

KIC 002578404

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}) |
|--------------|----------|------|---------------|--------------|-------------|------------------|------|------|-----------------------------|-----------------|------------------------|------------------------|
| 002578404-01 | OBS | No | 2.346635 | 132.987903 | 85.5 | 9.904 | 7.9 | 8.7 | 3.91 | 7538 | 3.79 | 23332.50 |
| 002578404-02 | OBS | No | 0.872268 | 132.043130 | 226.8 | 6.350 | 14.7 | 20.2 | 3.91 | 7538 | 6.92 | 87301.62 |

Robovetter Results

| TCE | Run Type | Disp | Score | N | S | C | E | Comments |
|--------------|----------|------|-------|---|---|---|---|---|
| 002578404-01 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | LPP_DV |
| 002578404-02 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT |

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

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

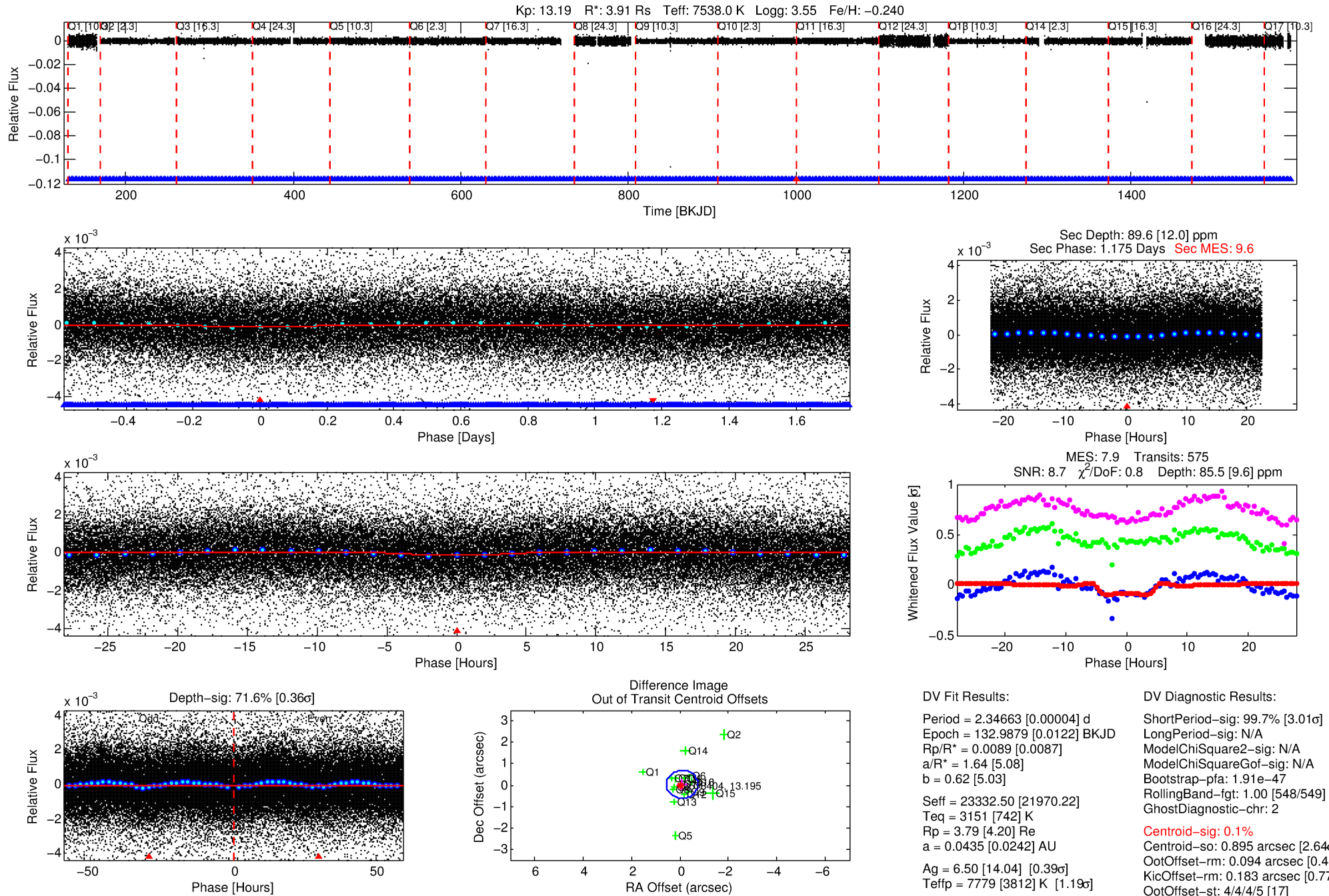
See http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col for comment definitions.

Ephemeris Match Information For 002578404-01

No Significant Match Found

DV One-Page Summary

KIC: 2578404 Candidate: 1 of 2 Period: 2.347 d



DV Fit Results:

Period = 2.34663 [0.00004] d
Epoch = 132.9879 [0.0122] BKJD
Rp/R* = 0.0089 [0.0087]
a/R* = 1.64 [5.08]
b = 0.62 [5.03]
Seff = 23332.50 [21970.22]
Teq = 3151 [742] K
Rp = 3.79 [4.20] Re
a = 0.0435 [0.0242] AU
Ag = 6.50 [14.04] [0.39σ]
Teffp = 7779 [3812] K [1.19σ]

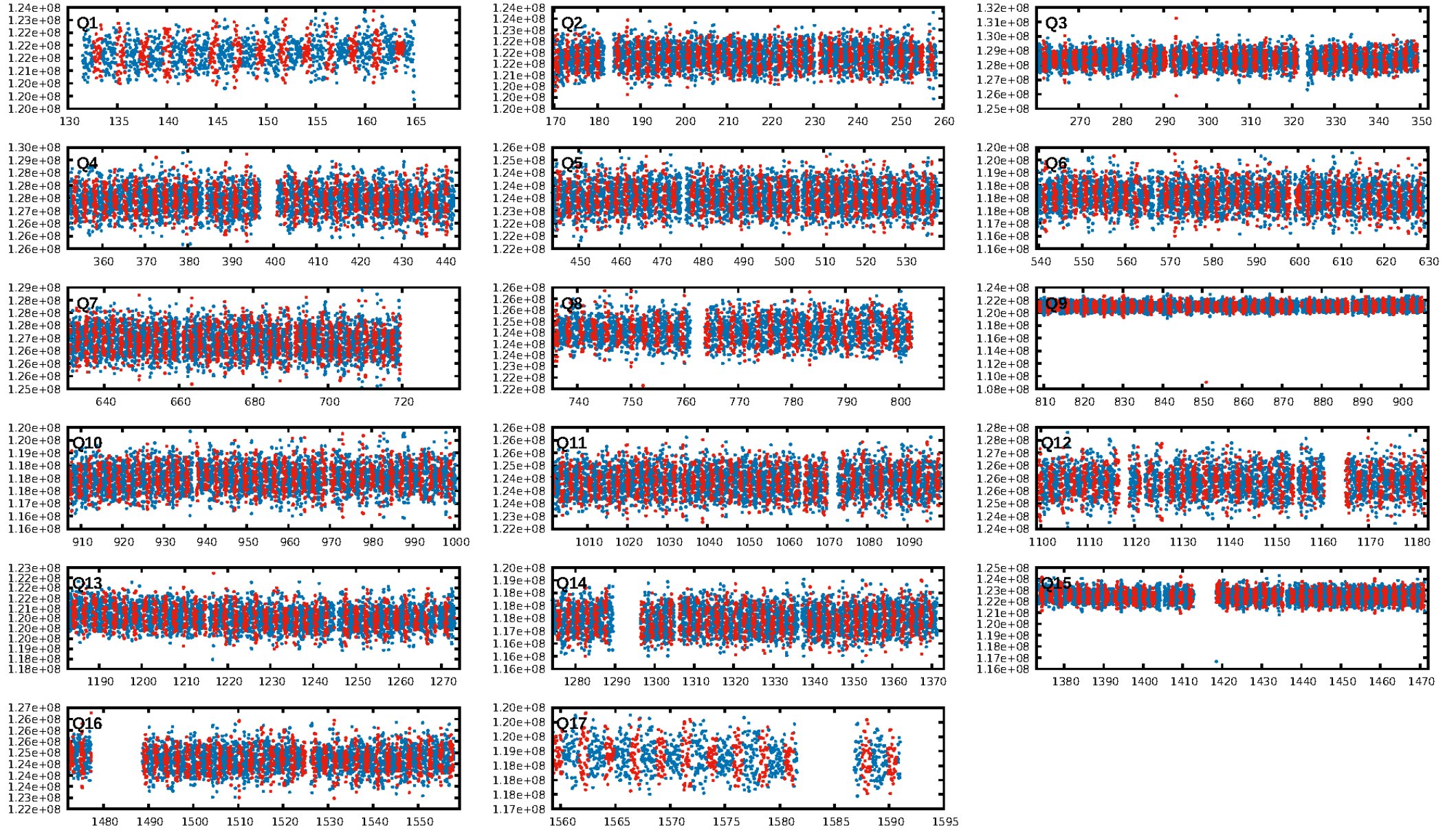
DV Diagnostic Results:

ShortPeriod-sig: 99.7% [3.01σ]
LongPeriod-sig: N/A
ModelChiSquare2-sig: N/A
ModelChiSquareGof-sig: N/A
Bootstrap-pfa: 1.91e-47
RollingBand-fgt: 1.00 [548/549]
GhostDiagnostic-chr: 2
Centroid-sig: 0.1%
Centroid-so: 0.895 arcsec [2.64σ]
OotOffset-rm: 0.094 arcsec [0.43σ]
KicOffset-rm: 0.183 arcsec [0.77σ]
OotOffset-st: 4/4/4/5 [17]
KicOffset-st: 4/4/4/5 [17]
DiffImageQuality-fgm: 1.00 [17/17]
DiffImageOverlap-fno: 0.00 [0/17]

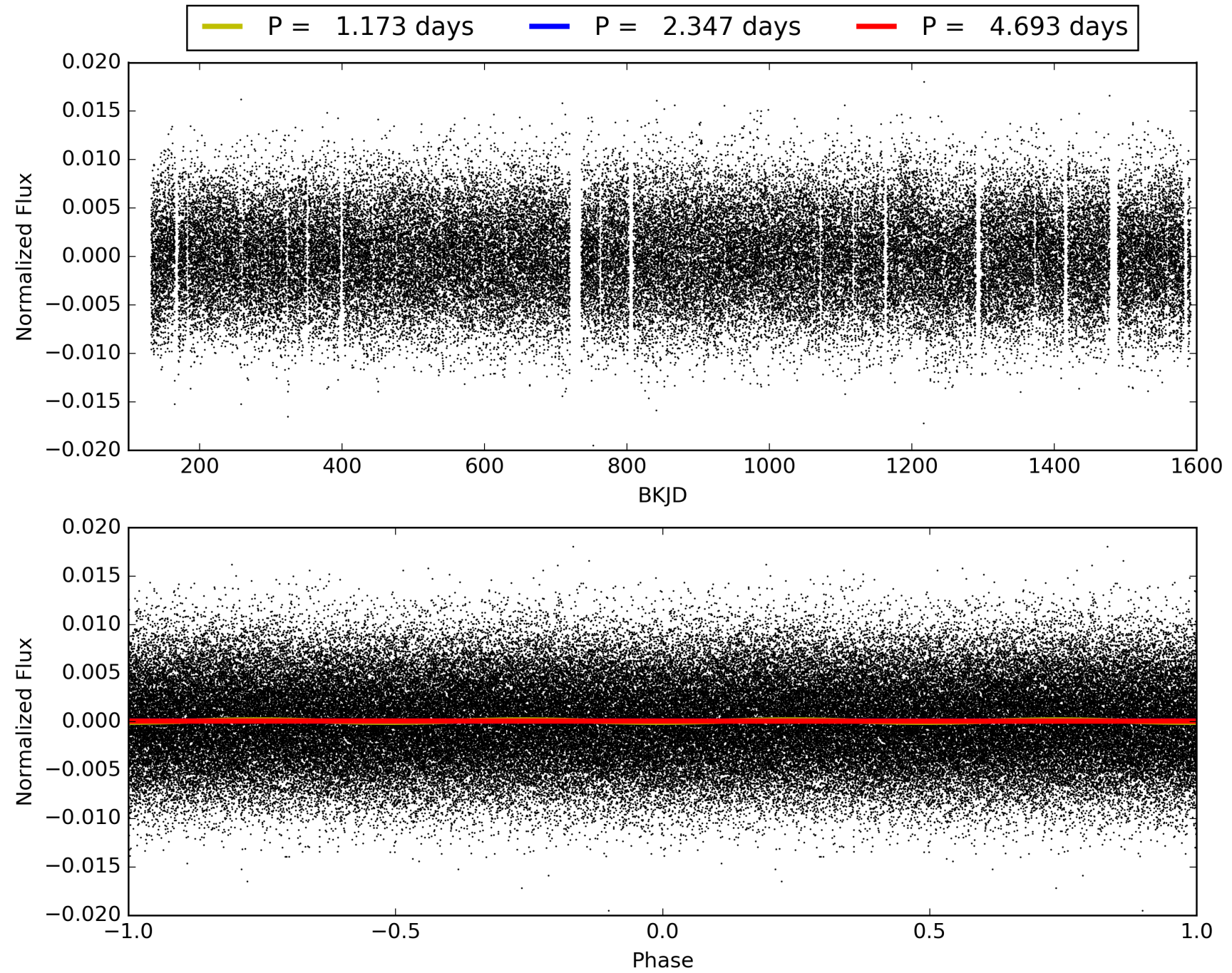
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 18:58:26 Z

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

TCE 002578404-01, PDC Light Curves

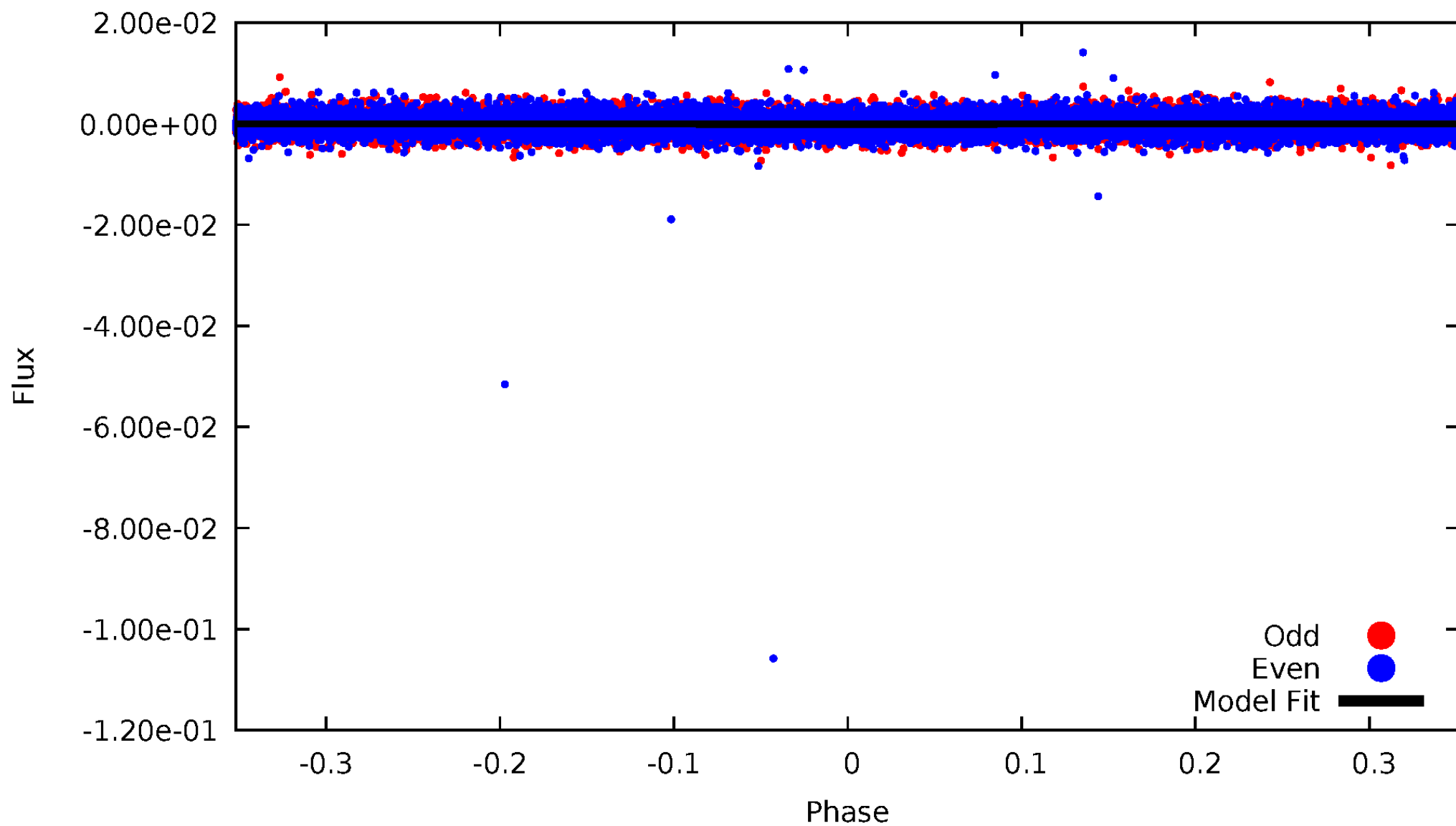


TCE 002578404-01



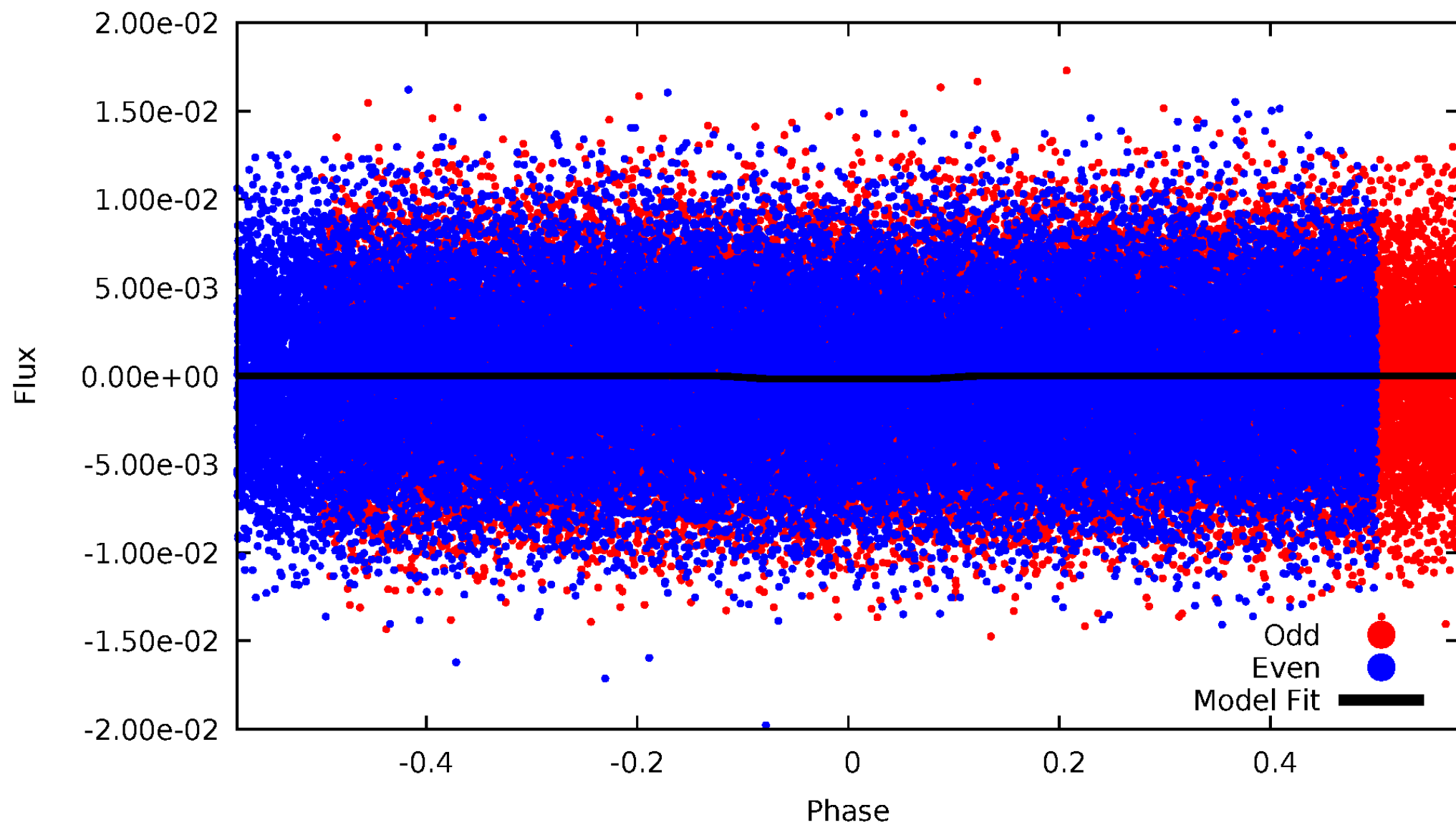
DV Odd/Even

TCE 002578404-01



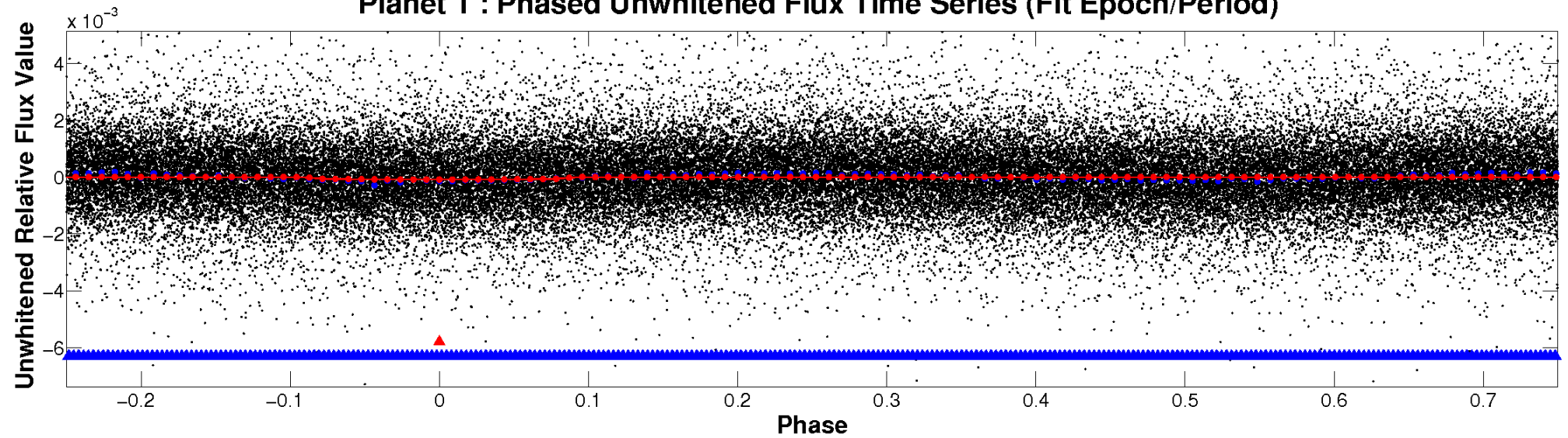
ALT Odd/Even

TCE 002578404-01

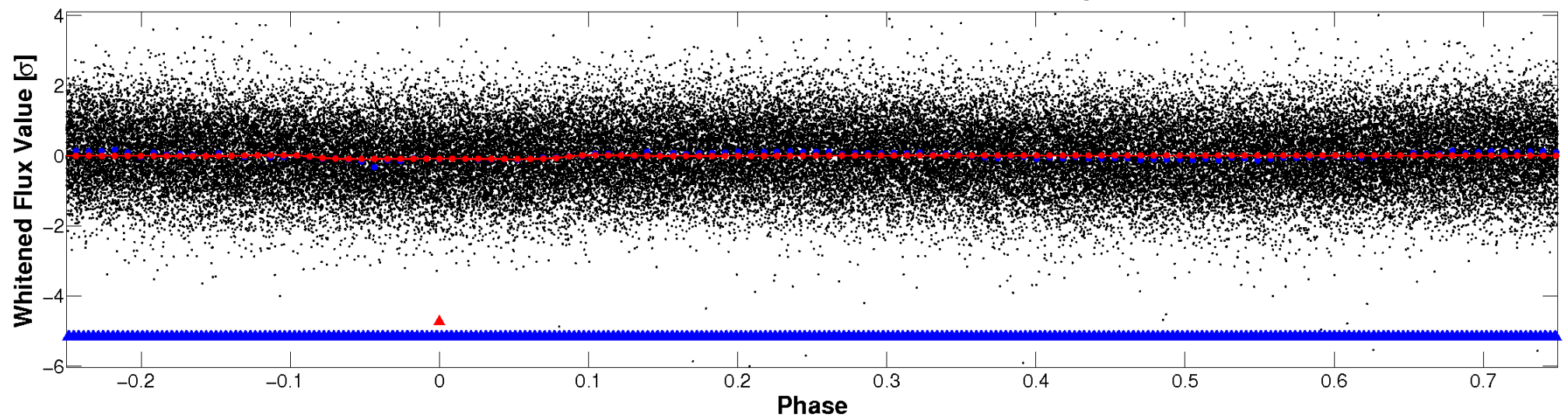


Non-Whitened Vs. Whitened Light Curve

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

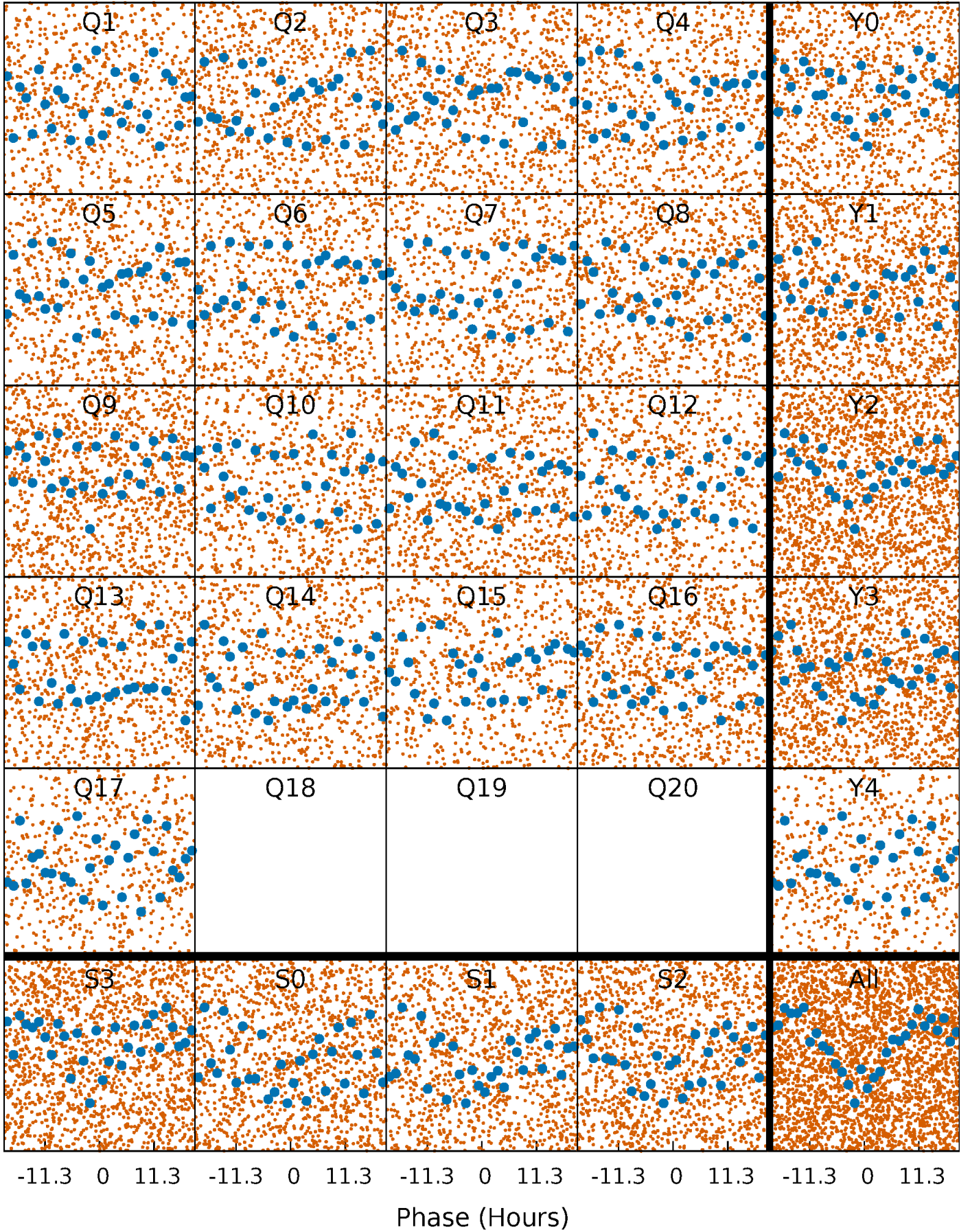


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



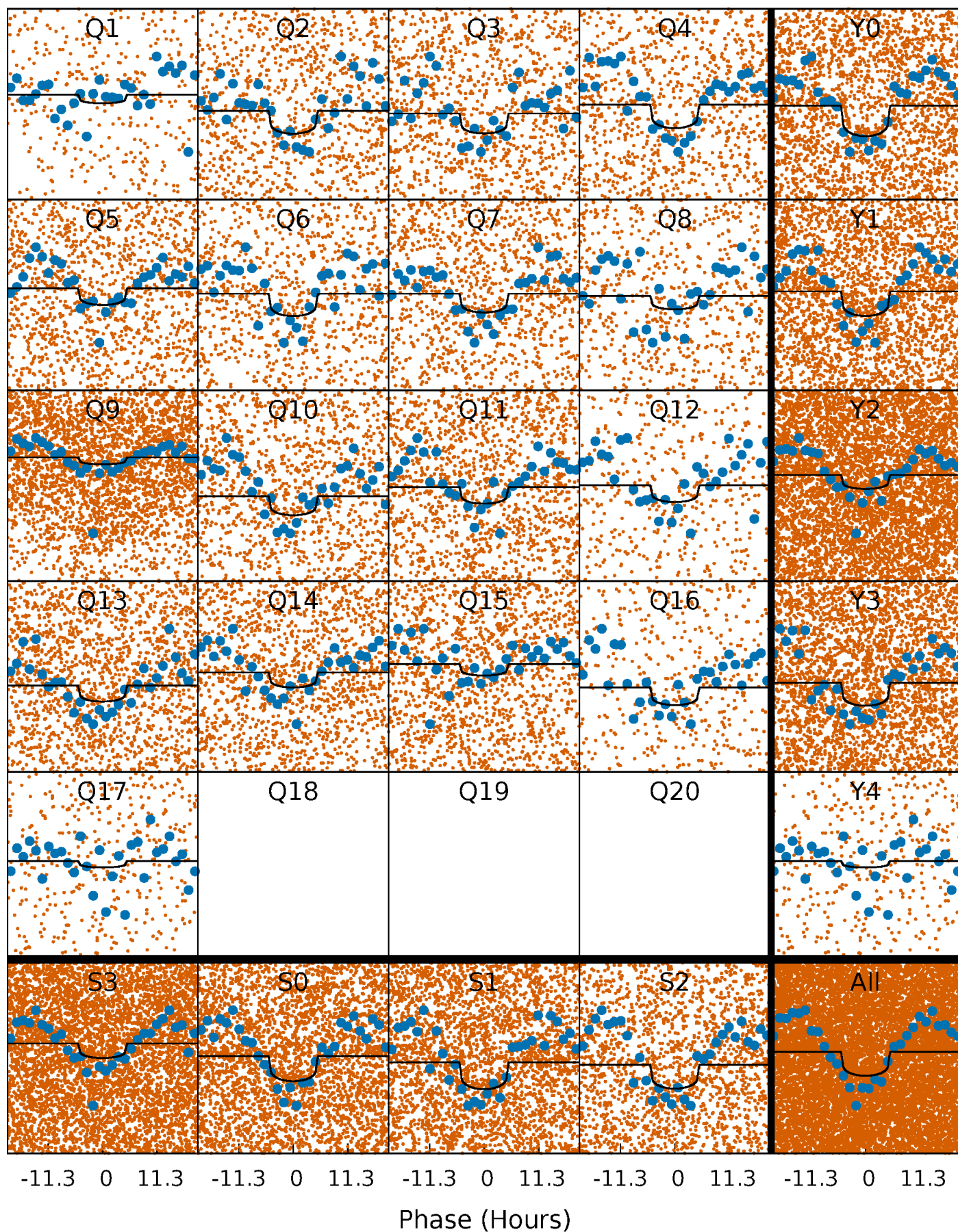
PDC Quarter-Phased Transit Curves

TCE 002578404-01 P= 2.346635 Days $T_0=132.987903$ (BKJD)



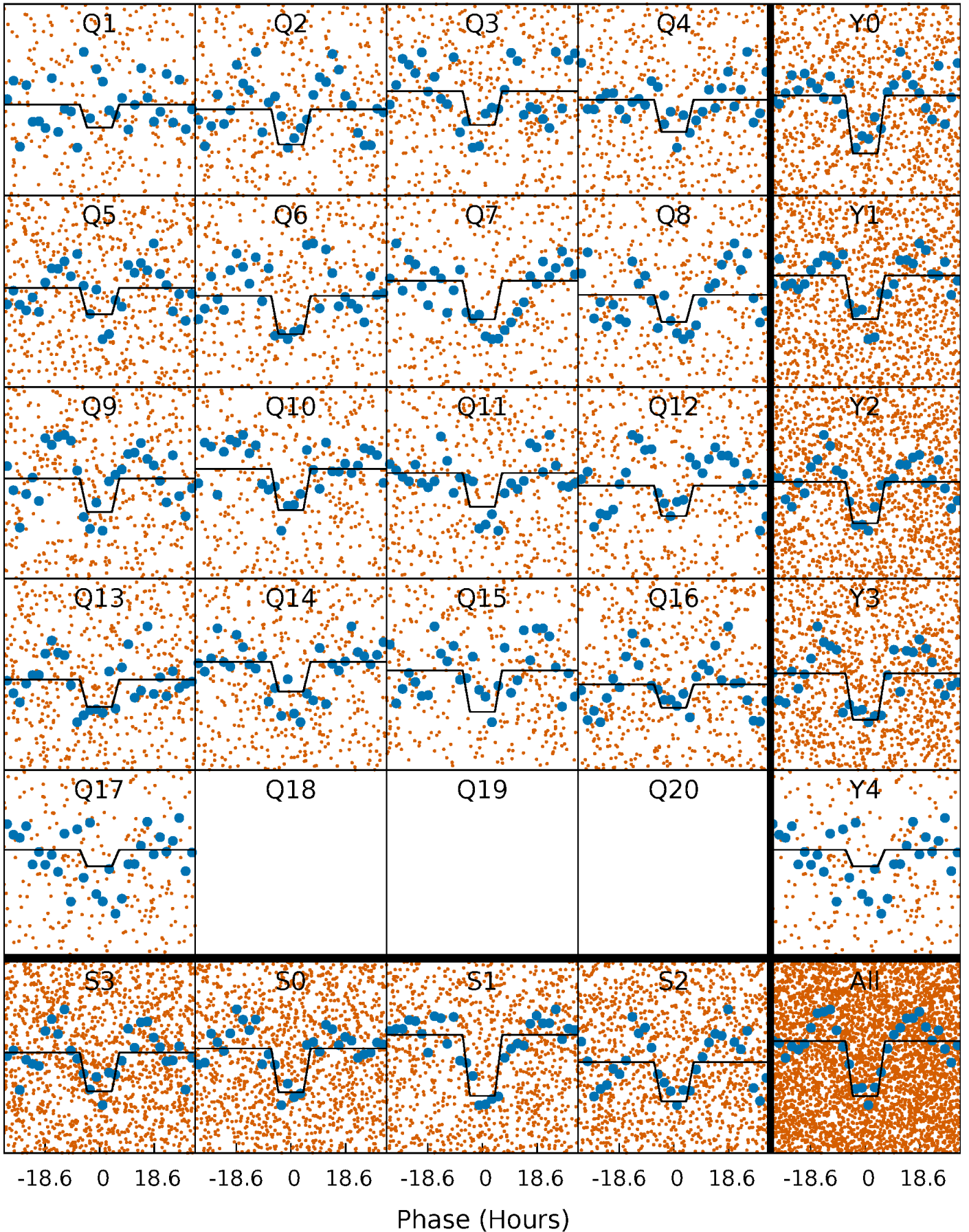
DV Quarter-Phased Transit Curves

TCE 002578404-01 P= 2.346635 Days $T_0=132.987903$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

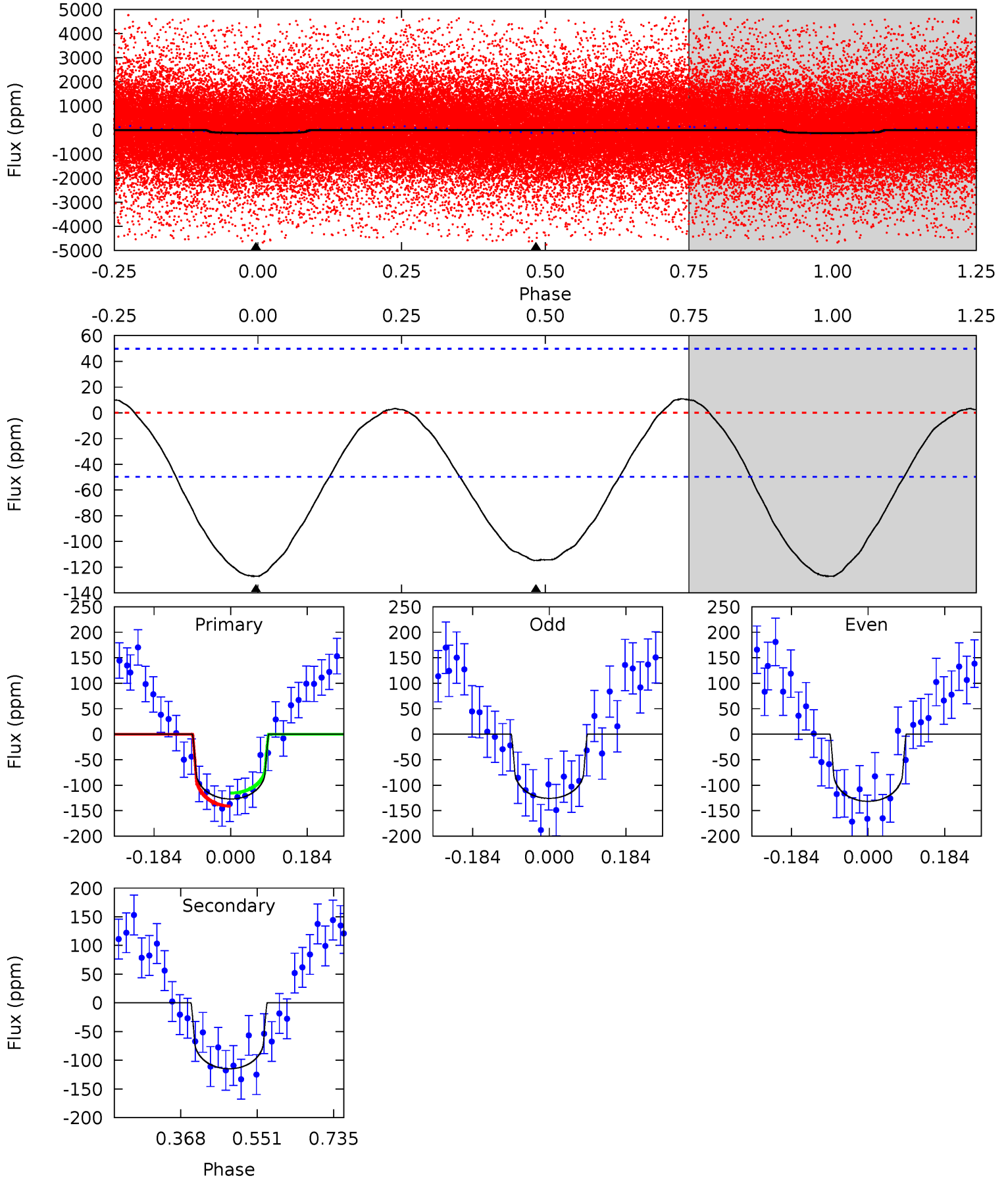
TCE 002578404-01 P= 2.346519 Days $T_0=132.963530$ (BKJD)



DV Model-Shift Uniqueness Test

002578404-01, P = 2.346635 Days, E = 130.641268 Days

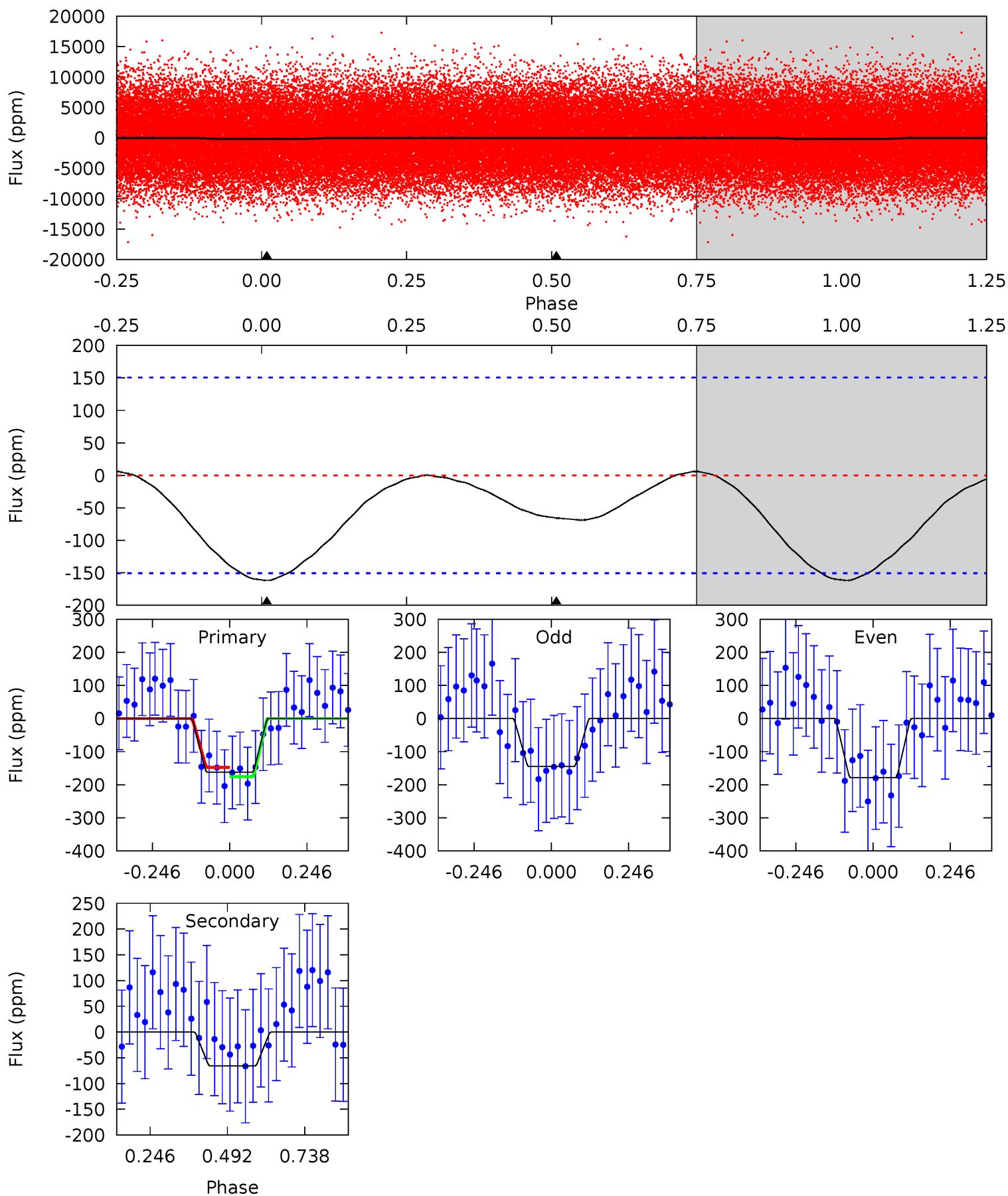
| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|-----|-----|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 11.3 | 10.2 | 0 | 0 | 4.44 | 1.33 | 0.69 | 11.3 | 11.3 | 10.2 | 10.2 | 0.26 | 1.06 | 0.08 | 1.15 |



Alt Model-Shift Uniqueness Test

002578404-01, P = 2.346519 Days, E = 130.617011 Days

| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|-----|-----|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 4.69 | 1.90 | 0 | 0 | 4.37 | 1.16 | 0.15 | 4.69 | 4.69 | 1.90 | 1.90 | 0.48 | 1.00 | 0.04 | 0.40 |



Stellar Parameters For KIC 002578404

| | $T_{\text{eff}}(K)$ | $\log(g)$ | [Fe/H] | R (R_{\odot}) | $M(M_{\odot})$ | p_{\star} ($\text{g}\cdot\text{cm}^{-3}$) |
|--------|----------------------|---------------------------|----------------------------|---------------------------|---------------------------|---|
| | 7538^{+235}_{-314} | $3.554^{+0.558}_{-0.062}$ | $-0.240^{+0.250}_{-0.300}$ | $3.908^{+0.389}_{-2.074}$ | $1.995^{+0.061}_{-0.545}$ | $0.047^{+0.331}_{-0.010}$ |
| | +3%/-4% | +16%/-2% | +104%/-125% | +10%/-53% | +3%/-27% | +703%/-21% |
| Source | KIC0 | 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 002578404-01 / KOI

| Detrend | Depth (ppm) | R_p (R_{\oplus}) | T_{max} (K) | T_{obs} (K) | A_{obs} |
|---------|---------------|------------------------|----------------------|------------------------|----------------------------|
| DV | -115 ± 11 | $3.80^{+3.15}_{-2.47}$ | 4212^{+301}_{-626} | 7486^{+9283}_{-2107} | $7.959^{+57.593}_{-5.617}$ |
| Alt. | -66 ± 34 | $5.10^{+3.56}_{-3.04}$ | 4204^{+337}_{-582} | 5320^{+3315}_{-1551} | $2.349^{+11.830}_{-1.771}$ |

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

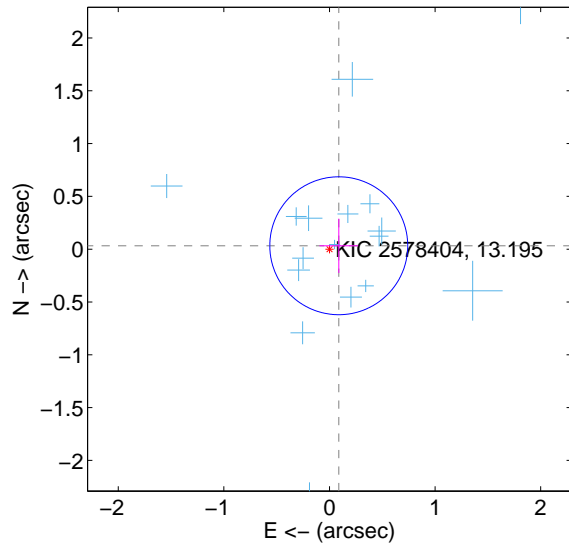
Supplemental centroid analysis for 002578404-01. Kepler magnitude: 13.20. Transit SNR 8.68

There are 17 quarters with good PRF difference image offsets

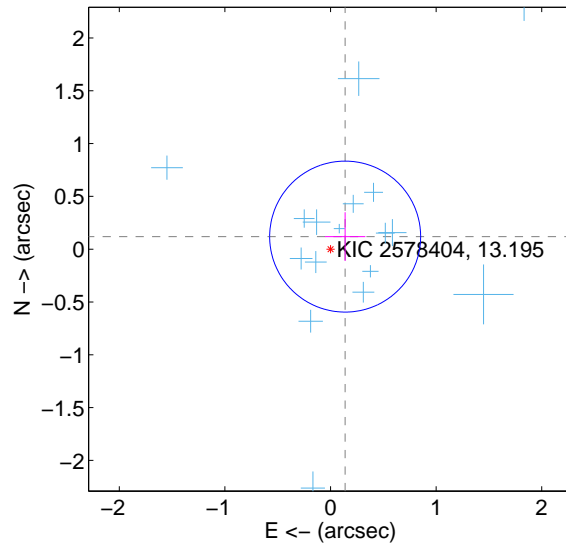
The direct PRF centroid is offset from the target star catalog position by about 0.15 arcsec

| | Distance in arcsec | Distance / σ | Δ RA | Δ Dec |
|---|--------------------|---------------------|--------------------|-------------------|
| PRF-fit source offset from OOT | 0.094 ± 0.218 | 0.43 | -0.088 ± 0.183 | 0.032 ± 0.257 |
| PRF-fit source offset from KIC position | 0.183 ± 0.238 | 0.77 | -0.139 ± 0.191 | 0.119 ± 0.230 |
| photometric centroid source offset | 0.89 ± 0.34 | 2.64 | 0.63 ± 0.34 | -0.63 ± 0.34 |

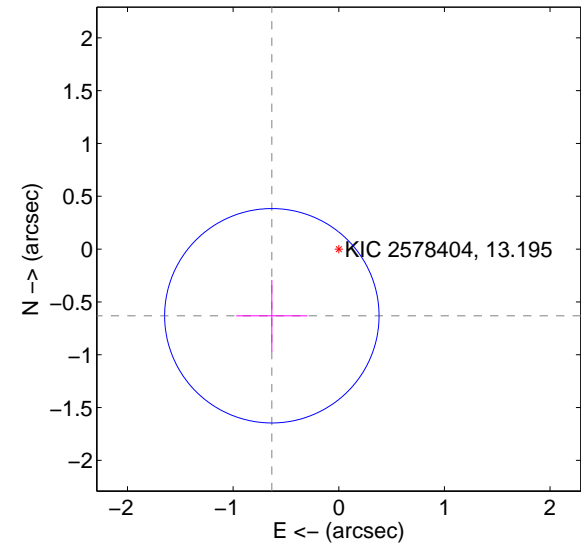
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

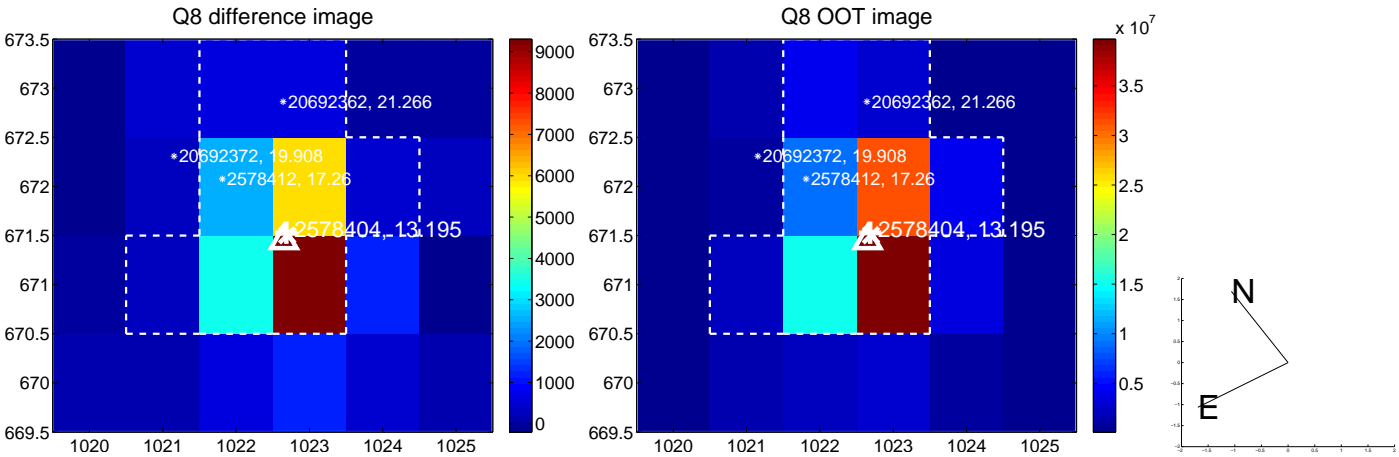
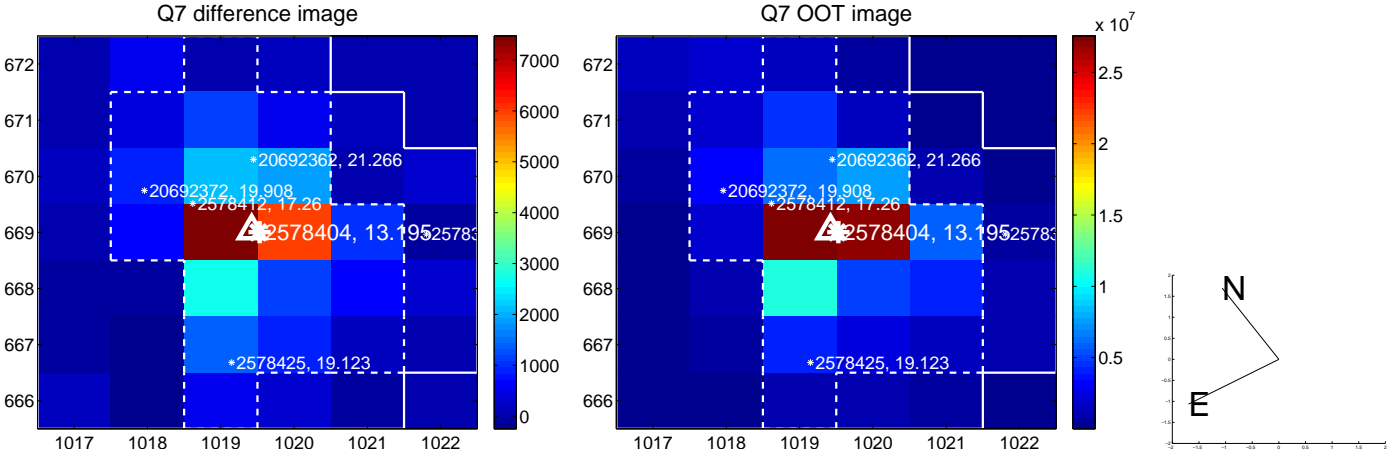
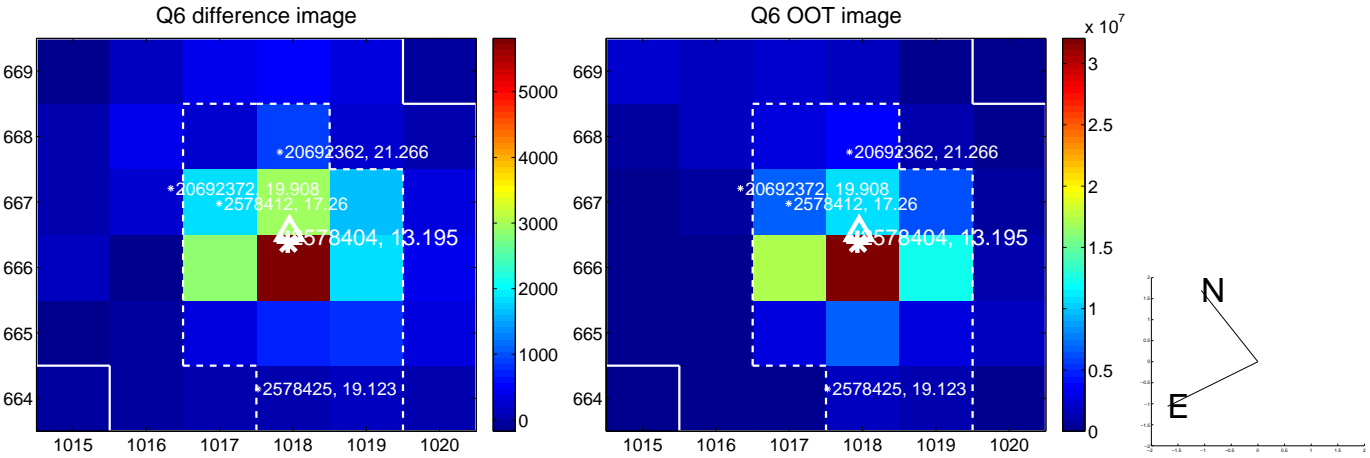
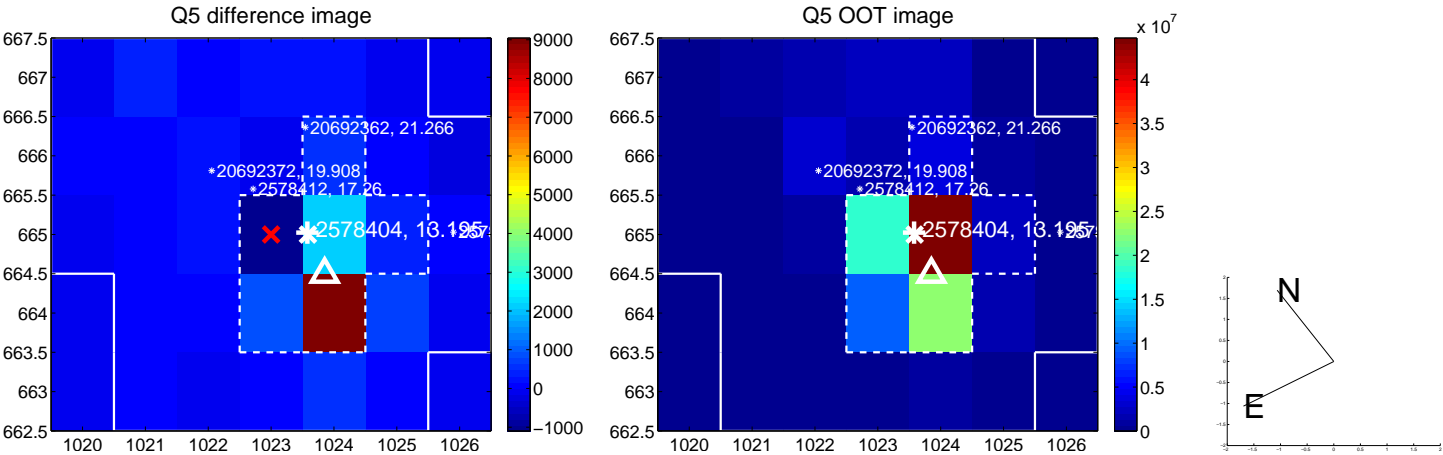


offset from photometric centroids

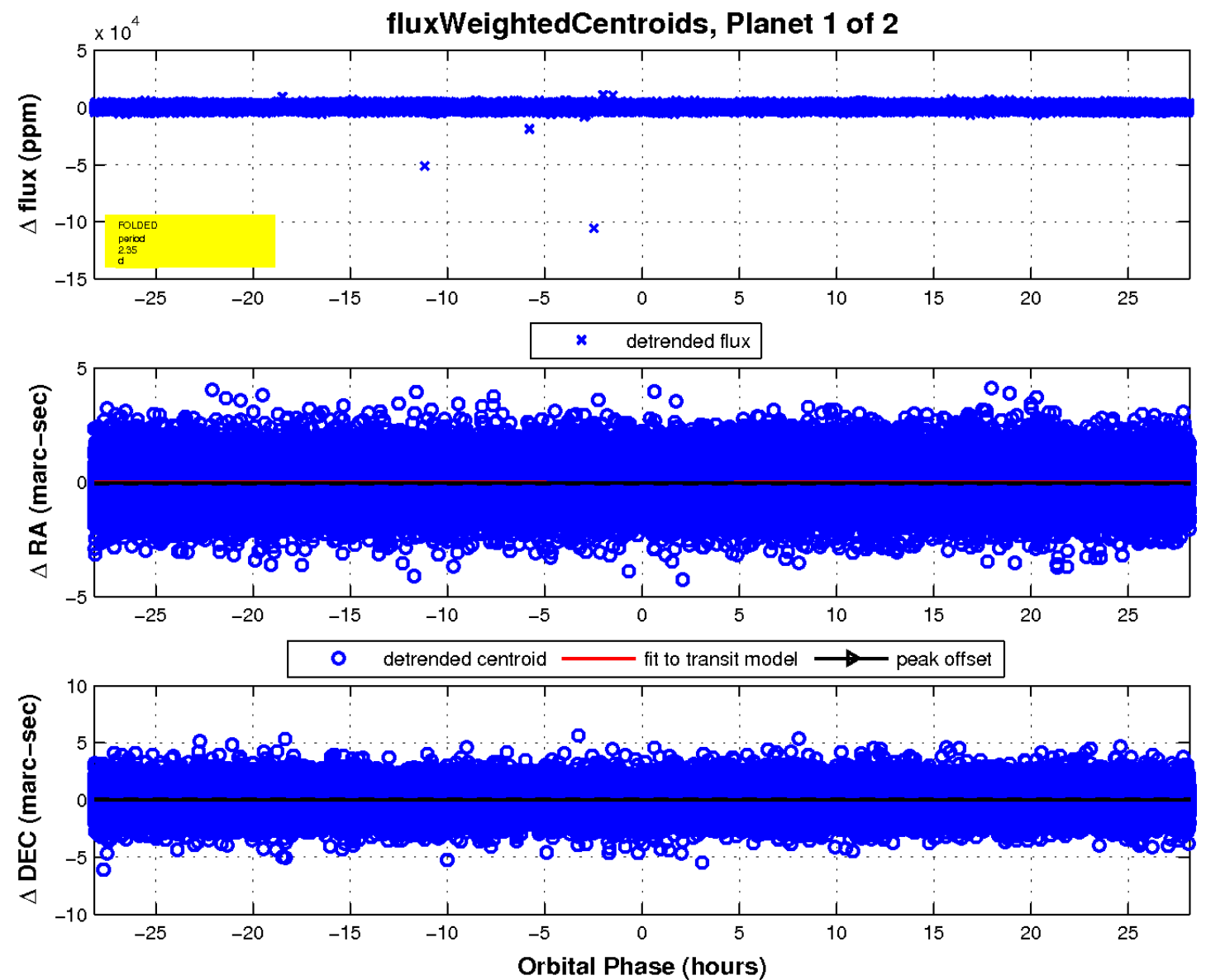
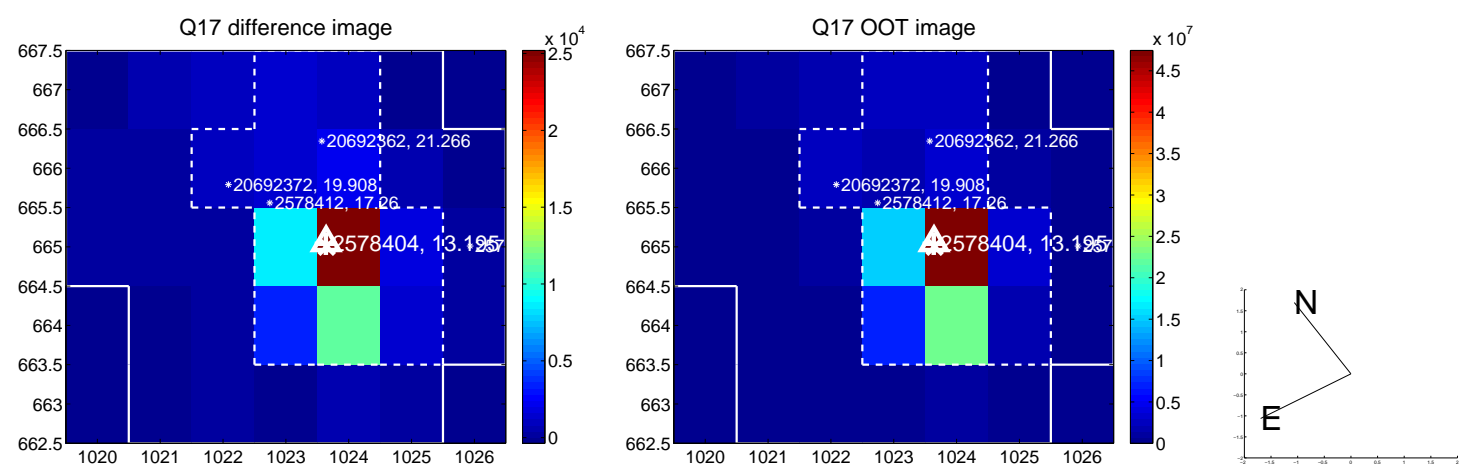


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- σ uncertainty. Blue circle: three-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

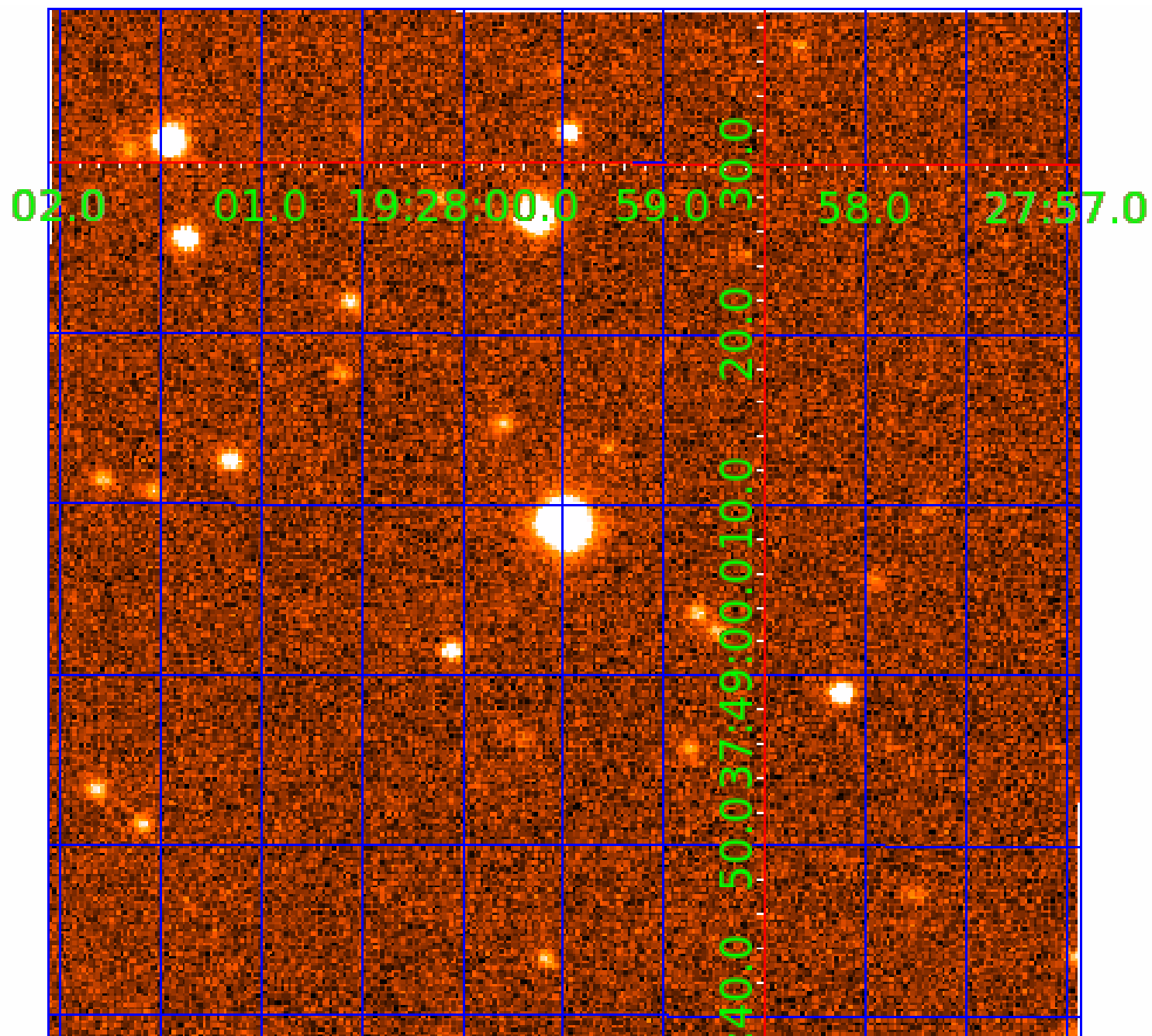


white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



UKIRT Image

Declination



KIC 002578404

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}) |
|--------------|----------|------|---------------|--------------|-------------|------------------|------|------|-----------------------------|-----------------|------------------------|------------------------|
| 002578404-01 | OBS | No | 2.346635 | 132.987903 | 85.5 | 9.904 | 7.9 | 8.7 | 3.91 | 7538 | 3.79 | 23332.50 |
| 002578404-02 | OBS | No | 0.872268 | 132.043130 | 226.8 | 6.350 | 14.7 | 20.2 | 3.91 | 7538 | 6.92 | 87301.62 |

Robovetter Results

| TCE | Run Type | Disp | Score | N | S | C | E | Comments |
|--------------|----------|------|-------|---|---|---|---|---|
| 002578404-01 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | LPP_DV |
| 002578404-02 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT |

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

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

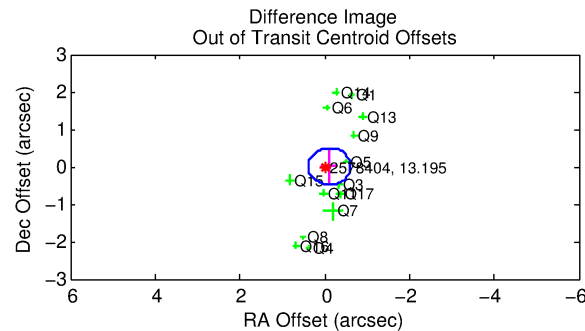
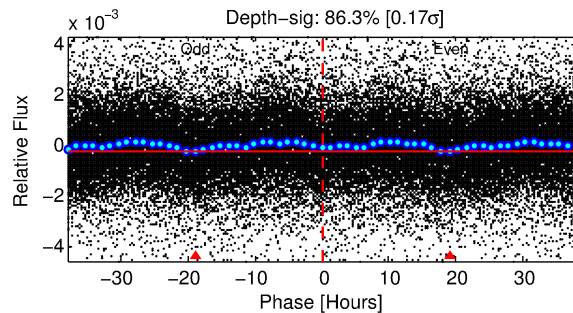
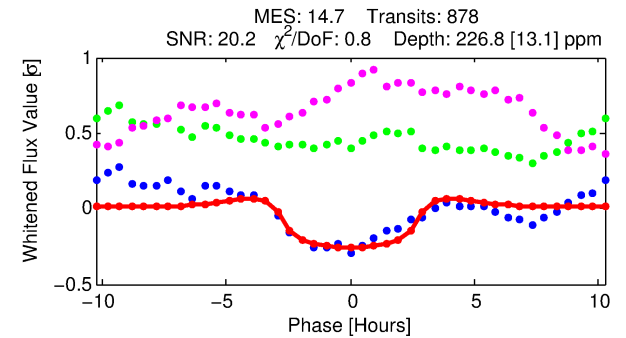
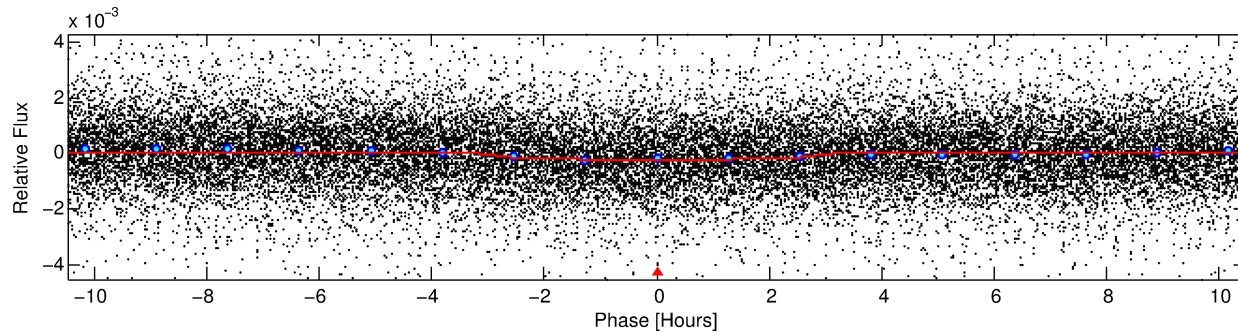
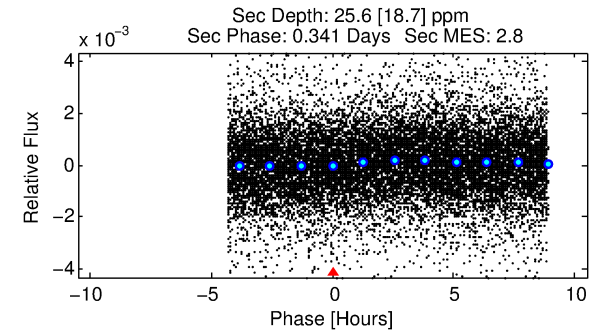
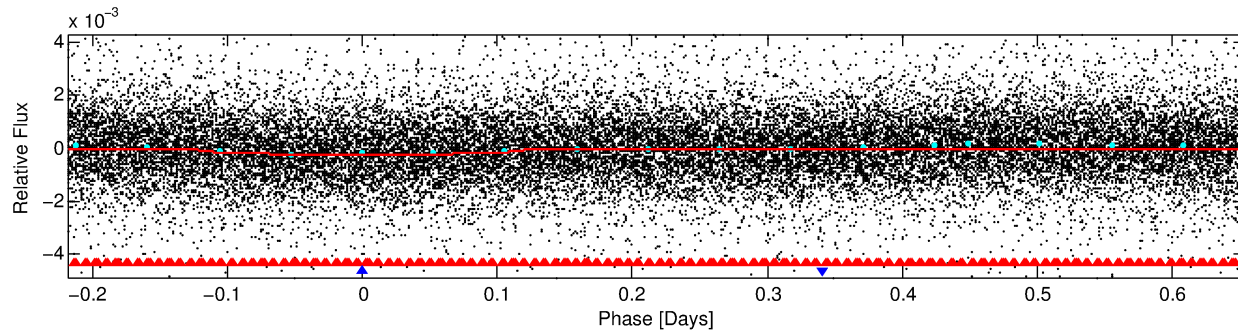
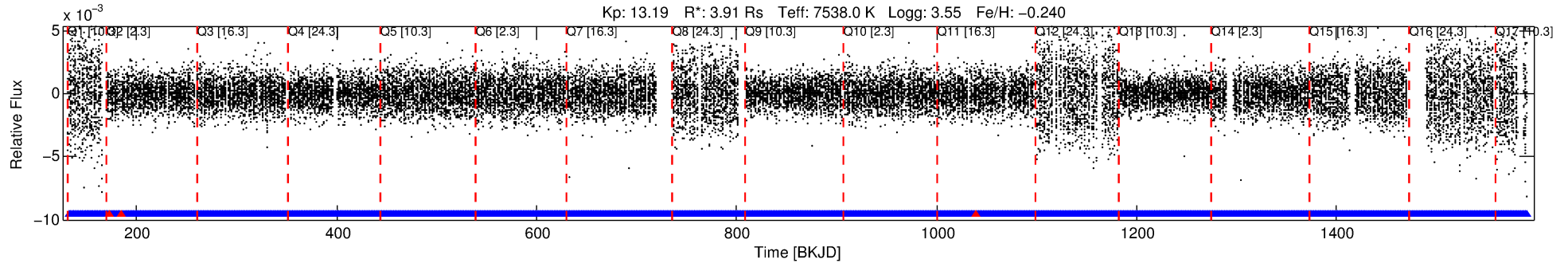
See http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col for comment definitions.

Ephemeris Match Information For 002578404-02

No Significant Match Found

DV One-Page Summary

KIC: 2578404 Candidate: 2 of 2 Period: 0.872 d



DV Fit Results:

Period = 0.87227 [0.00001] d
Epoch = 132.0431 [0.0037] BKJD
Rp/R* = 0.0162 [0.0017]
a/R* = 1.07 [0.07]
b = 0.90 [0.12]
Seff = 87301.62 [82204.49]
Teq = 4383 [1032] K
Rp = 6.92 [3.74] Re
a = 0.0225 [0.0125] AU
Ag = 0.15 [0.18] [-4.77σ]
Teffp = 4210 [818] K [-0.13σ]

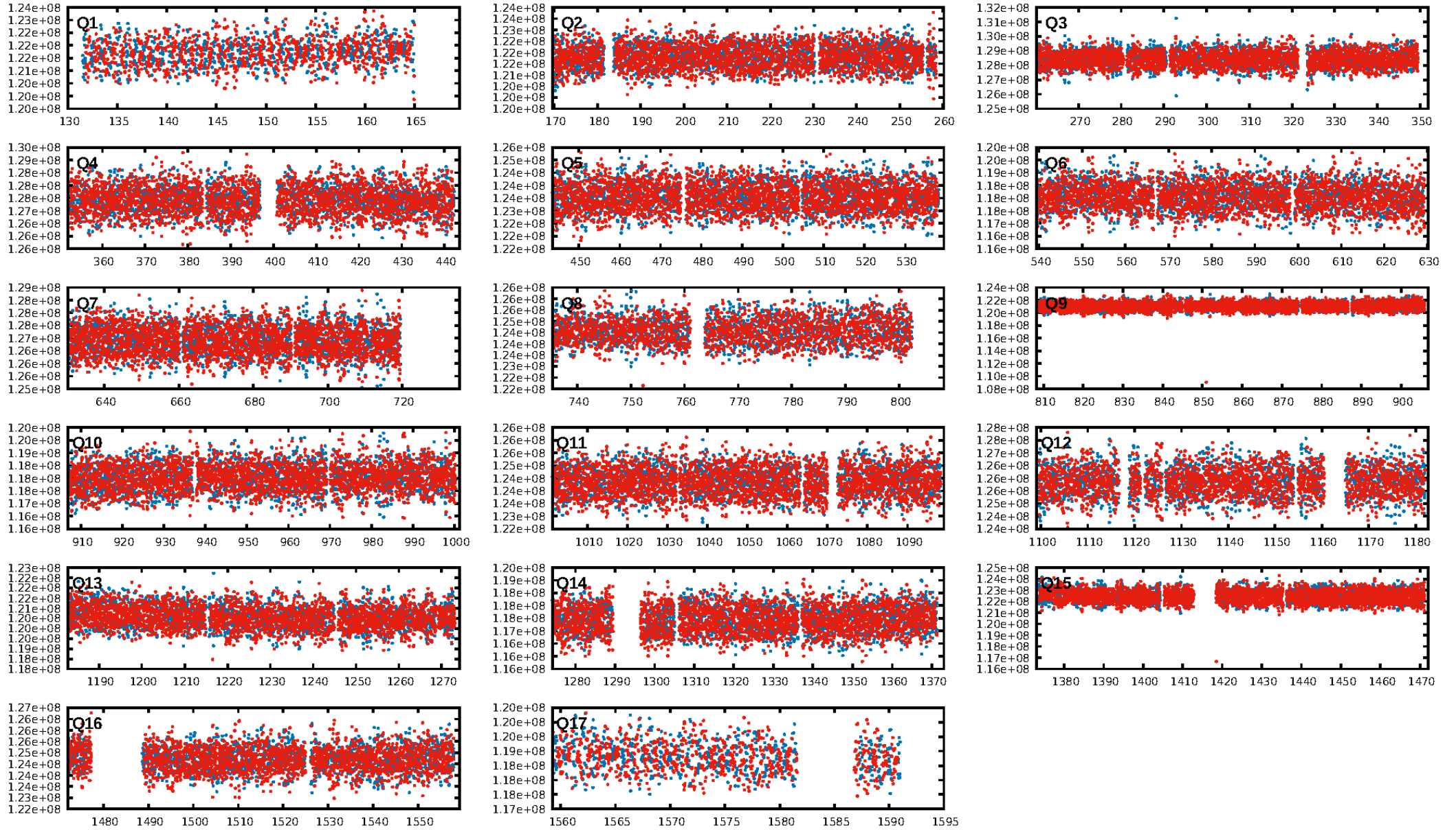
DV Diagnostic Results:

ShortPeriod-sig: N/A
LongPeriod-sig: 99.7% [3.01σ]
ModelChiSquare2-sig: N/A
ModelChiSquareGof-sig: N/A
Bootstrap-pfa: 5.16e-120
RollingBand-fgt: 1.00 [837/840]
GhostDiagnostic-chr: 1.531
Centroid-sig: 32.9%
Centroid-so: 0.254 arcsec [2.55σ]
OotOffset-rm: 0.108 arcsec [0.66σ]
KicOffset-rm: 0.171 arcsec [0.59σ]
OotOffset-st: 2/4/3/5 [14]
KicOffset-st: 2/4/3/5 [14]
DiffImageQuality-fgm: 1.00 [14/14]
DiffImageOverlap-fno: 1.00 [17/17]

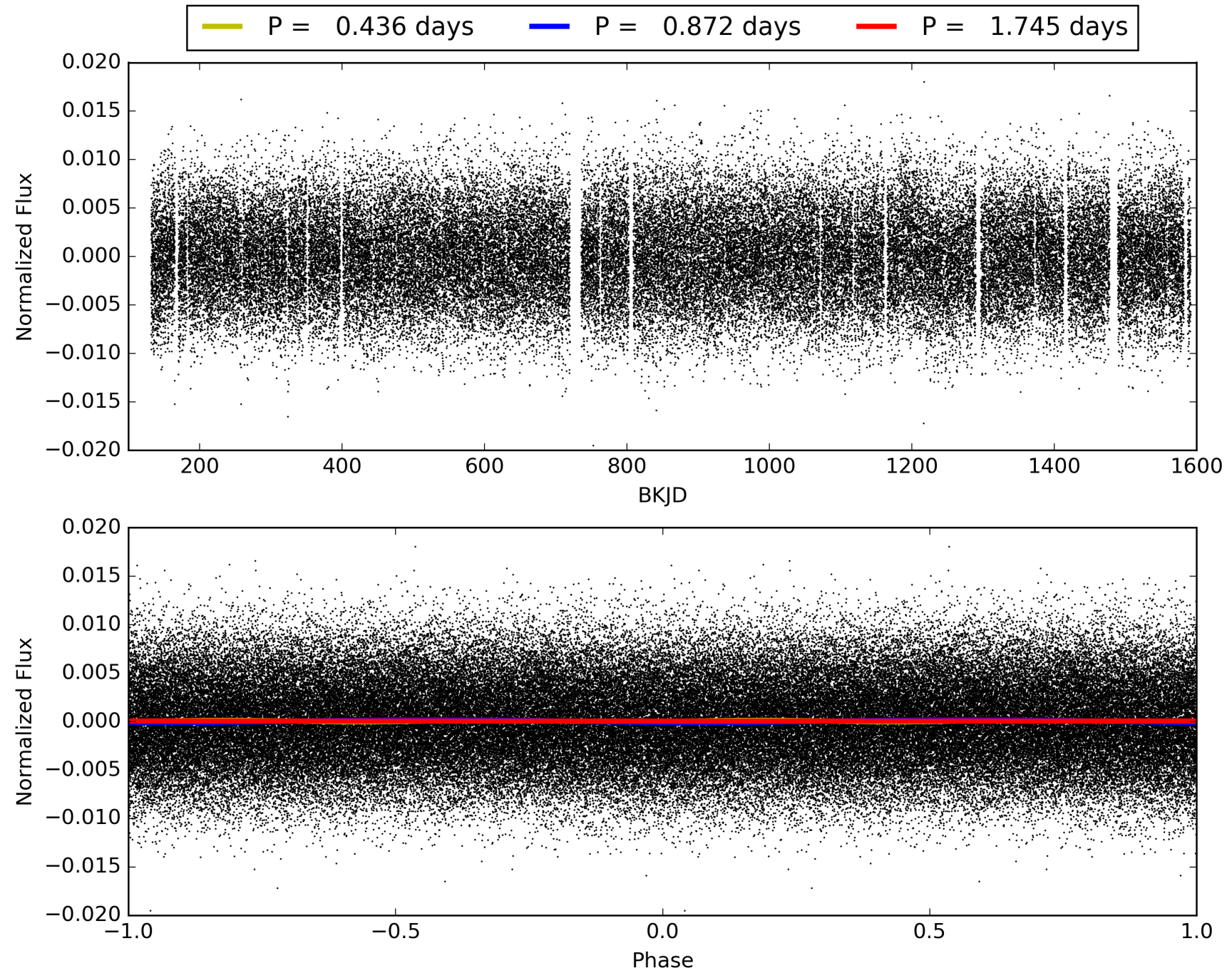
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 18:58:40 Z

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

TCE 002578404-02, PDC Light Curves

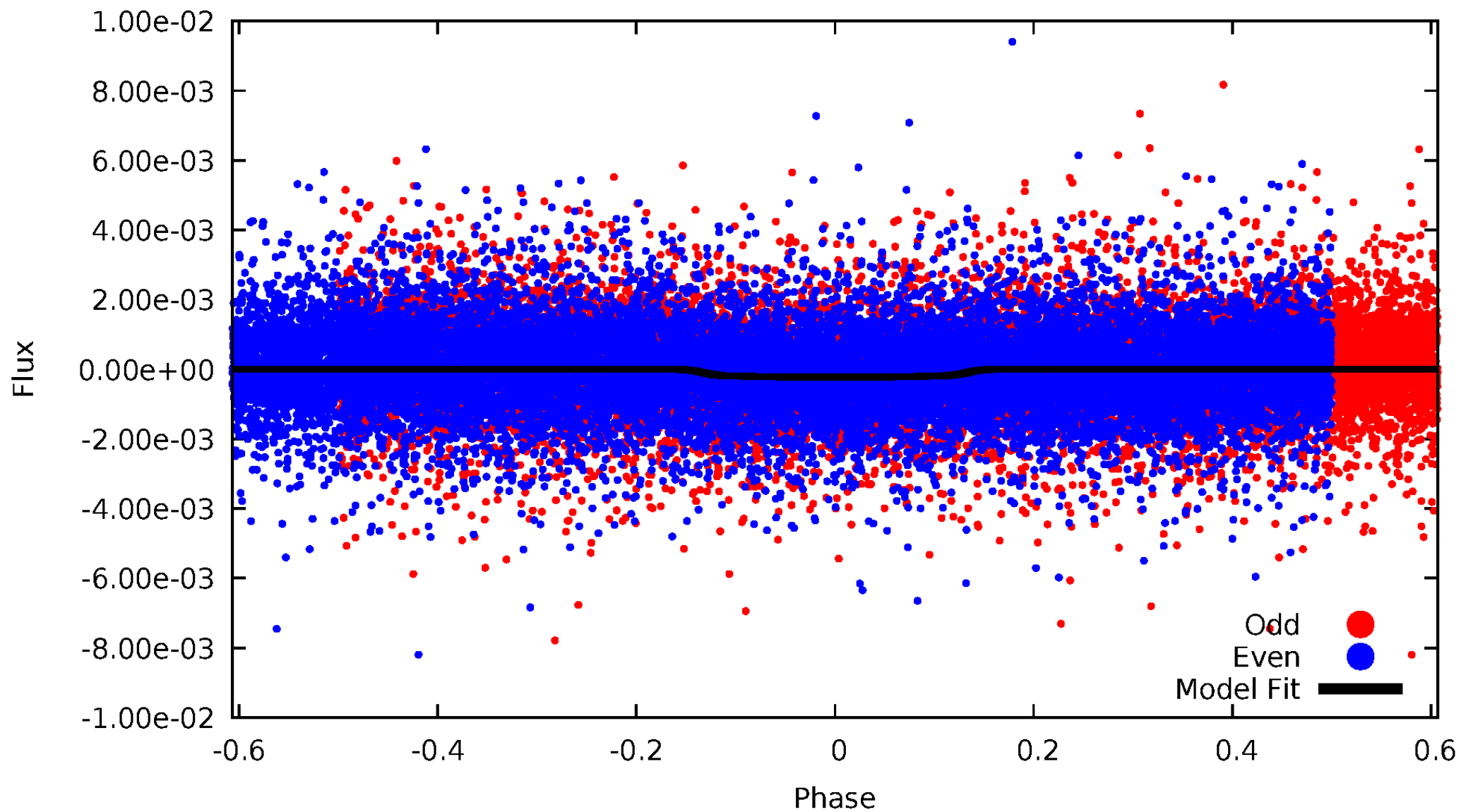


TCE 002578404-02



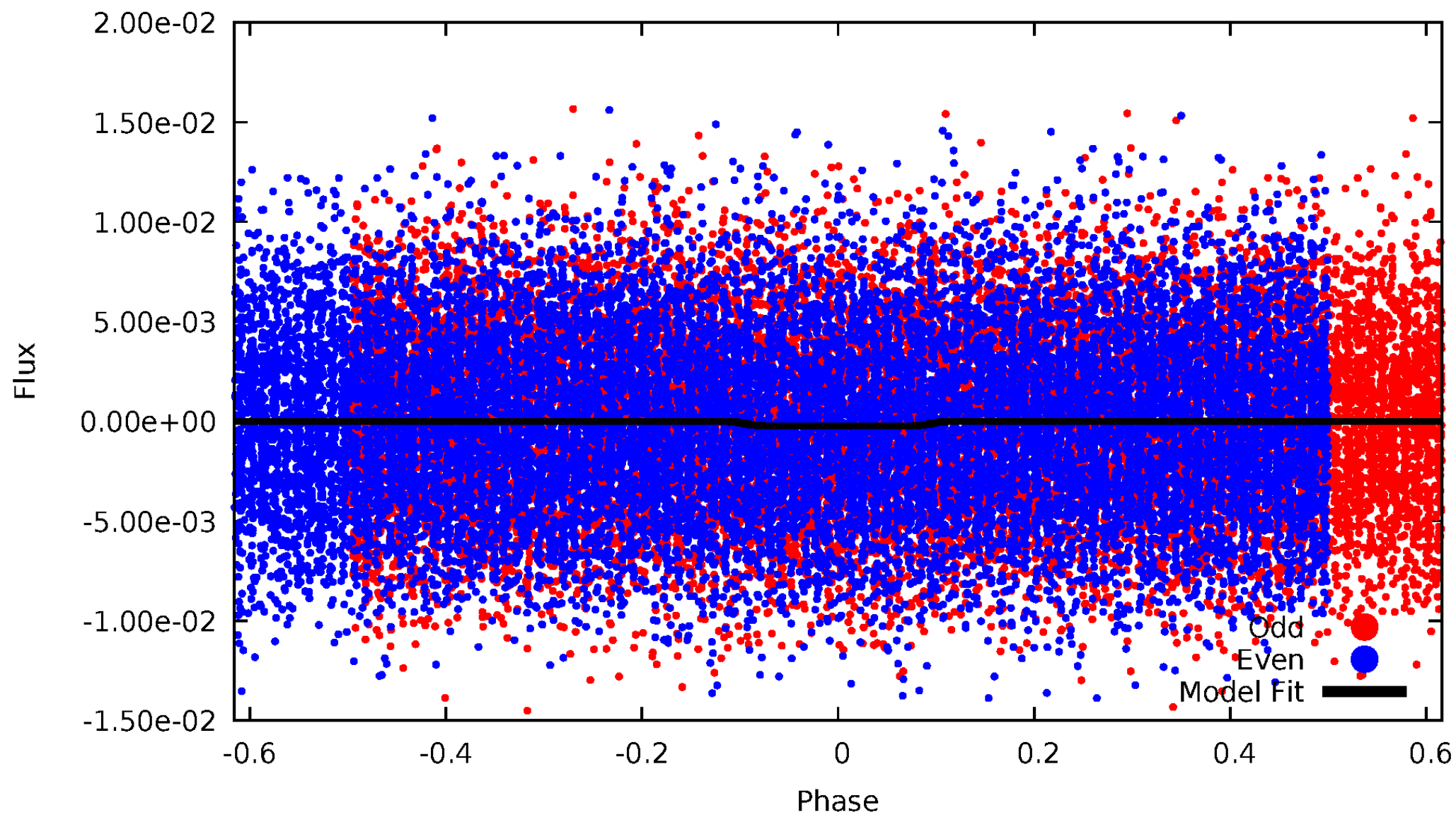
DV Odd/Even

TCE 002578404-02



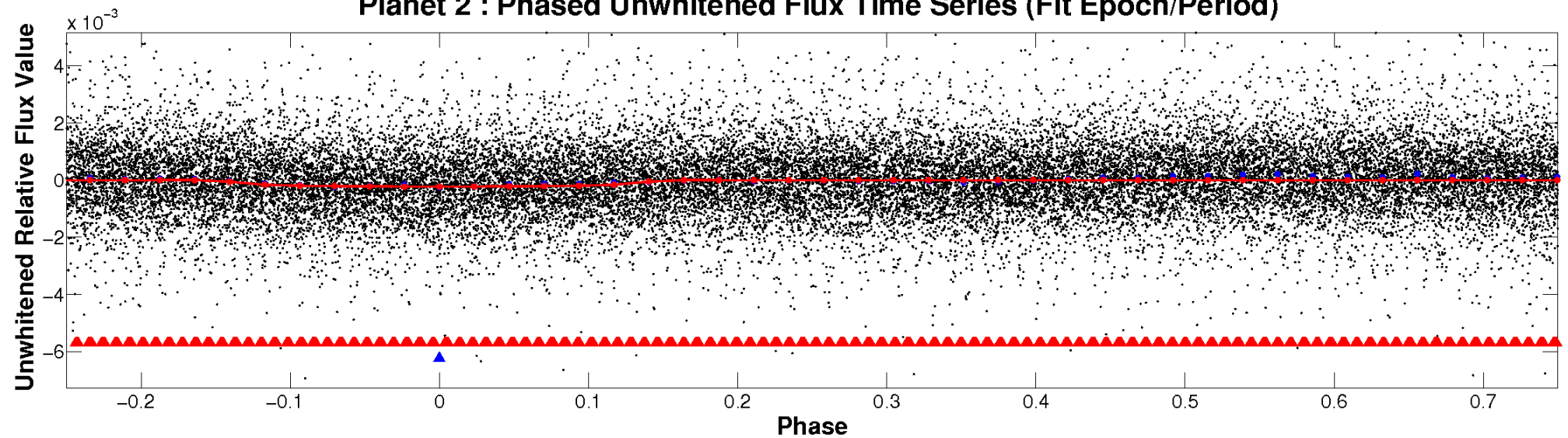
ALT Odd/Even

TCE 002578404-02

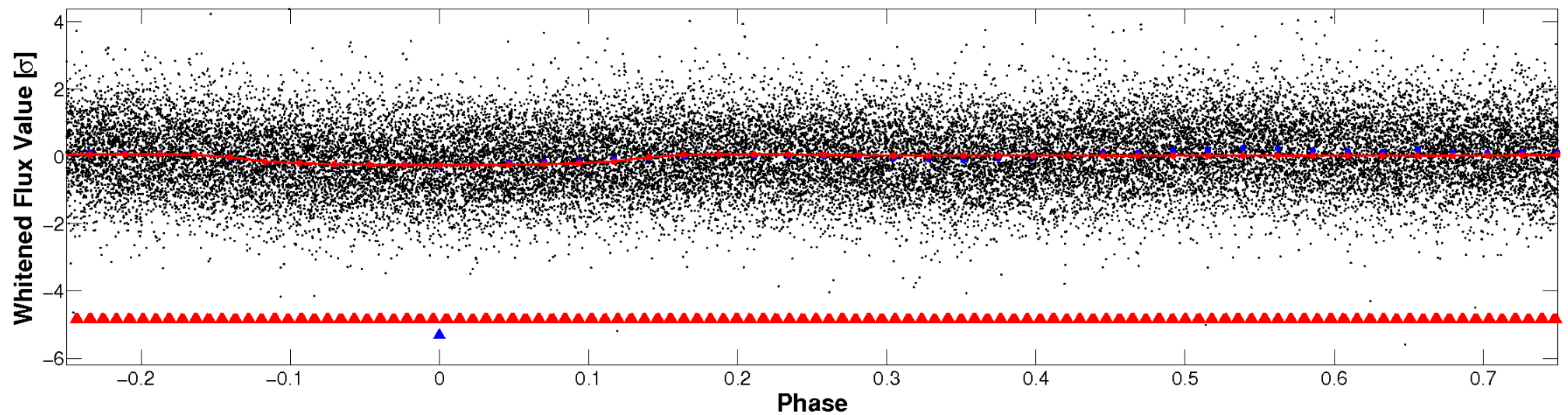


Non-Whitened Vs. Whitened Light Curve

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

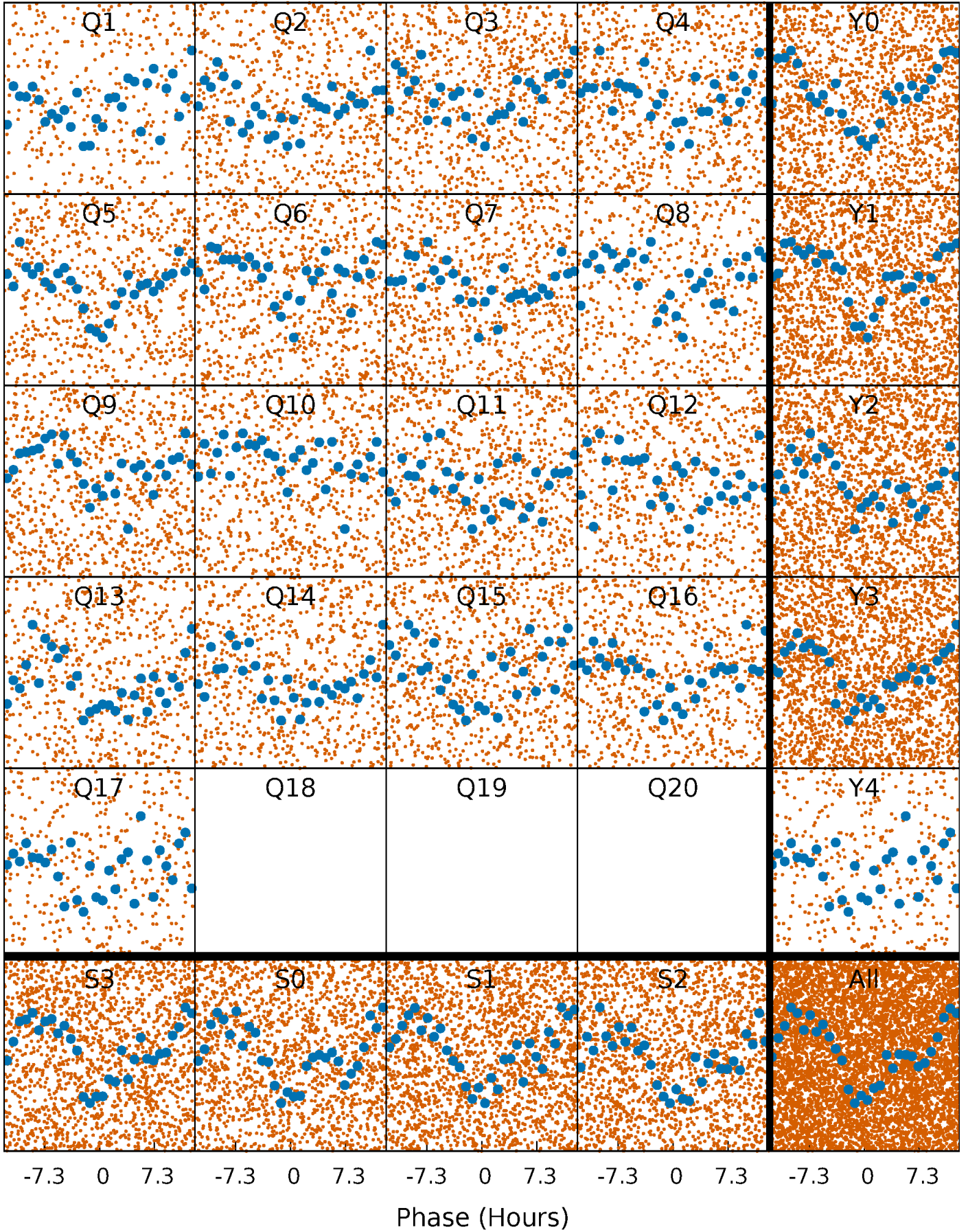


Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



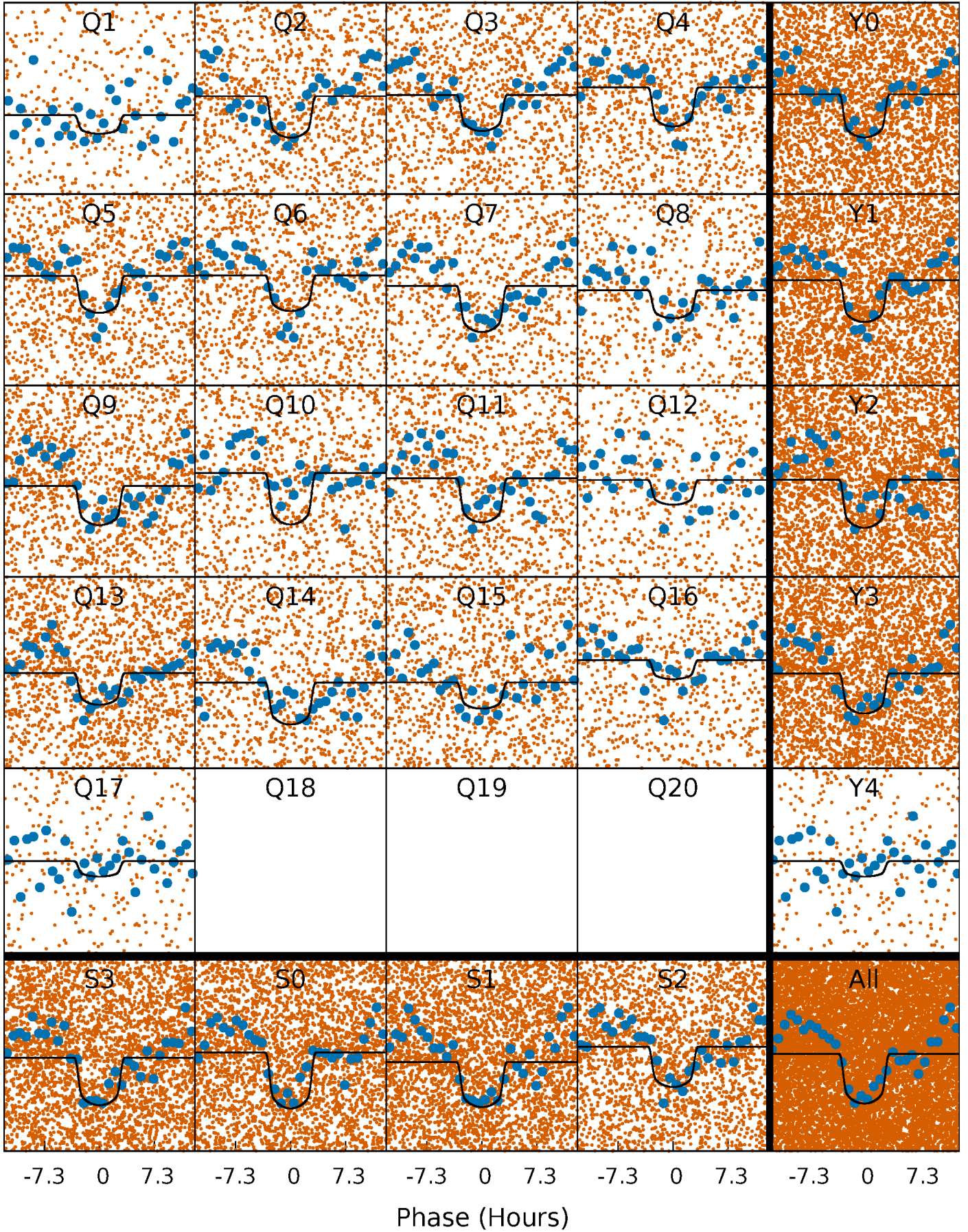
PDC Quarter-Phased Transit Curves

TCE 002578404-02 P= 0.872268 Days $T_0=132.043130$ (BKJD)



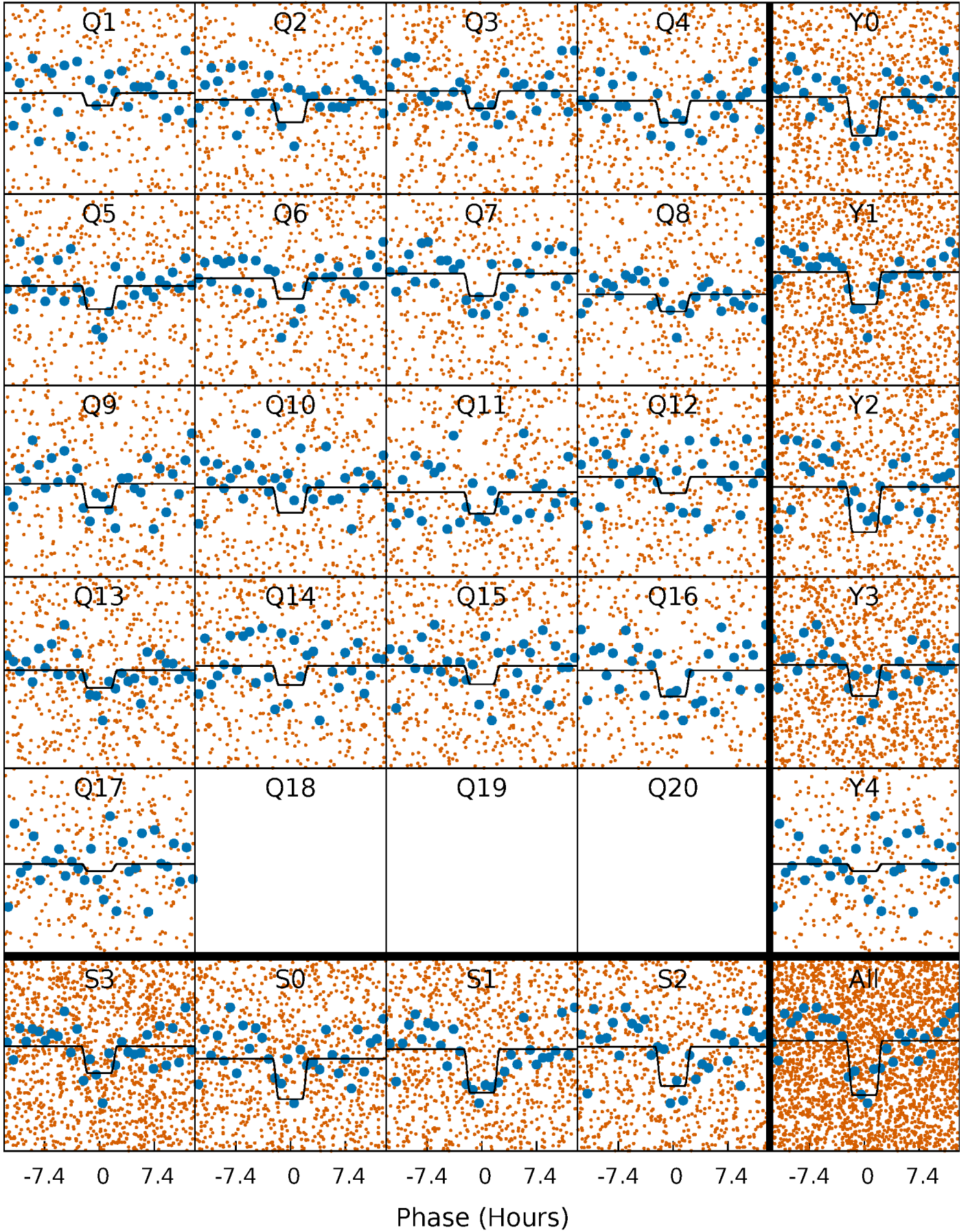
DV Quarter-Phased Transit Curves

TCE 002578404-02 $P = 0.872268$ Days $T_0 = 132.043130$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

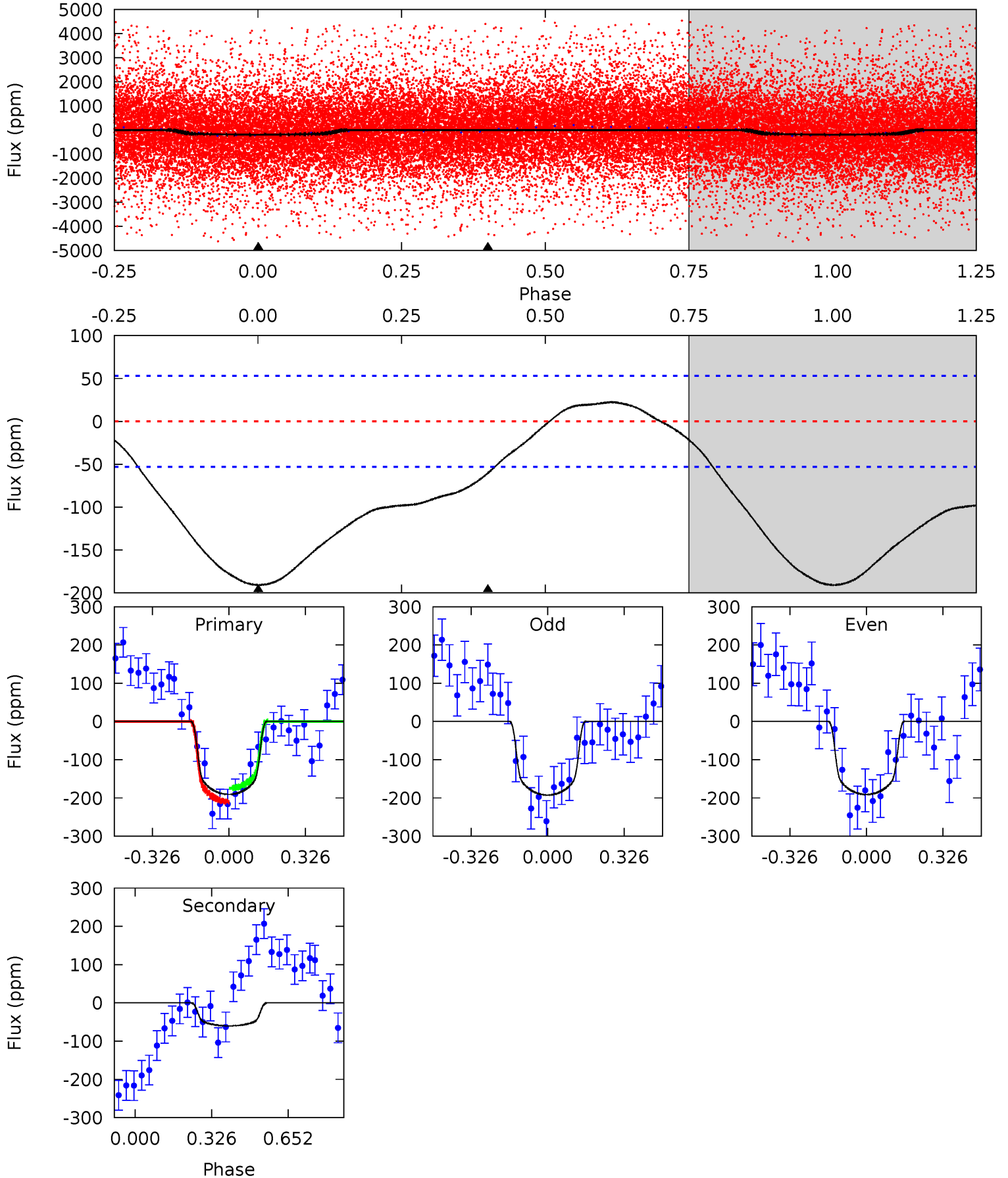
TCE 002578404-02 P= 0.872201 Days $T_0=132.067669$ (BKJD)



DV Model-Shift Uniqueness Test

002578404-02, P = 0.872268 Days, E = 131.170862 Days

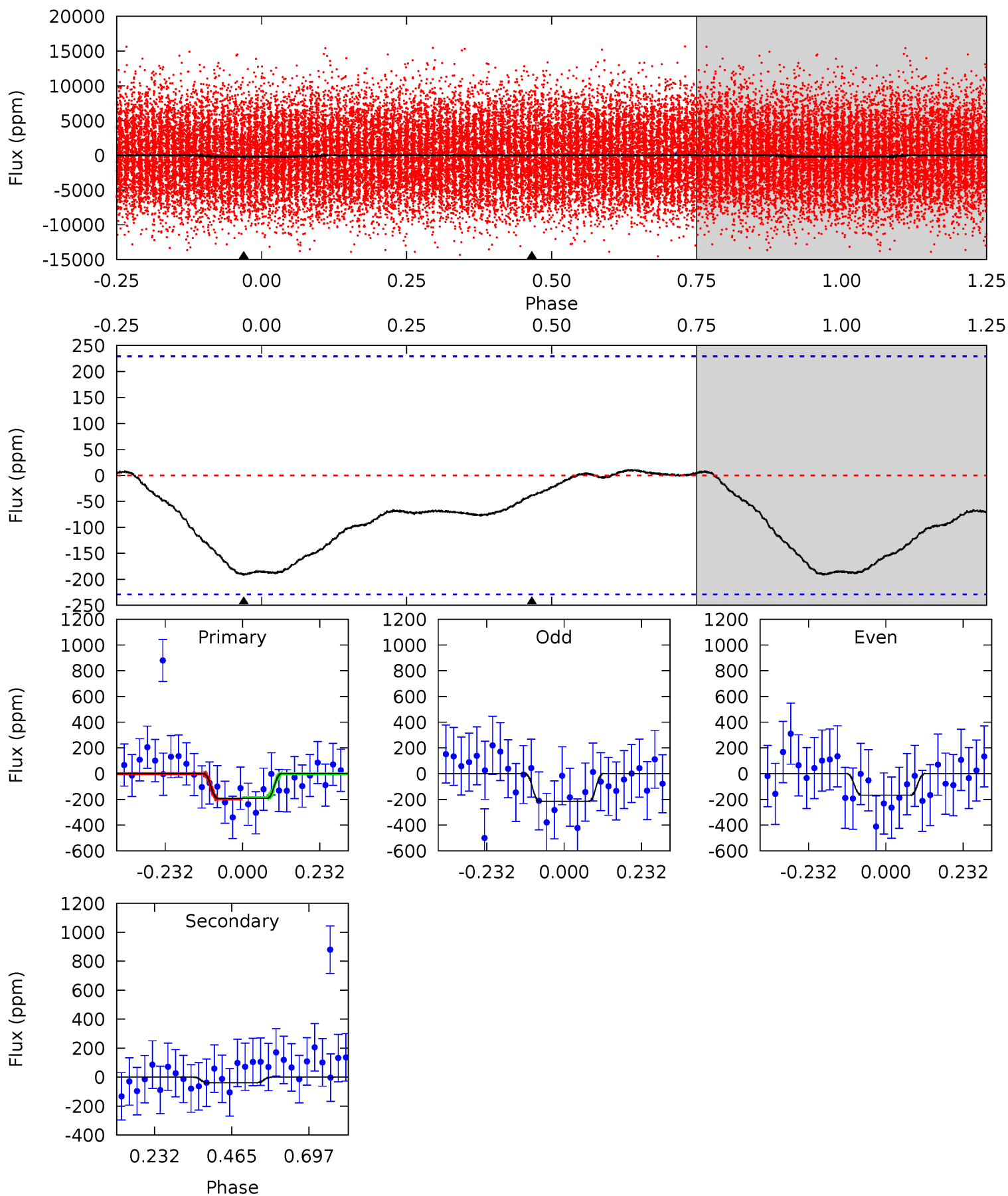
| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|-----|-----|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 15.5 | 4.89 | 0 | 0 | 4.31 | 0.98 | 0.94 | 15.5 | 15.5 | 4.89 | 4.89 | 0.06 | 0.94 | 0.10 | 1.44 |



Alt Model-Shift Uniqueness Test

002578404-02, P = 0.872201 Days, E = 131.195468 Days

| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|-----|-----|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 3.66 | 0.73 | 0 | 0 | 4.38 | 1.19 | 0.70 | 3.66 | 3.66 | 0.73 | 0.73 | 0.45 | 0.75 | 0.05 | 0.11 |



Stellar Parameters For KIC 002578404

| | $T_{\text{eff}}(K)$ | $\log(g)$ | [Fe/H] | R (R_{\odot}) | $M(M_{\odot})$ | p_{\star} ($\text{g}\cdot\text{cm}^{-3}$) |
|--------|----------------------|---------------------------|----------------------------|---------------------------|---------------------------|---|
| | 7538^{+235}_{-314} | $3.554^{+0.558}_{-0.062}$ | $-0.240^{+0.250}_{-0.300}$ | $3.908^{+0.389}_{-2.074}$ | $1.995^{+0.061}_{-0.545}$ | $0.047^{+0.331}_{-0.010}$ |
| | +3%/-4% | +16%/-2% | +104%/-125% | +10%/-53% | +3%/-27% | +703%/-21% |
| Source | KIC0 | 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 002578404-02 / KOI

| Detrend | Depth (ppm) | R_p (R_{\oplus}) | T_{max} (K) | T_{obs} (K) | A_{obs} |
|---------|--------------|------------------------|----------------------|------------------------|---------------------------|
| DV | -60 ± 12 | $6.28^{+1.16}_{-1.78}$ | 5875^{+432}_{-840} | 4057^{+807}_{-7067} | $0.423^{+0.388}_{-0.138}$ |
| Alt. | -38 ± 52 | $5.84^{+1.14}_{-1.70}$ | 5874^{+423}_{-835} | 2894^{+2467}_{-8008} | $0.315^{+0.550}_{-0.407}$ |

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

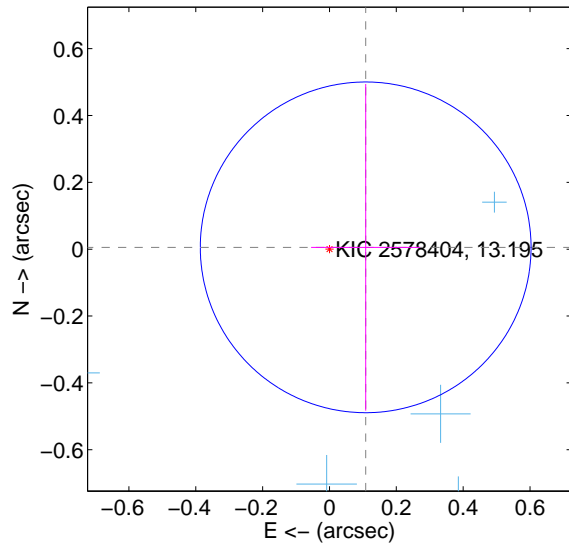
Supplemental centroid analysis for 002578404-02. Kepler magnitude: 13.20. Transit SNR 20.16

There are 14 quarters with good PRF difference image offsets

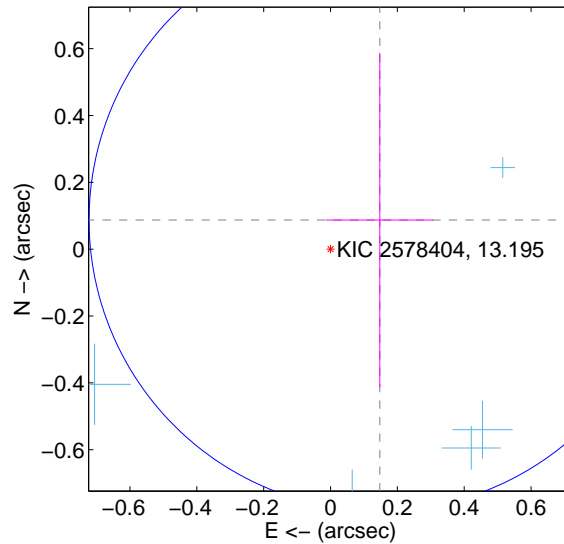
The direct PRF centroid is offset from the target star catalog position by about 0.15 arcsec

| | Distance in arcsec | Distance / σ | Δ RA | Δ Dec |
|---|--------------------|---------------------|--------------------|-------------------|
| PRF-fit source offset from OOT | 0.108 ± 0.165 | 0.66 | -0.108 ± 0.163 | 0.005 ± 0.489 |
| PRF-fit source offset from KIC position | 0.171 ± 0.290 | 0.59 | -0.147 ± 0.161 | 0.087 ± 0.500 |
| photometric centroid source offset | 0.25 ± 0.10 | 2.55 | -0.07 ± 0.10 | -0.24 ± 0.10 |

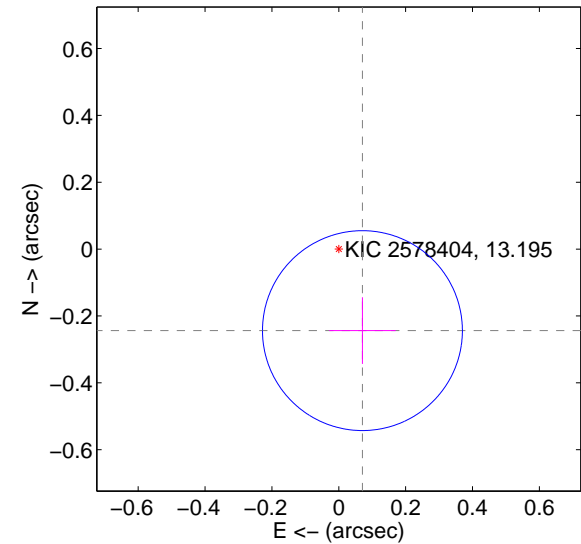
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

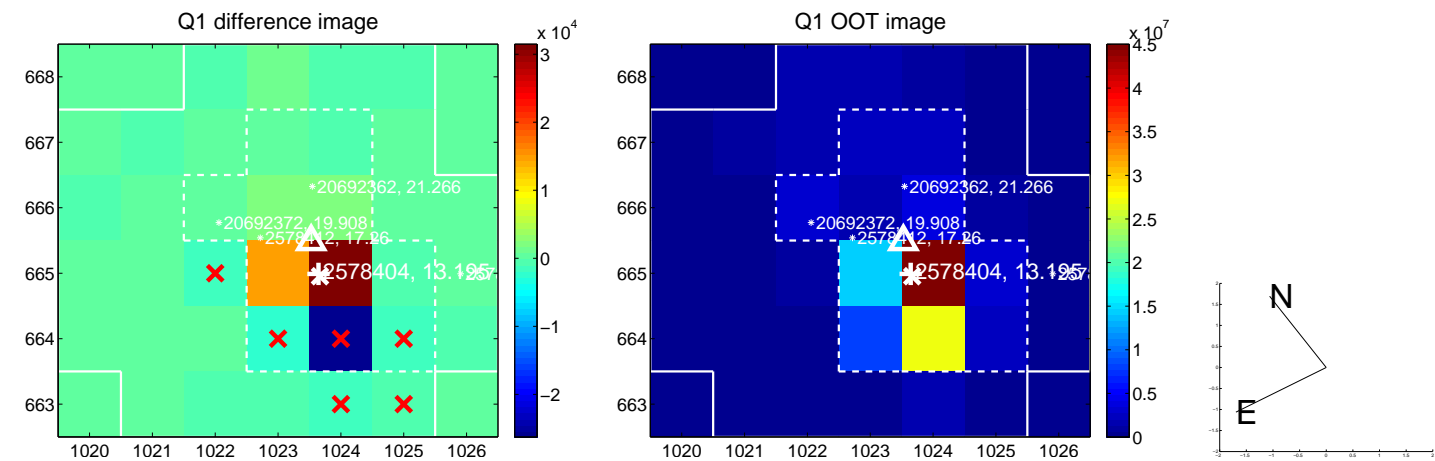


offset from photometric centroids

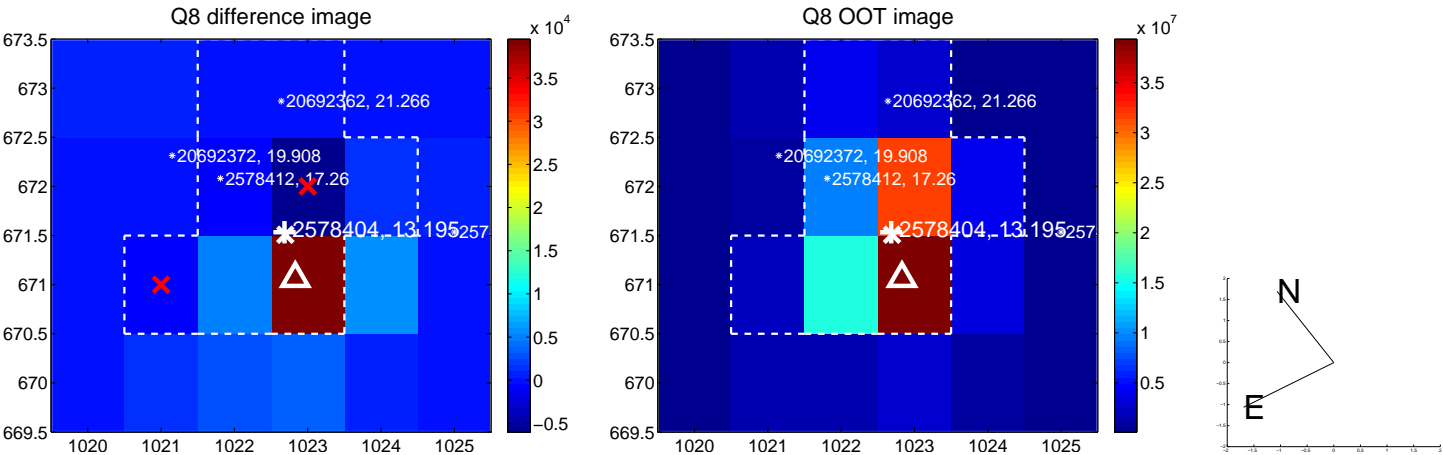
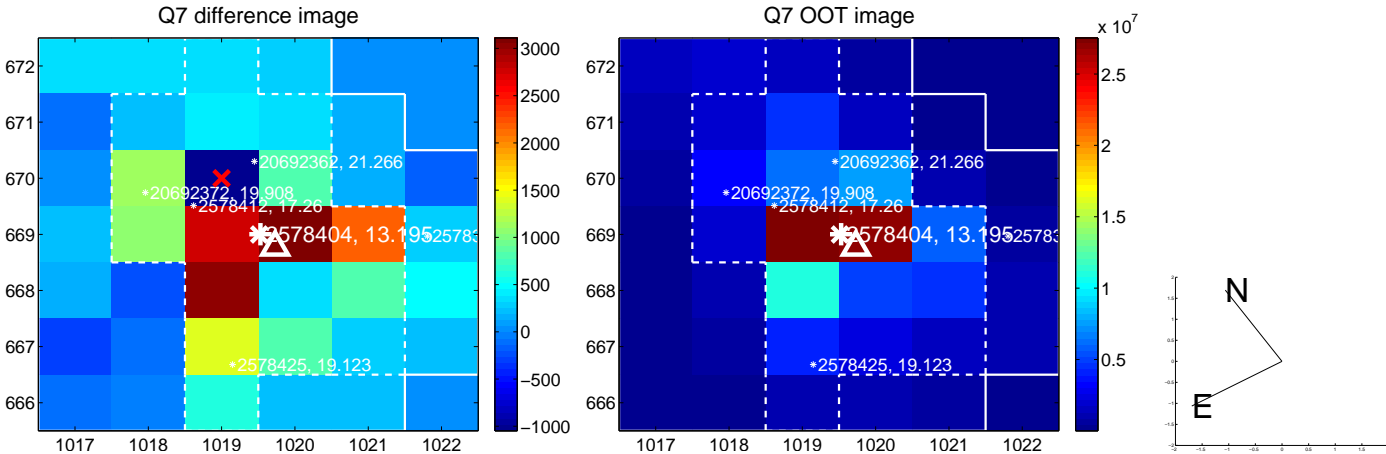
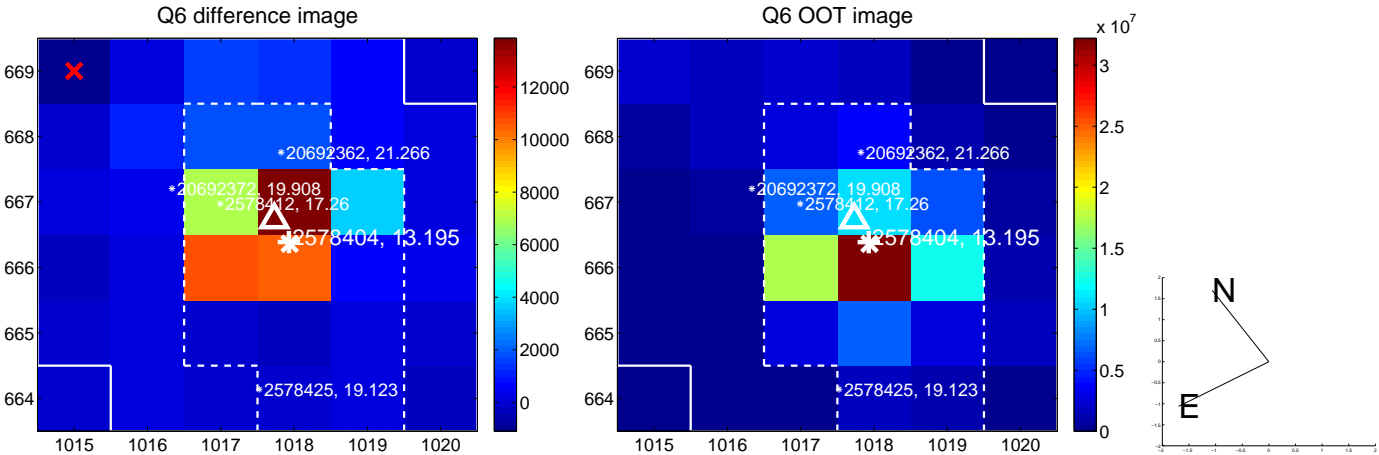
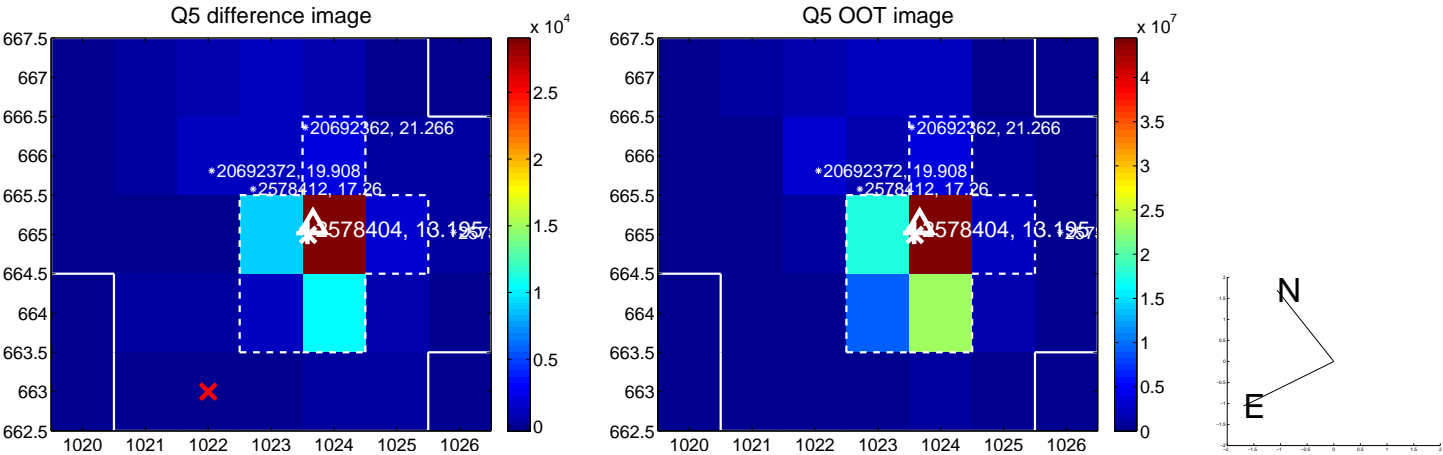


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- σ uncertainty. Blue circle: three-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

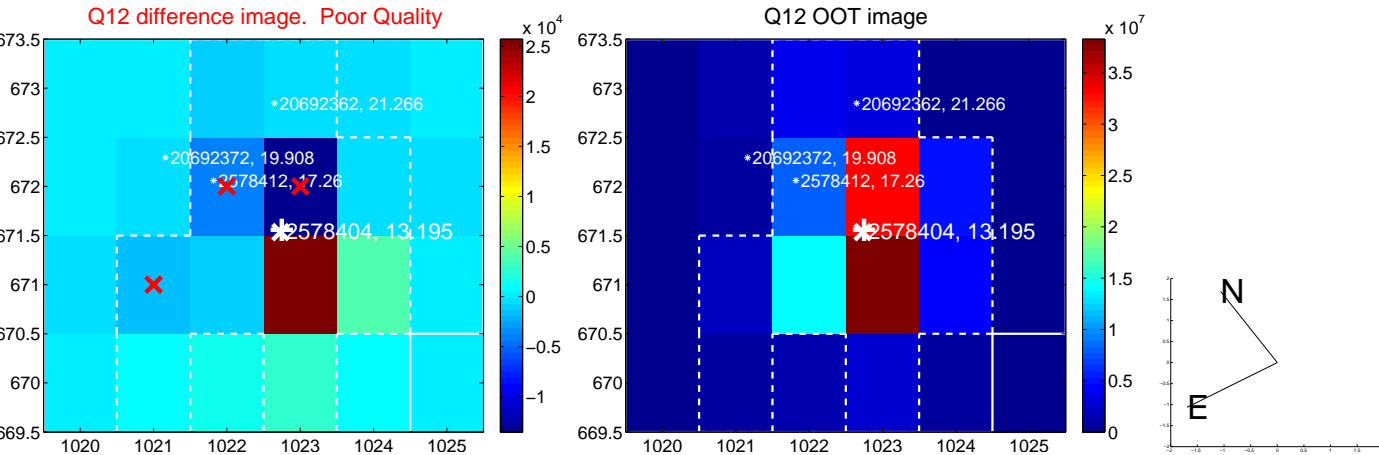
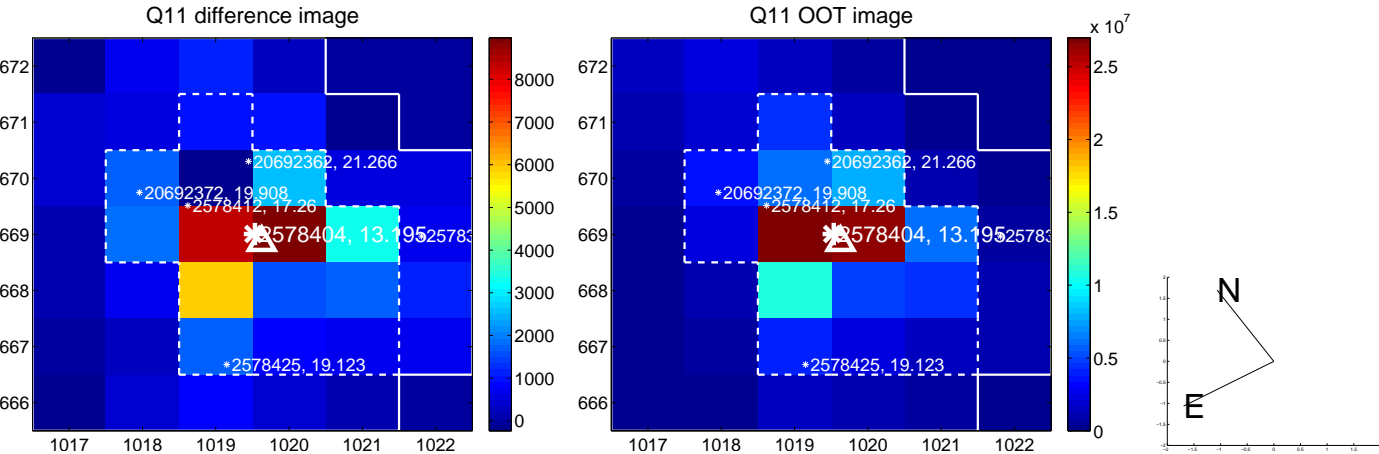
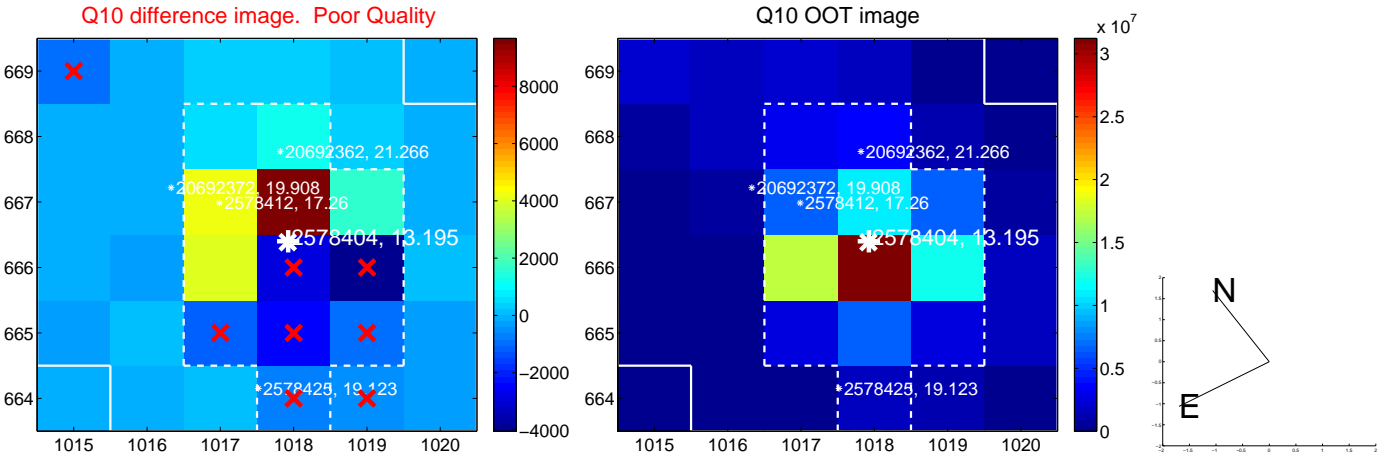
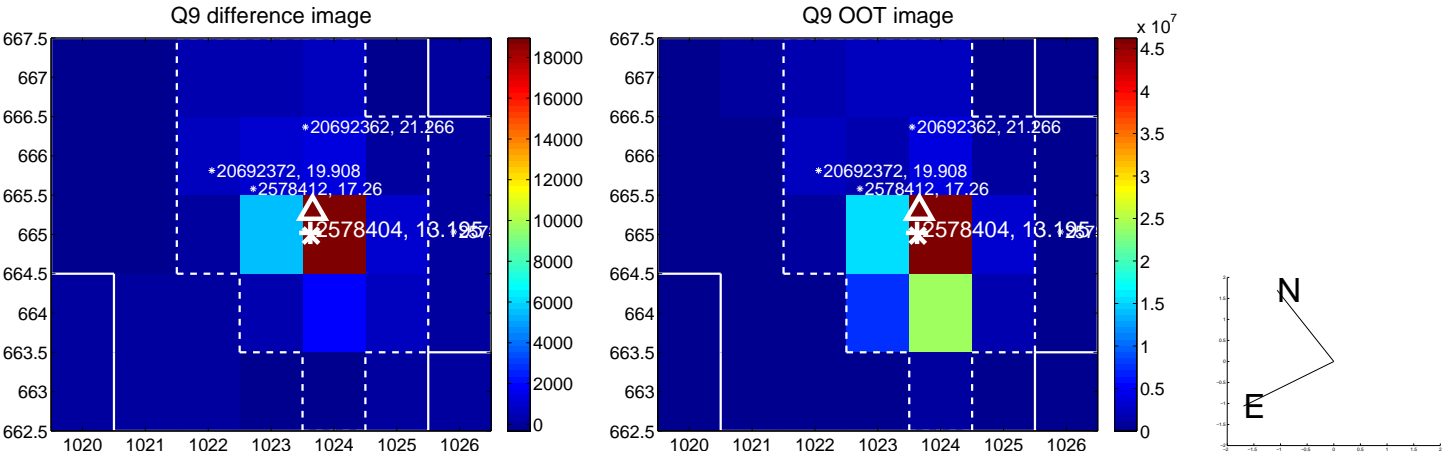
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



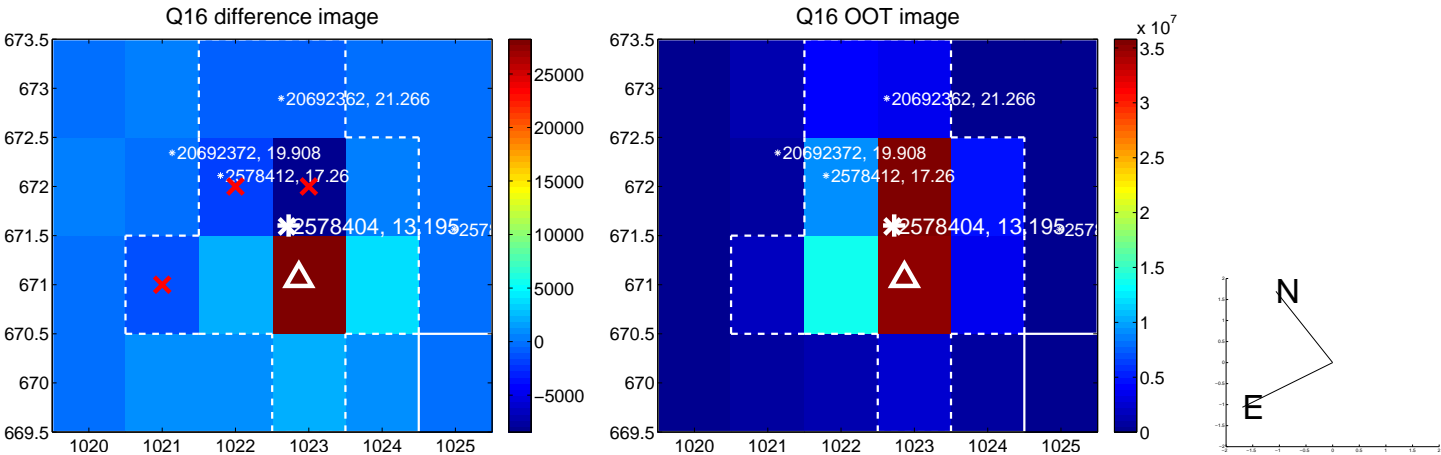
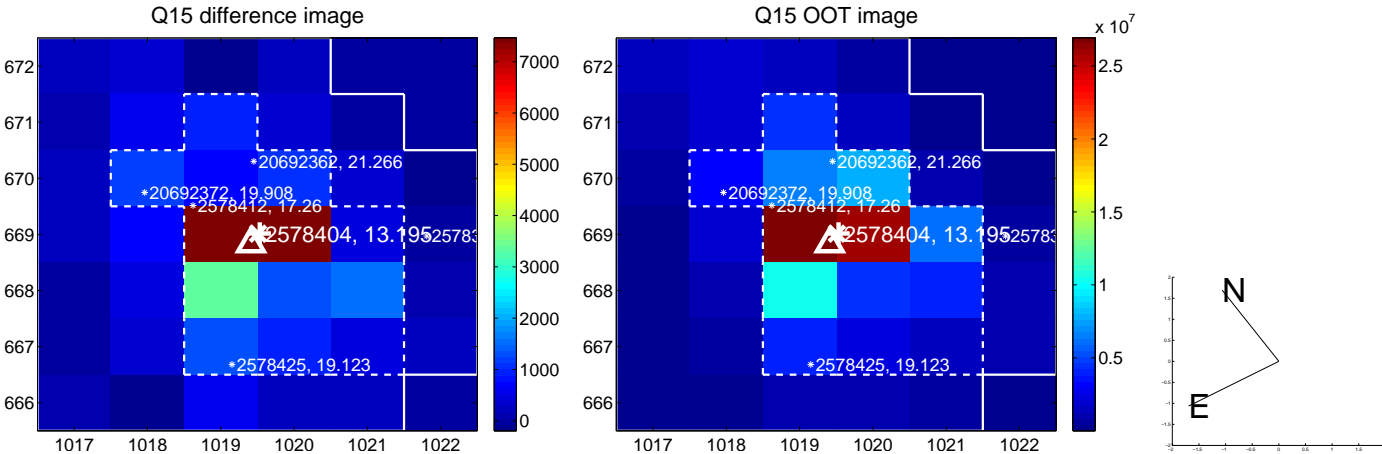
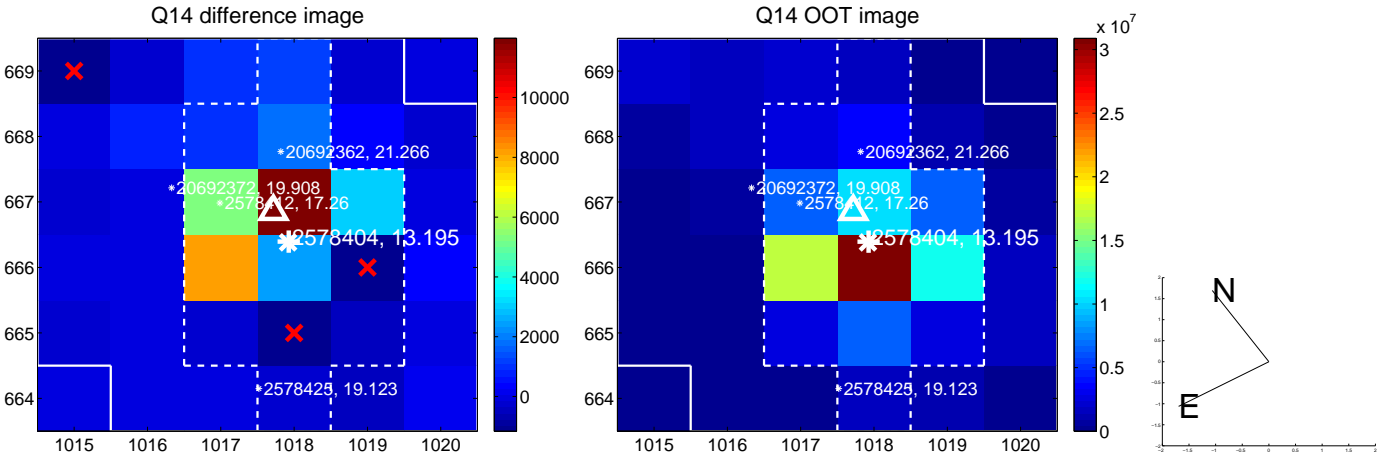
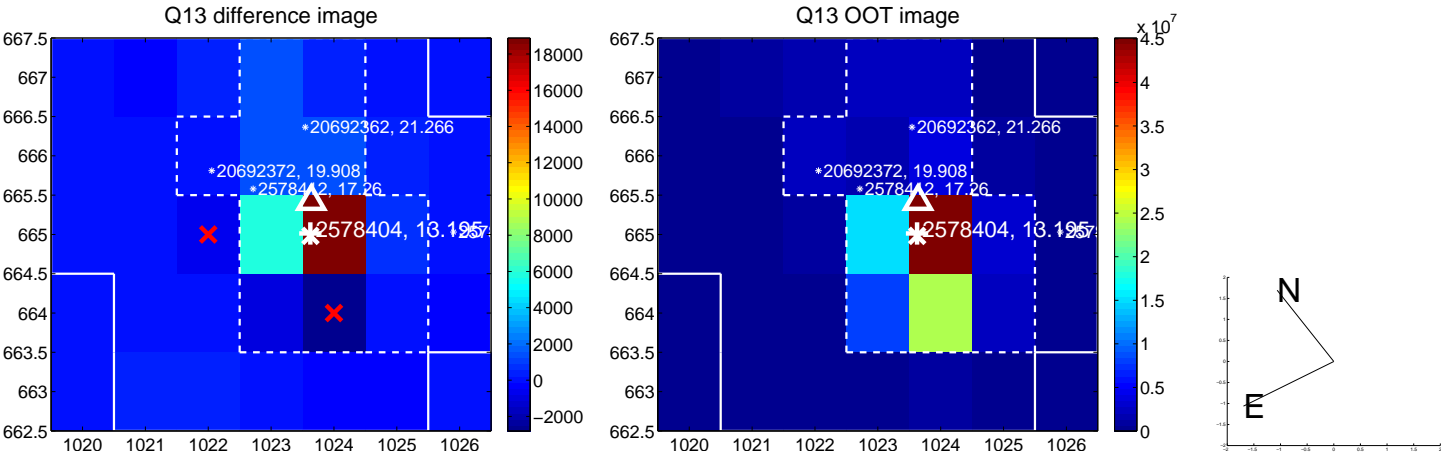
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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



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



UKIRT Image

Declination

