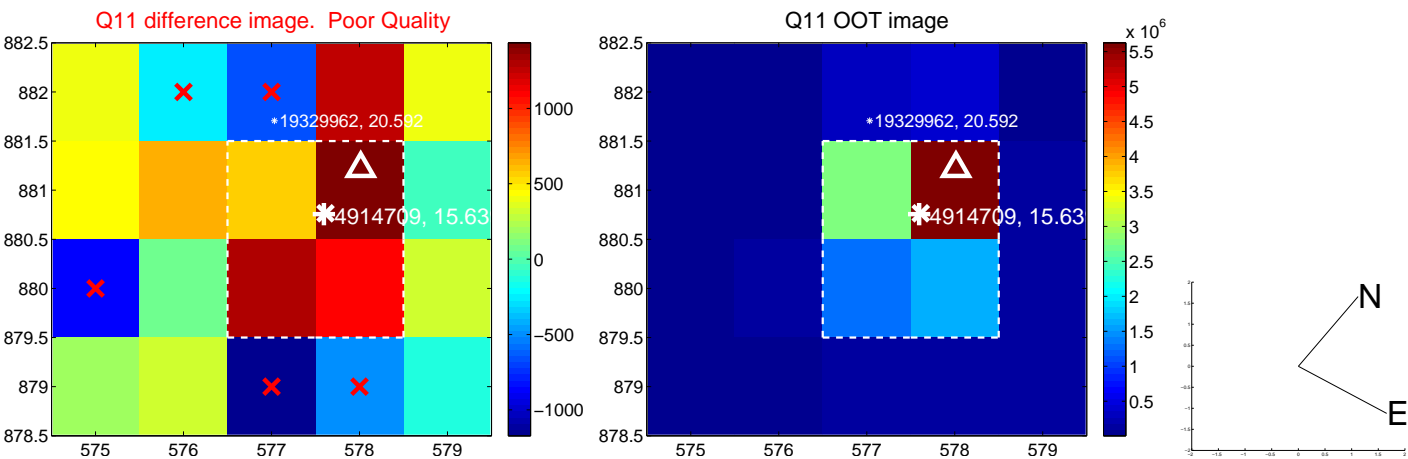
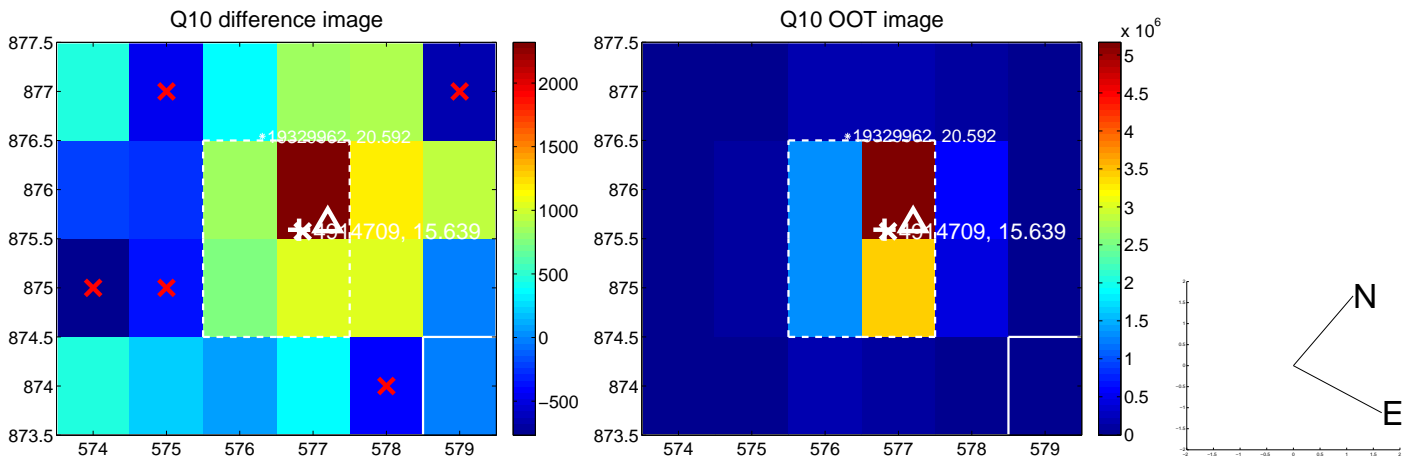
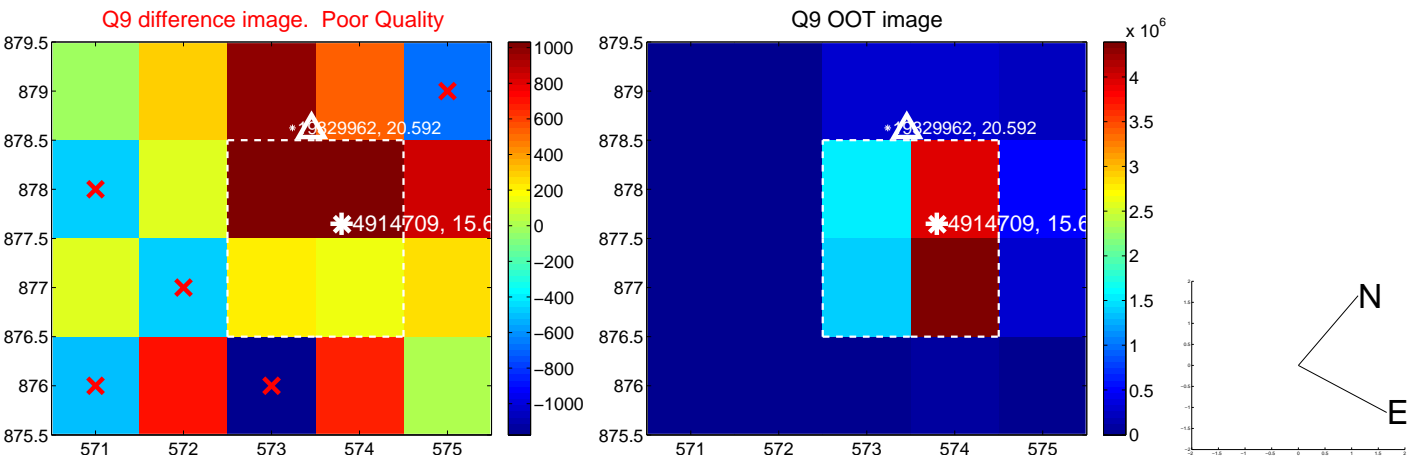


offset from photometric centroids

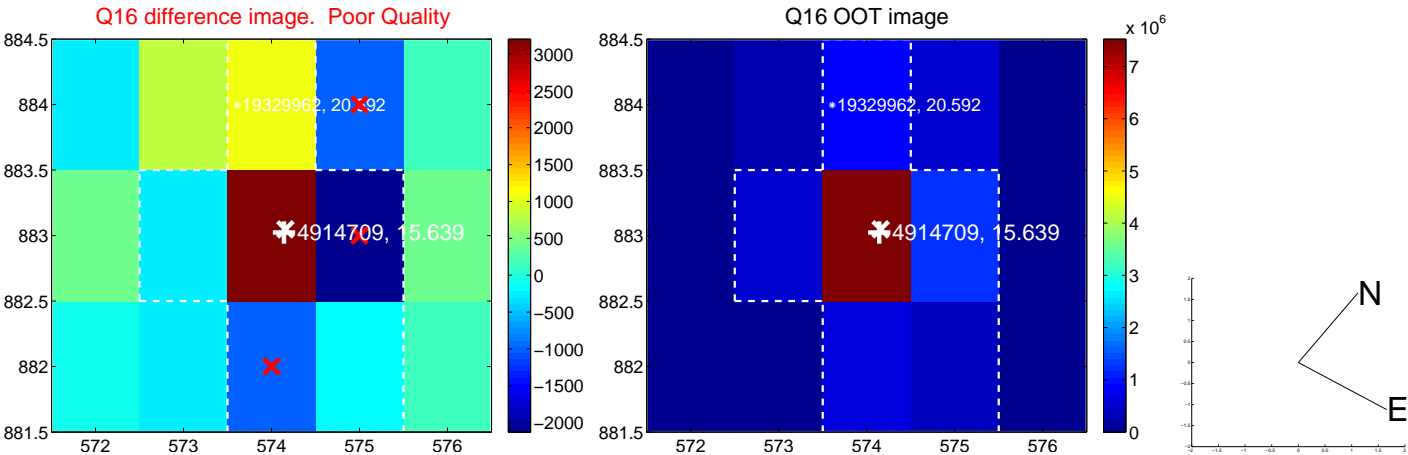
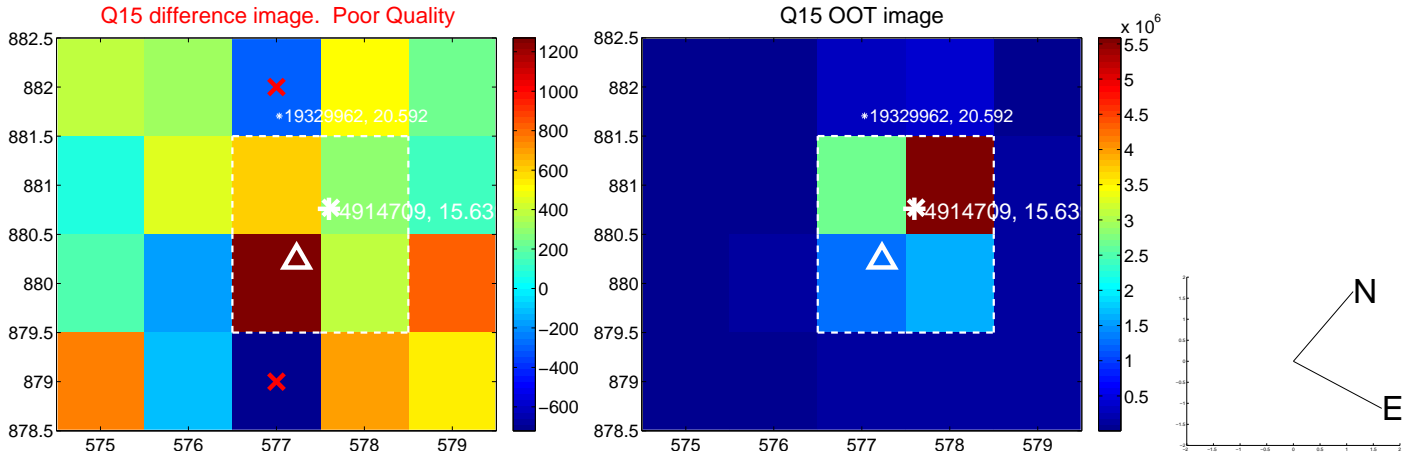
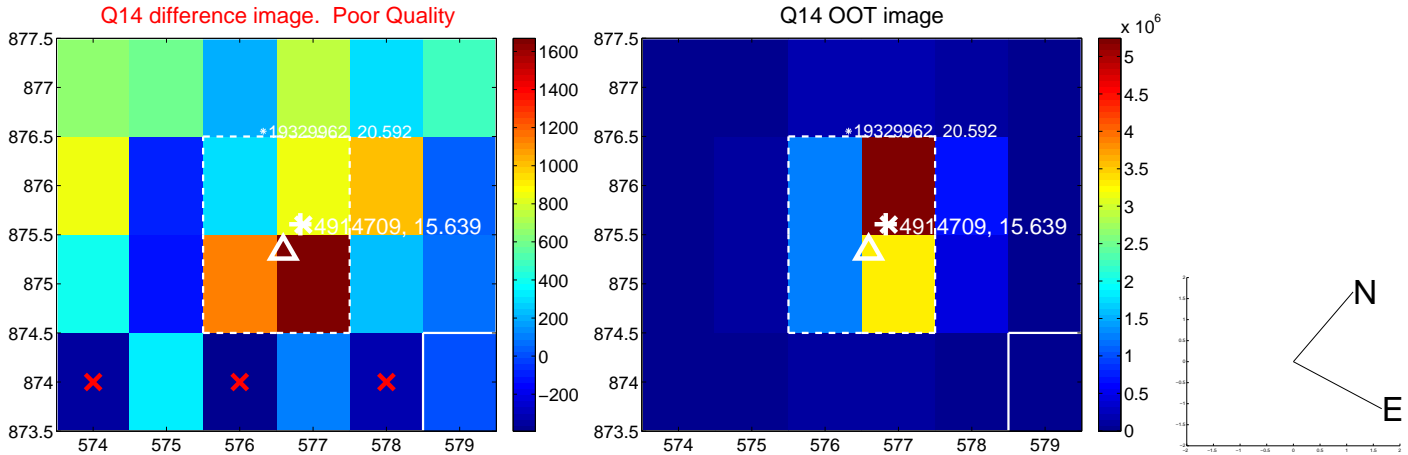
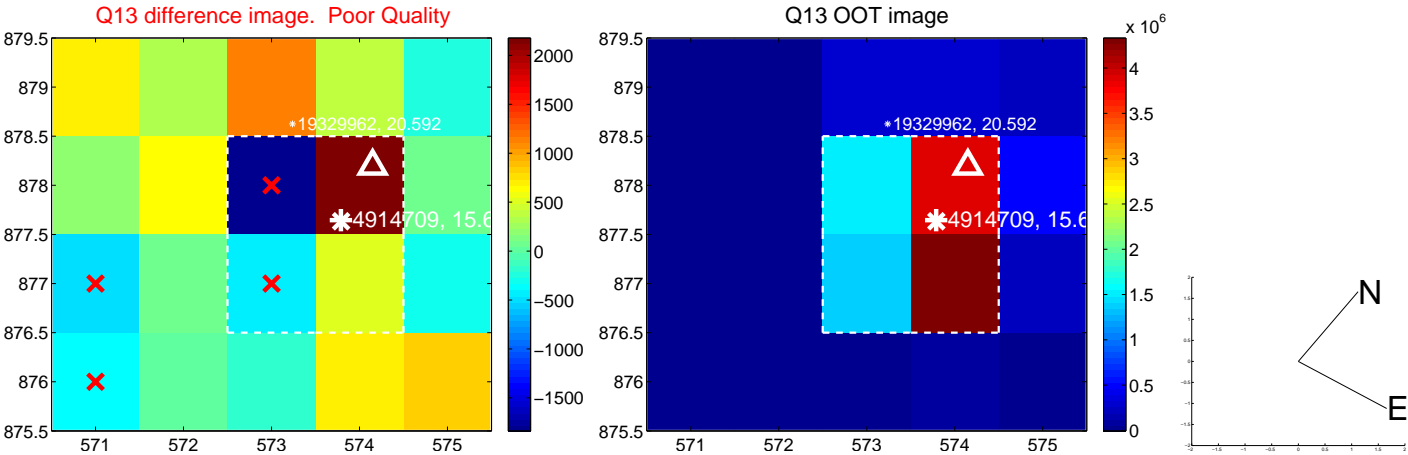


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- σ uncertainty. Blue circle: three-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

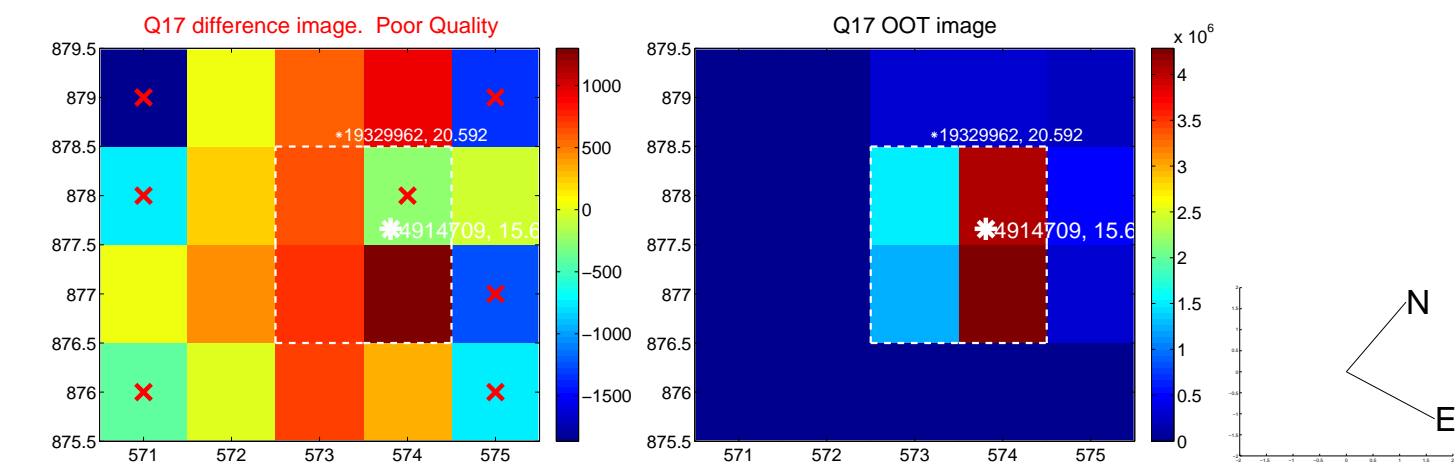
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



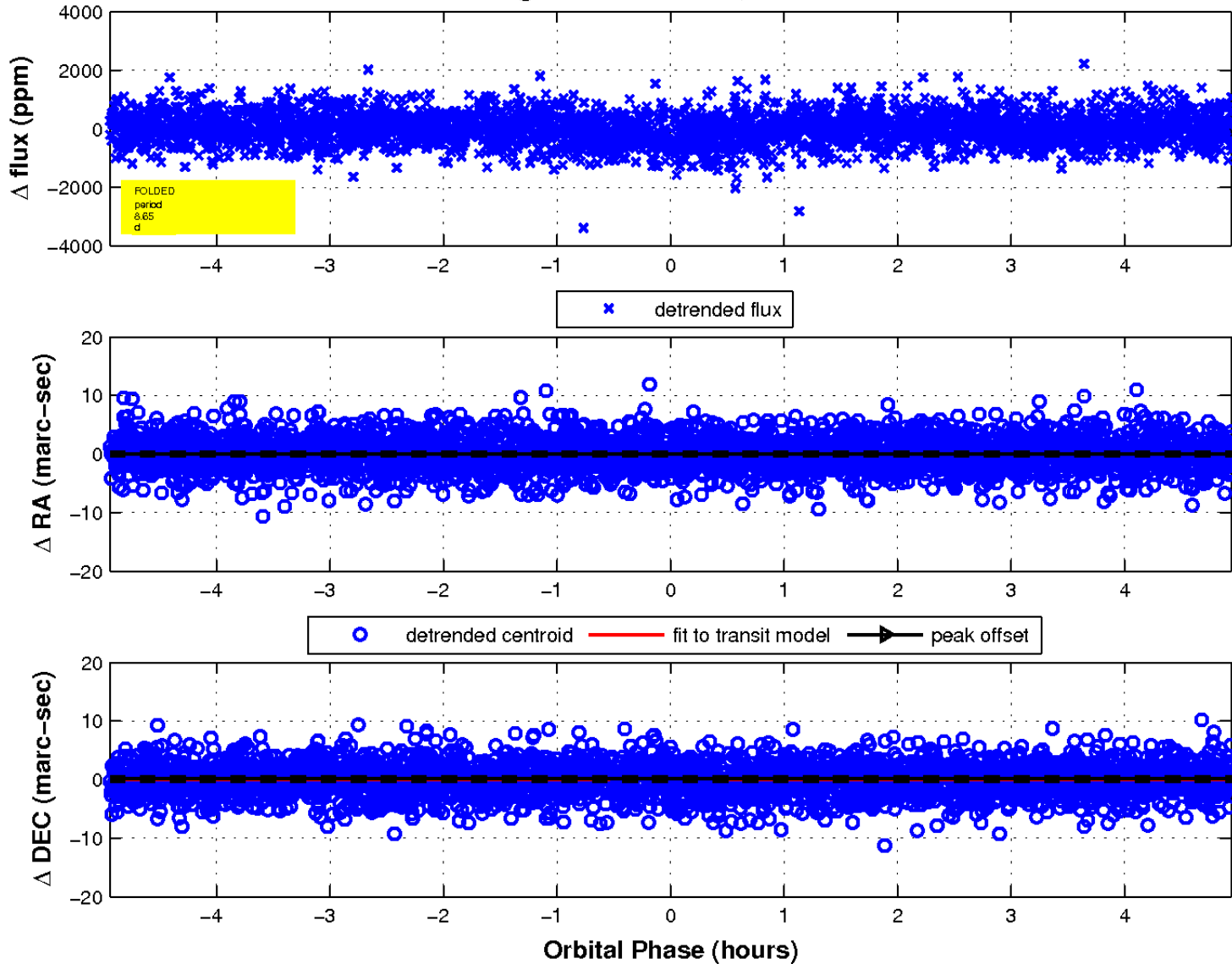
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

