

KIC 004378554

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}) |
|--------------|----------|------|---------------|--------------|-------------|------------------|-------|------|-----------------------------|-----------------|------------------------|------------------------|
| 004378554-01 | OBS | No | 307.021050 | 339.851572 | 26902.9 | 15.000 | 312.9 | -1.0 | 0.87 | 5845 | 14.26 | 1.03 |
| 004378554-02 | OBS | No | 301.108177 | 342.265251 | 29745.4 | 52.605 | 213.2 | 68.2 | 0.87 | 5845 | 26.22 | 1.05 |
| 004378554-03 | OBS | No | 300.591290 | 358.173664 | 17280.1 | 15.000 | 146.6 | -1.0 | 0.87 | 5845 | 11.42 | 1.06 |
| 004378554-04 | OBS | No | 209.707241 | 298.587602 | 19840.7 | 84.939 | 124.8 | 86.5 | 0.87 | 5845 | 21.66 | 1.71 |

Robovetter Results

| TCE | Run Type | Disp | Score | N | S | C | E | Comments |
|--------------|----------|------|-------|---|---|---|---|--|
| 004378554-01 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | INDIV_TRANS_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS |
| 004378554-02 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS |
| 004378554-03 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS |
| 004378554-04 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | INDIV_TRANS_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS |

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

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

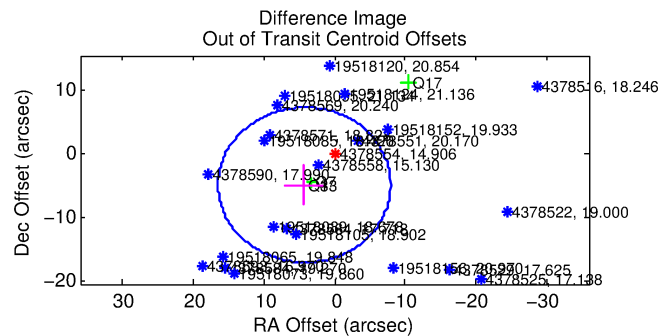
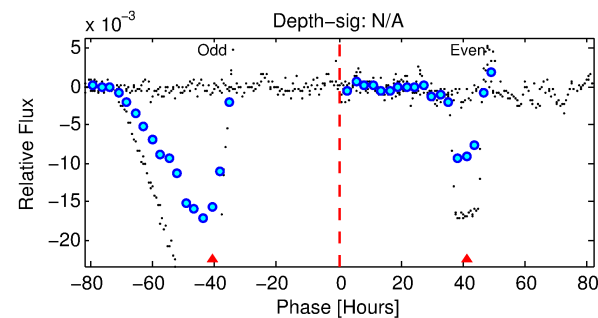
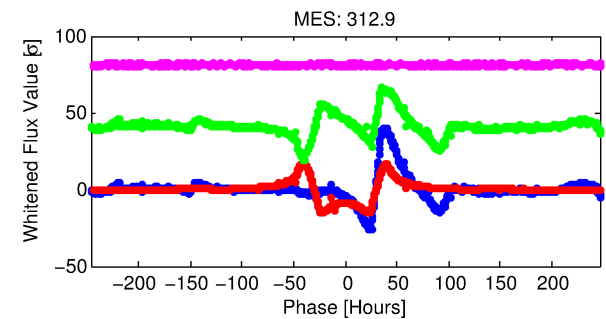
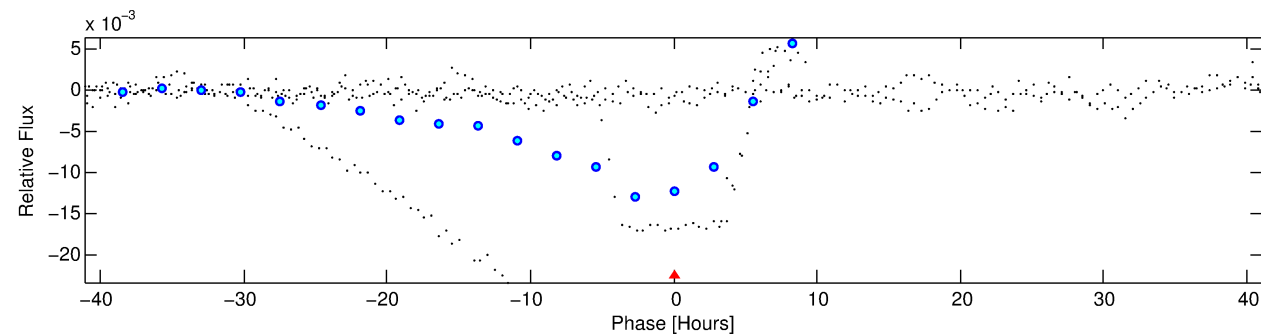
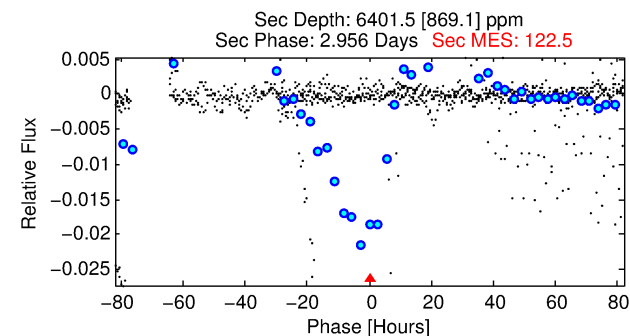
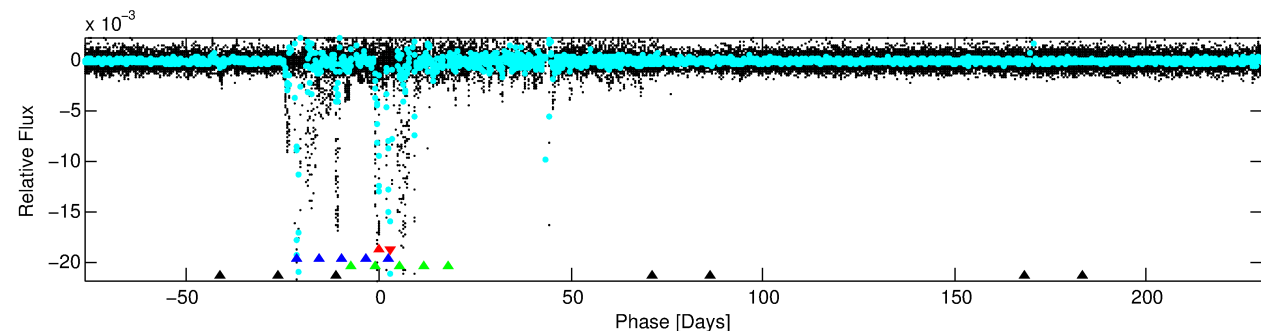
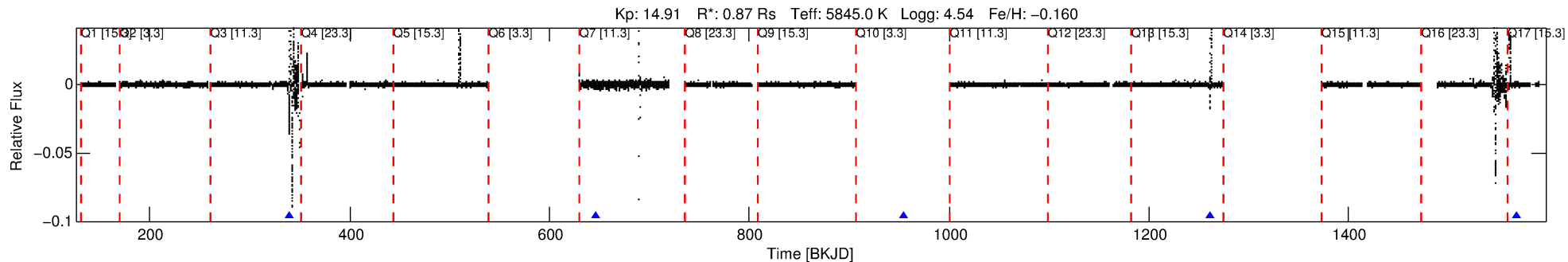
See http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col for comment definitions.

Ephemeris Match Information For 004378554-01

No Significant Match Found

DV One-Page Summary

KIC: 4378554 Candidate: 1 of 4 Period: 307.021 d



TPS TCE Results:

Period = 307.02105 d
Epoch = 339.8516 BKJD

DV fit results are unavailable

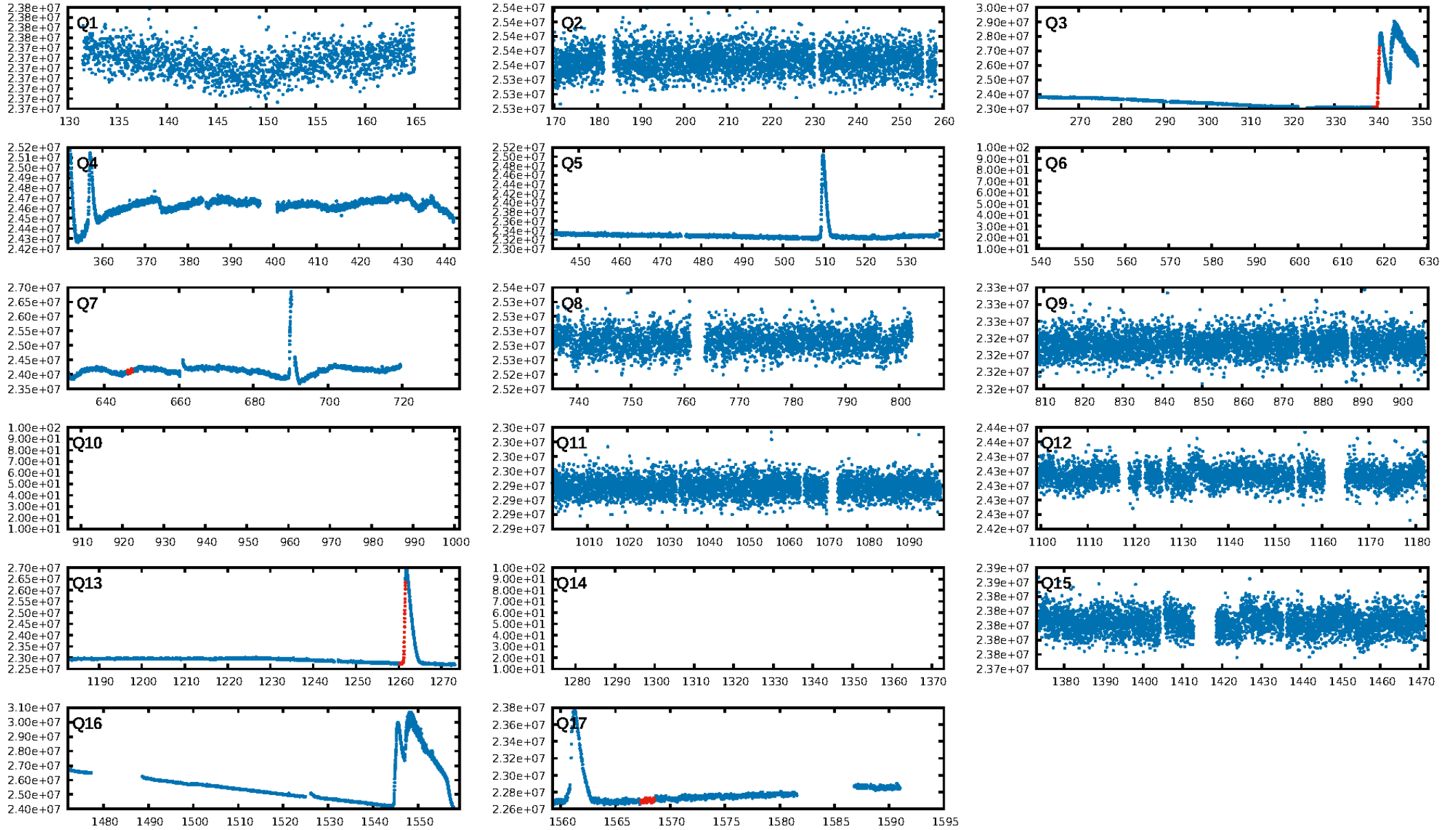
DV Diagnostic Results:

ShortPeriod-sig: 99.1% [2.59σ]
LongPeriod-sig: N/A
ModelChiSquare2-sig: N/A
ModelChiSquareGof-sig: N/A
Bootstrap-pfa: 2.43e-102
RollingBand-fgt: 1.00 [3/3]
GhostDiagnostic-chr: 0.3824
Centroid-sig: 73.8%
Centroid-so: 0.221 arcsec [0.75σ]
OotOffset-rm: 6.478 arcsec [1.59σ]
KicOffset-rm: 6.639 arcsec [2.47σ]
OotOffset-st: 0/2/0/2 [4]
KicOffset-st: 0/2/0/2 [4]
DiffImageQuality-fgm: 0.50 [2/4]
DiffImageOverlap-fno: 0.75 [3/4]

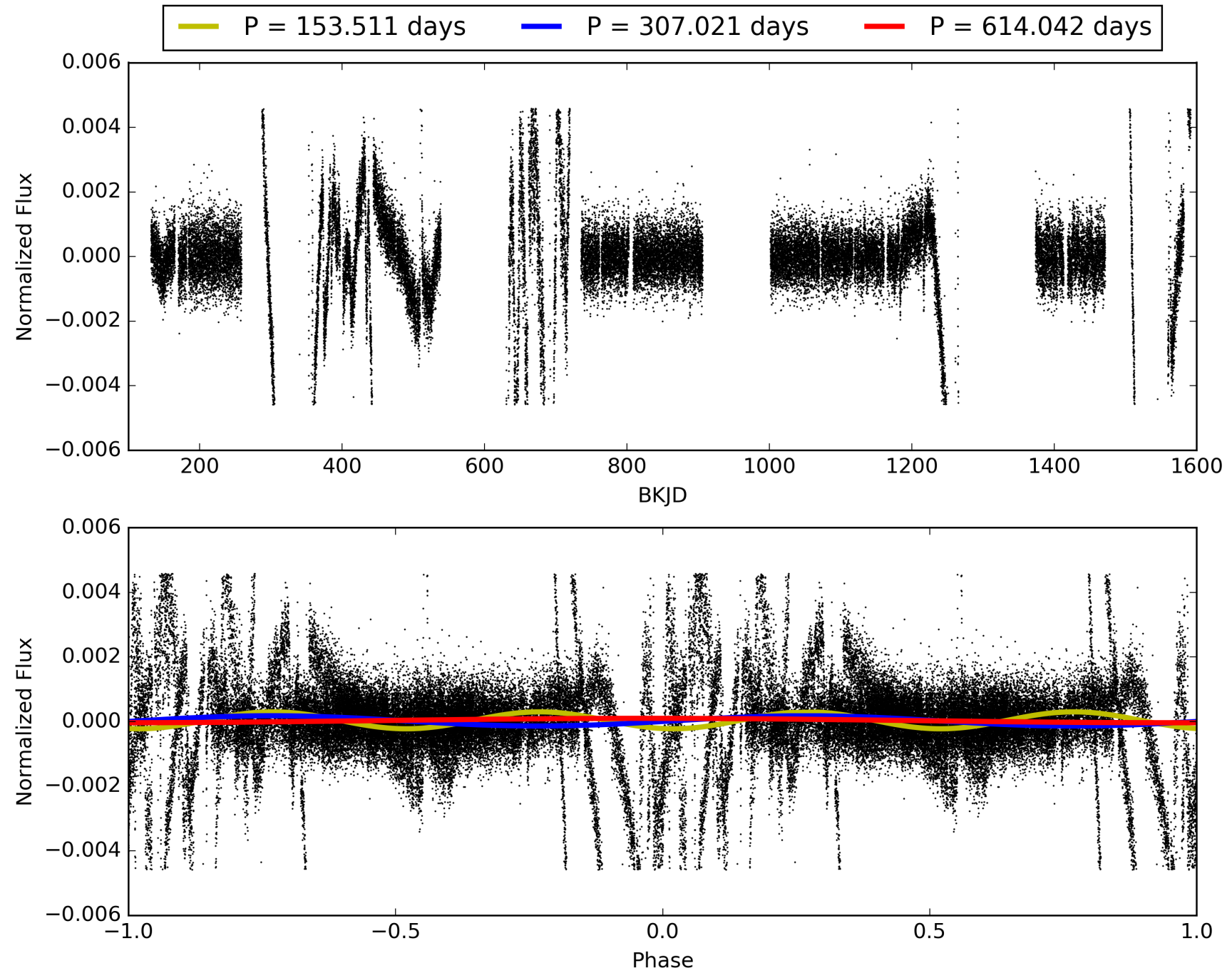
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 18:03:29 Z

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

TCE 004378554-01, PDC Light Curves

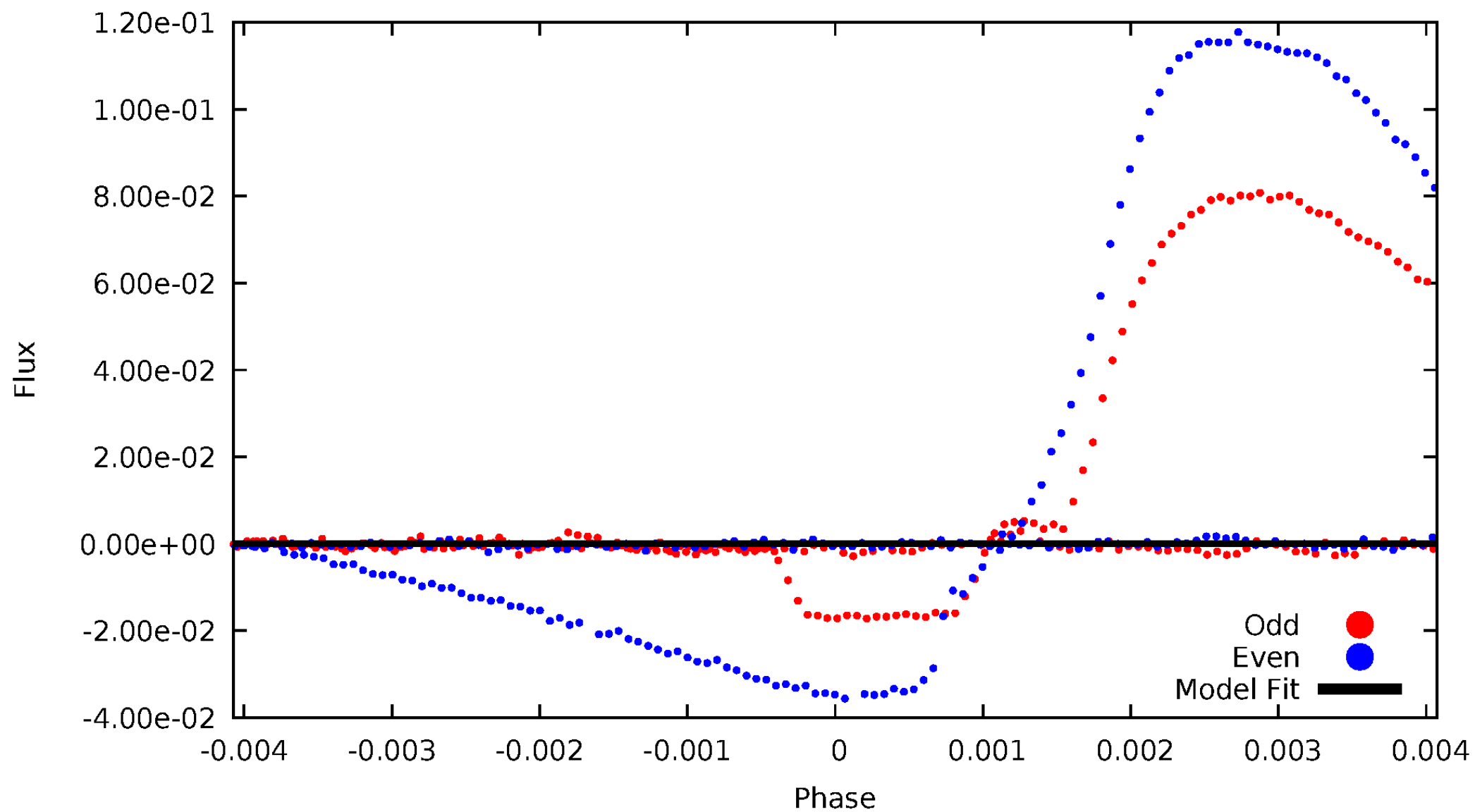


TCE 004378554-01



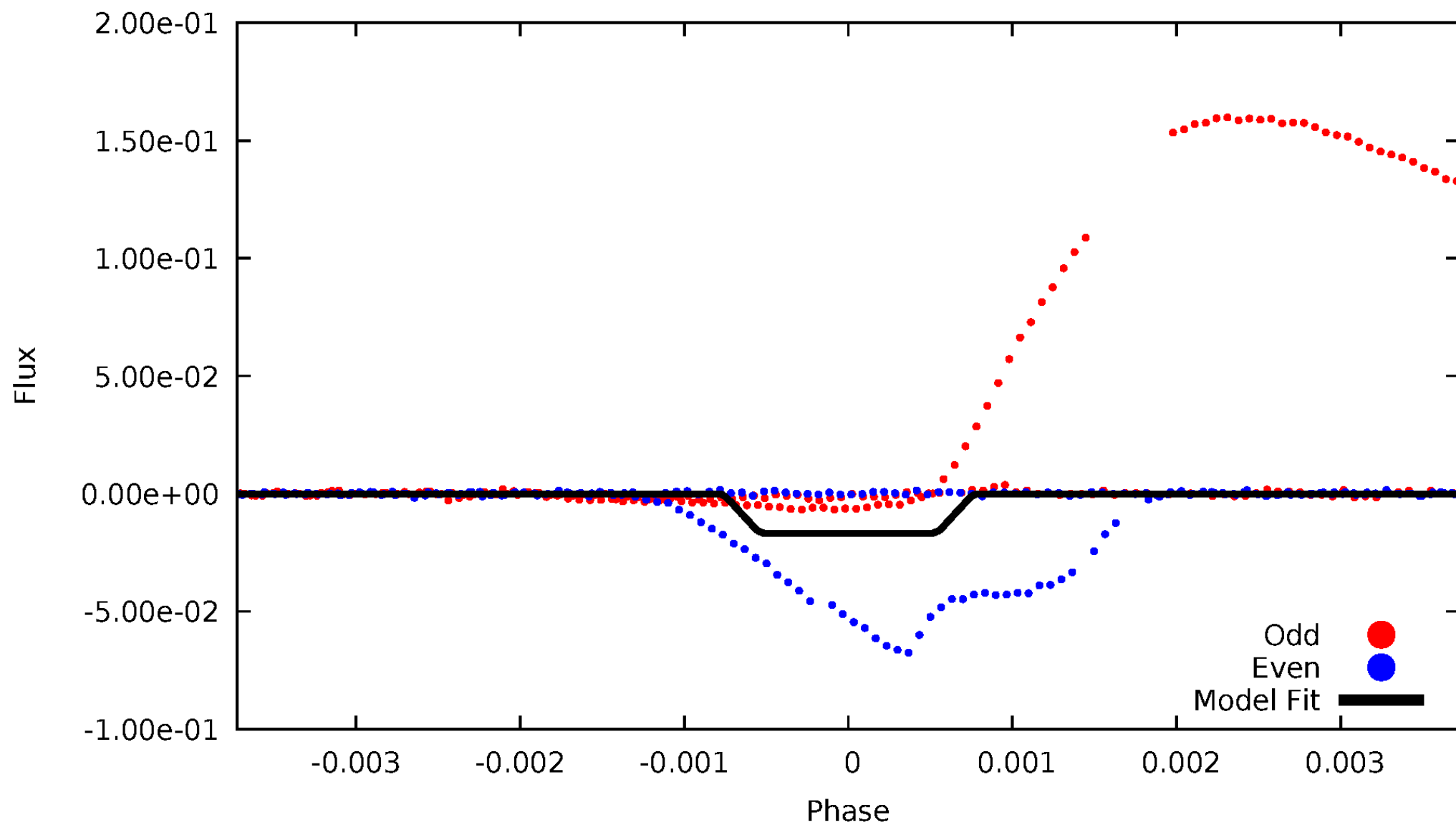
DV Odd/Even

TCE 004378554-01



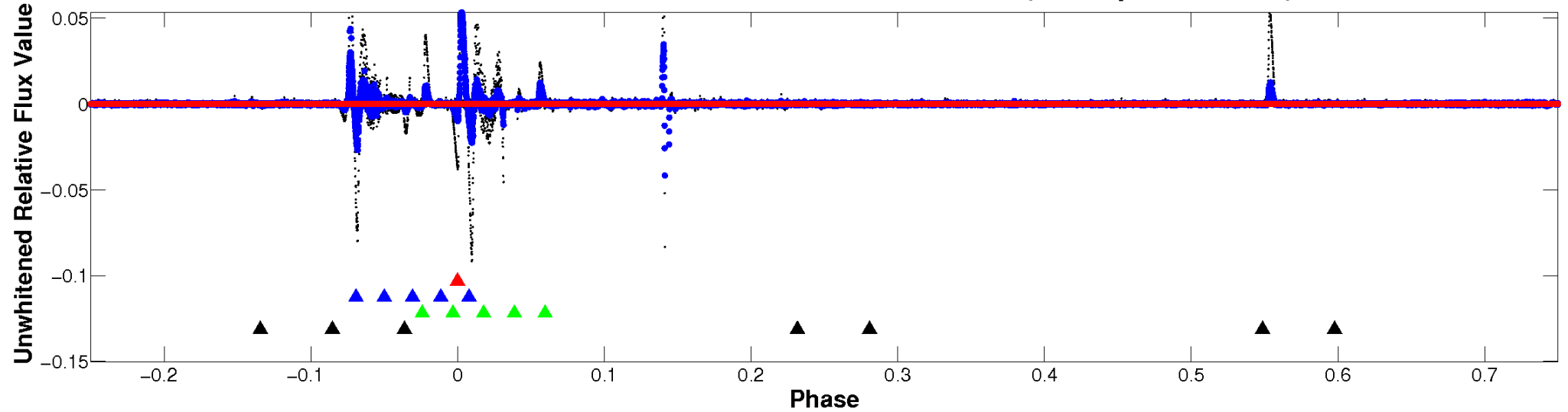
ALT Odd/Even

TCE 004378554-01

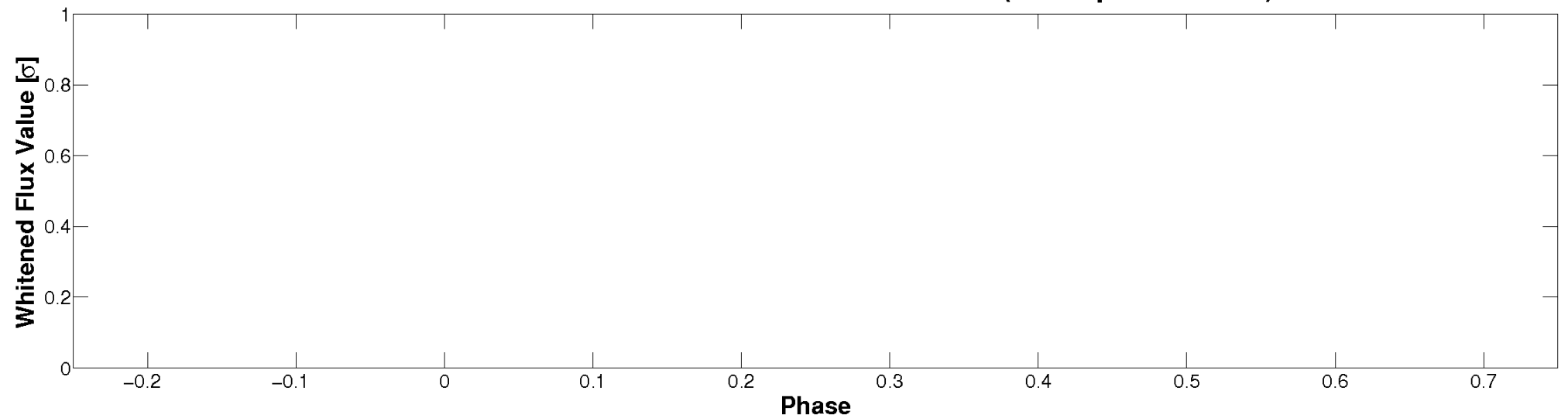


Non-Whitened Vs. Whitened Light Curve

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

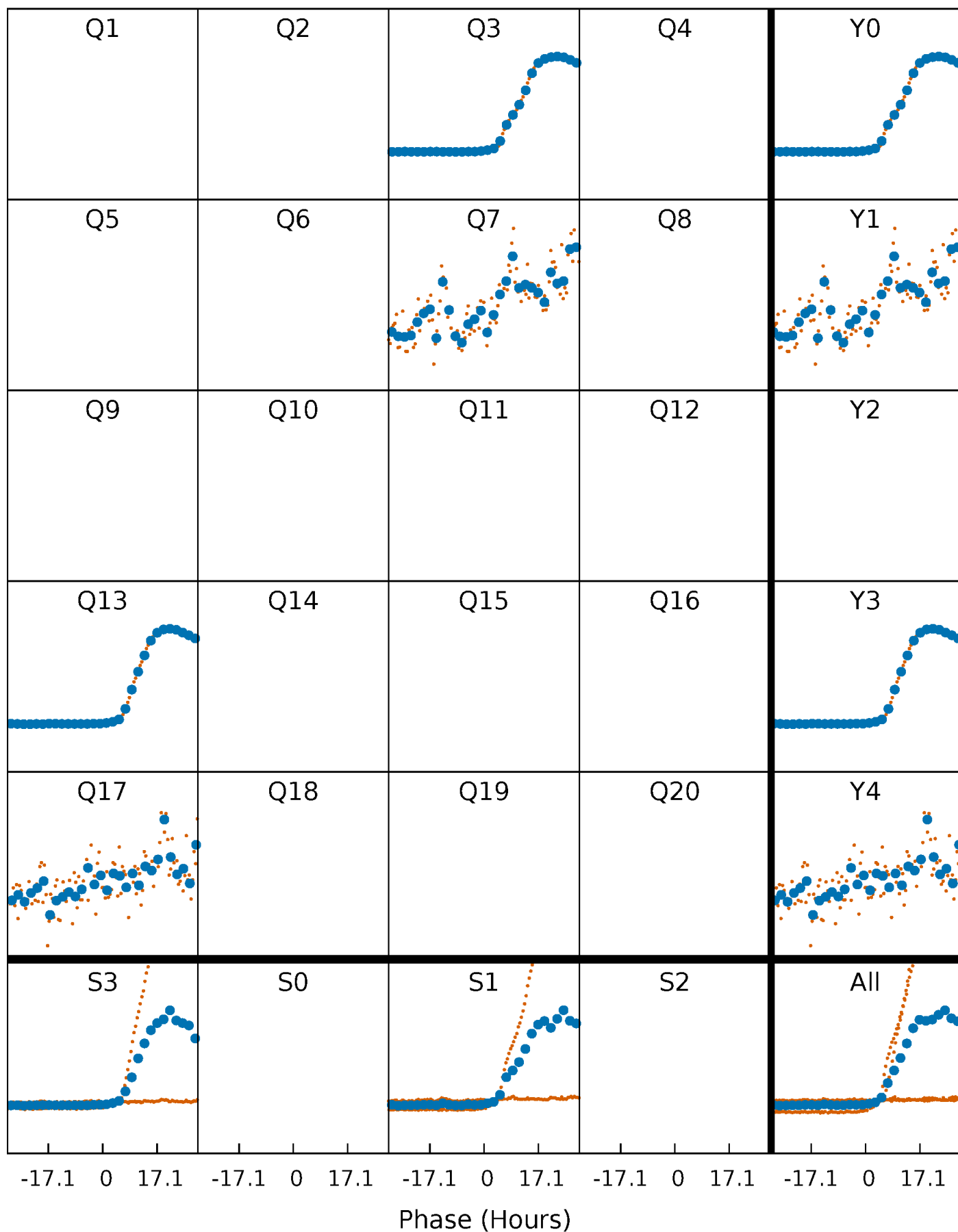


Planet 1 : Phased Whitened Flux Time Series (TPS Epoch/Period)



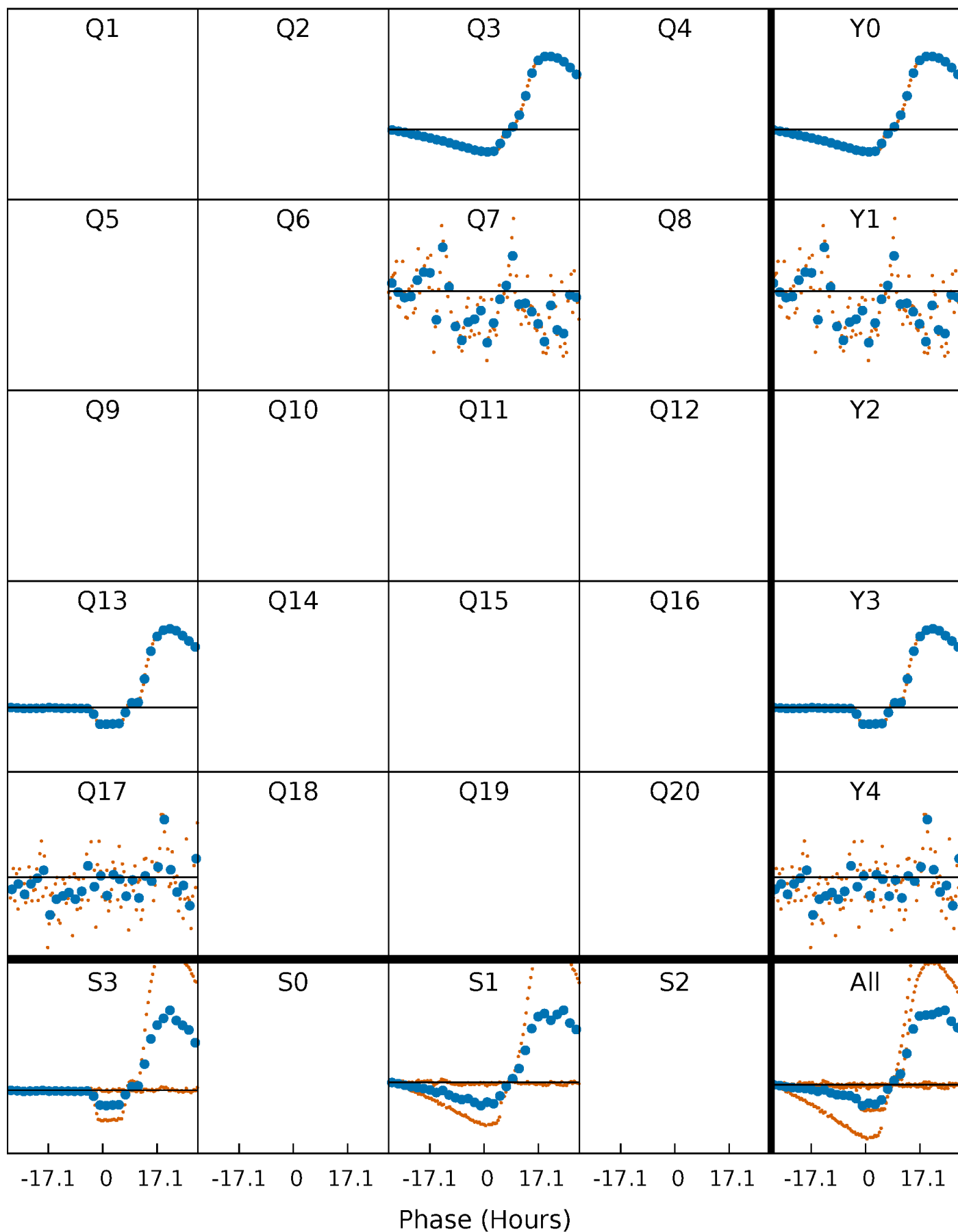
PDC Quarter-Phased Transit Curves

TCE 004378554-01 $P=307.021050$ Days $T_0=339.851572$ (BKJD)



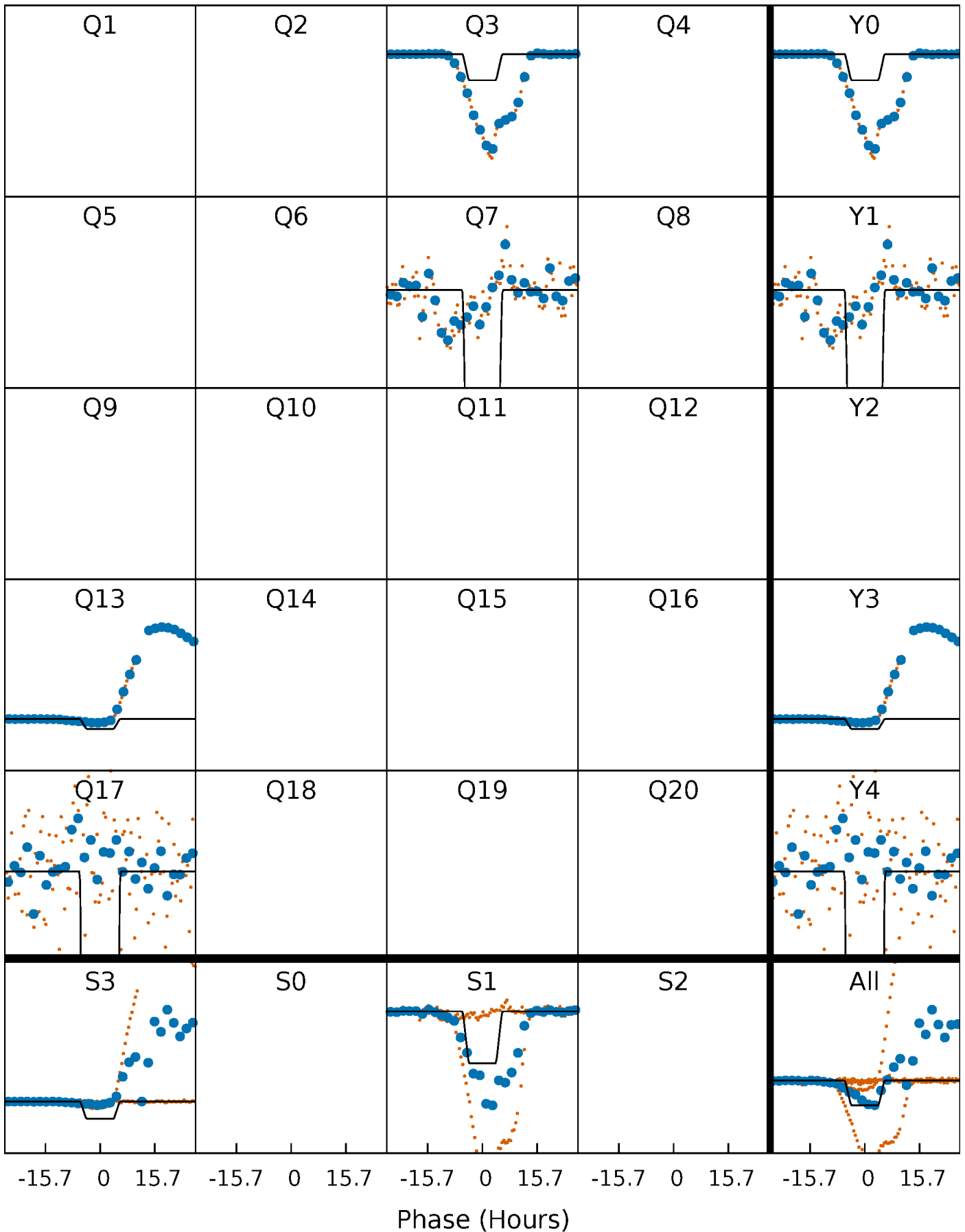
DV Quarter-Phased Transit Curves

TCE 004378554-01 P=307.021050 Days $T_0=339.851572$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

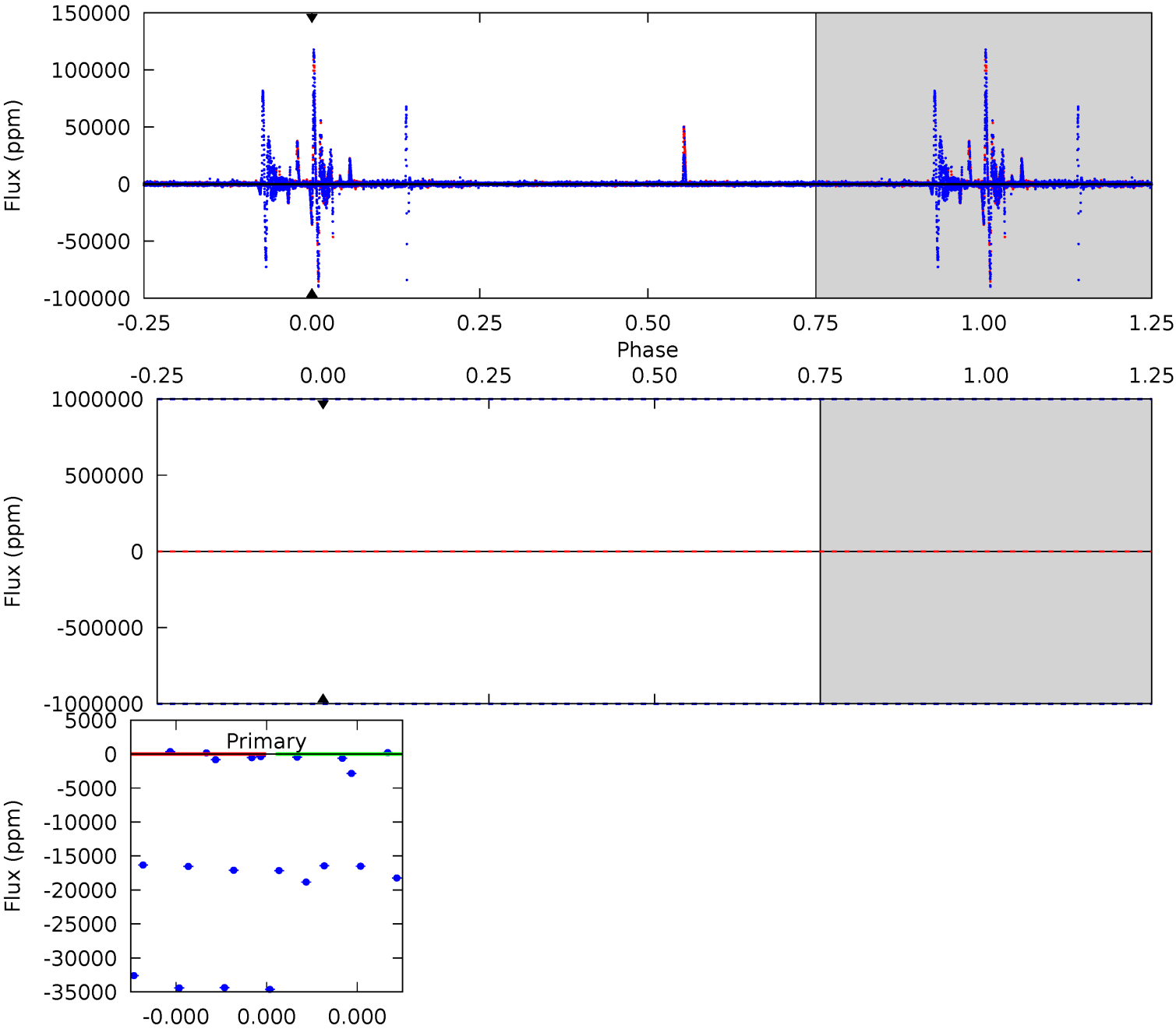
TCE 004378554-01 P=307.021050 Days $T_0=339.943172$ (BKJD)



DV Model-Shift Uniqueness Test

004378554-01, P = 307.021050 Days, E = 32.830522 Days

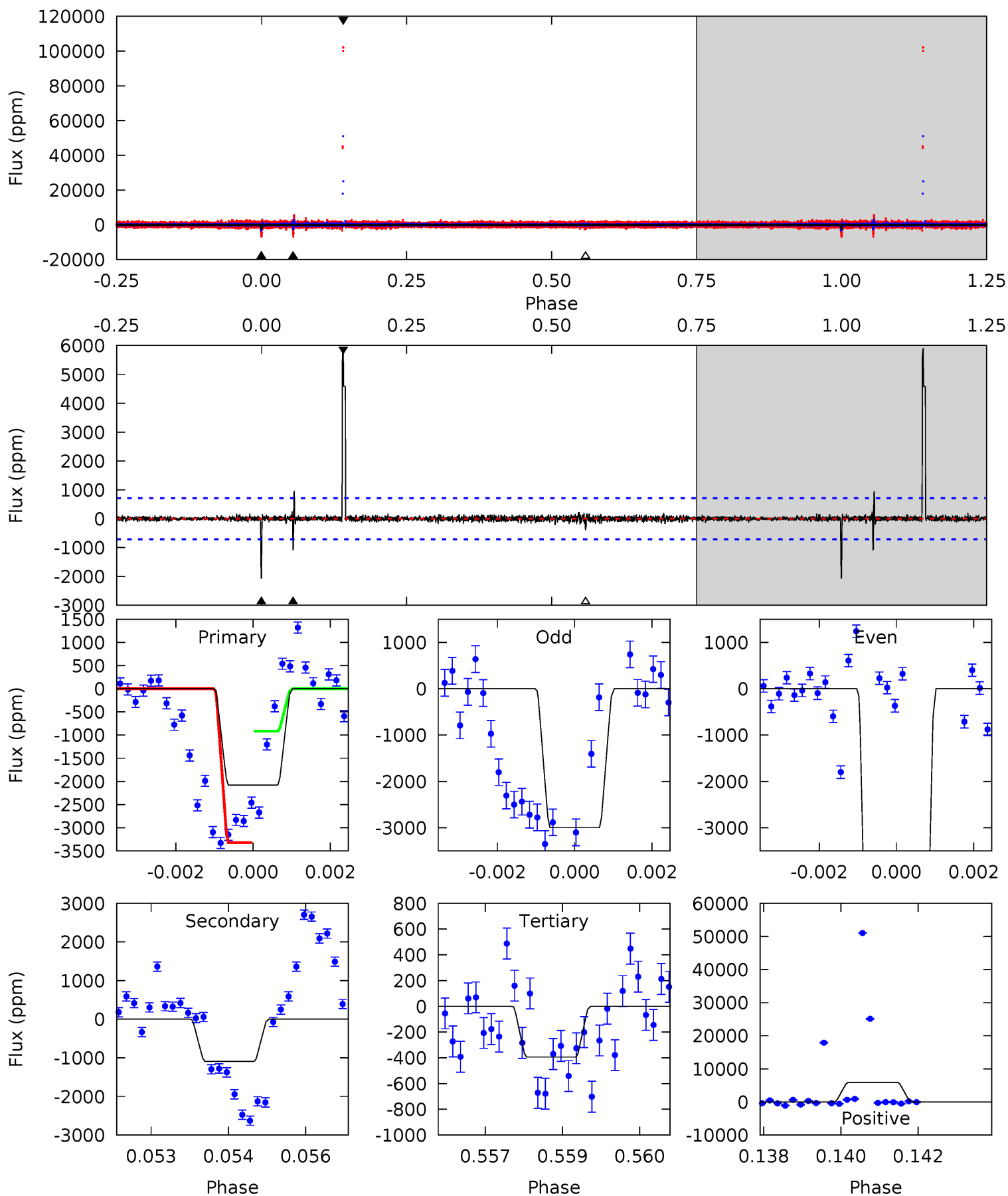
| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|-----|-----|-----|-----|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|-----|-------|-----|
| 0 | 0 | 0 | 0 | 1.00 | 1.00 | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |



Alt Model-Shift Uniqueness Test

004378554-01, P = 307.021050 Days, E = 32.922122 Days

| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 15.7 | 8.22 | 2.97 | 44.5 | 5.37 | 3.16 | 1.36 | 12.7 | -28.9 | 5.25 | -36.3 | 7.69 | 5.74 | 0.74 | 8.78 |



Stellar Parameters For KIC 004378554

| | $T_{\text{eff}}(K)$ | $\log(g)$ | [Fe/H] | $R (R_{\odot})$ | $M(M_{\odot})$ | $p_{\star} (\text{g}\cdot\text{cm}^{-3})$ |
|--------|----------------------|---------------------------|----------------------------|---------------------------|---------------------------|---|
| | 5845^{+158}_{-176} | $4.541^{+0.038}_{-0.200}$ | $-0.160^{+0.300}_{-0.300}$ | $0.874^{+0.264}_{-0.082}$ | $0.968^{+0.108}_{-0.120}$ | $2.042^{+0.417}_{-1.074}$ |
| | +3%/-3% | +1%/-4% | +188%/-188% | +30%/-9% | +11%/-12% | +20%/-53% |
| 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 004378554-01 / KOI

| Detrend | Depth (ppm) | $R_p (R_{\oplus})$ | $T_{max} (K)$ | $T_{obs} (K)$ | A_{obs} |
|---------|-----------------|-------------------------|-------------------|--------------------------|---|
| DV | 0 ± 1000000 | $16.02^{+9.55}_{-8.07}$ | 368^{+25}_{-16} | -3472^{+13636}_{-5573} | $-2665.960^{+259049.784}_{-205211.424}$ |
| Alt. | -1090 ± 133 | $14.39^{+9.34}_{-8.77}$ | 368^{+26}_{-16} | 3368^{+1274}_{-479} | 2281^{+12193}_{-1496} |

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 $A_{obs} \gg 1.0$

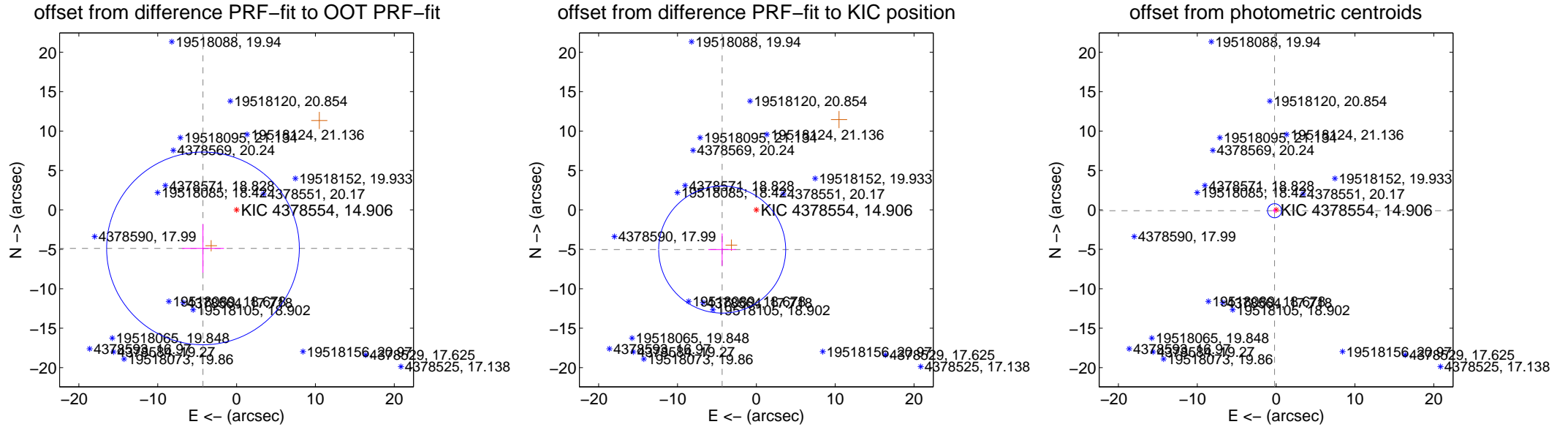
DV Centroid Data

Supplemental centroid analysis for 004378554-01. Kepler magnitude: 14.91. Transit SNR -1.00

There are 2 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.12 arcsec

| | Distance in arcsec | Distance / σ | Δ RA | Δ Dec |
|---|--------------------|---------------------|-------------------|--------------------|
| PRF-fit source offset from OOT | 6.478 ± 4.072 | 1.59 | 4.259 ± 2.665 | -4.882 ± 3.080 |
| PRF-fit source offset from KIC position | 6.639 ± 2.684 | 2.47 | 4.332 ± 1.754 | -5.030 ± 2.037 |
| photometric centroid source offset | 0.22 ± 0.30 | 0.75 | 0.20 ± 0.29 | -0.10 ± 0.31 |



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 are from the UKIRT catalog.

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

Q1 no difference image



Q1 no OOT image



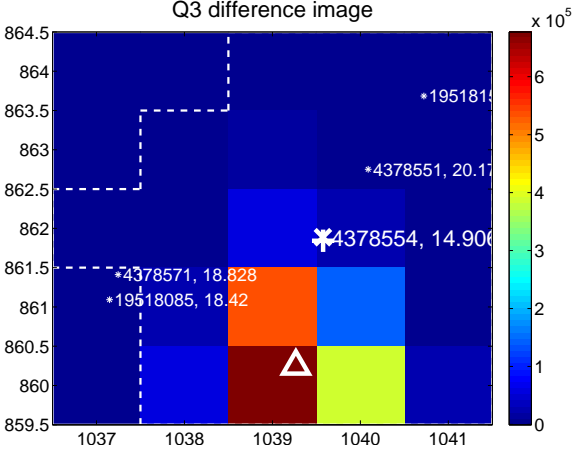
Q2 no difference image



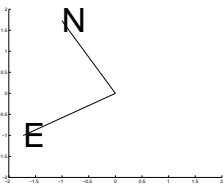
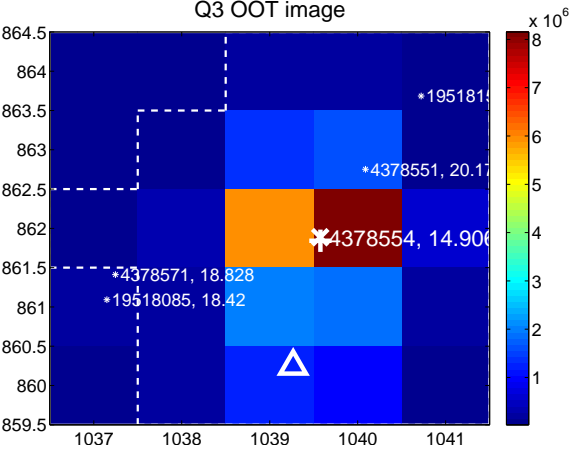
Q2 no OOT image



Q3 difference image



Q3 OOT image



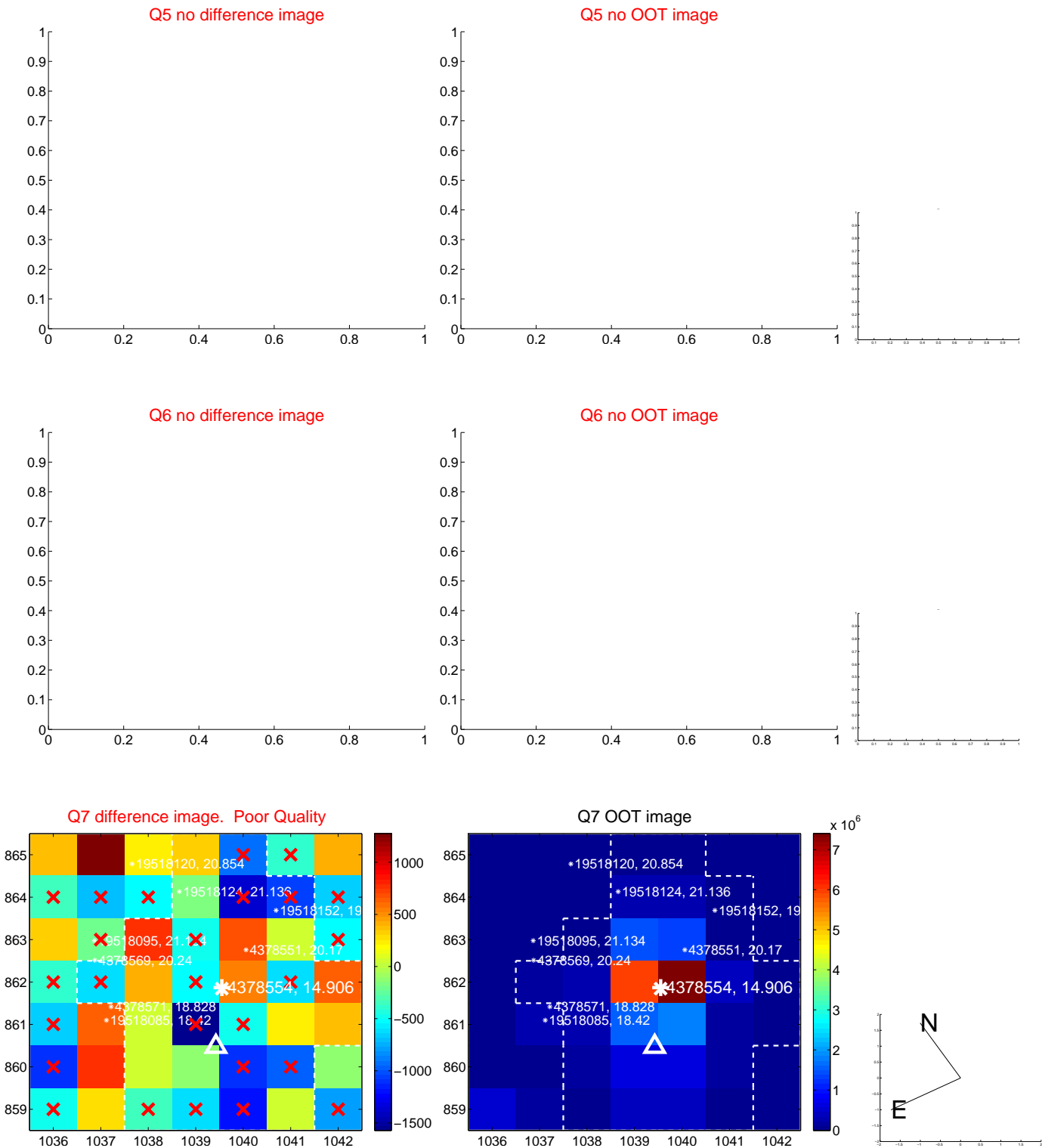
Q4 no difference image



Q4 no OOT image



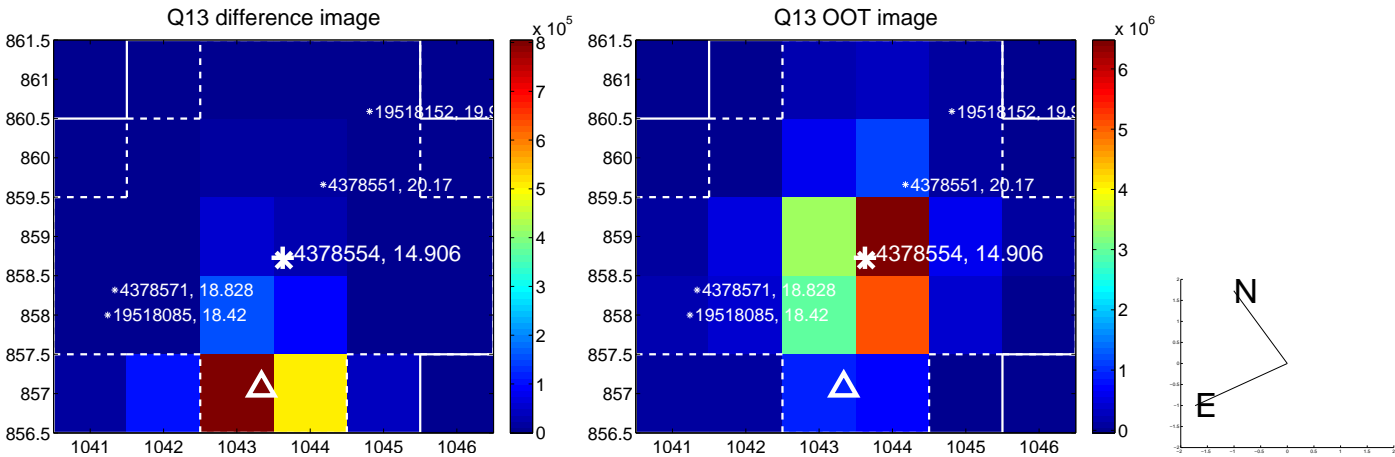
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



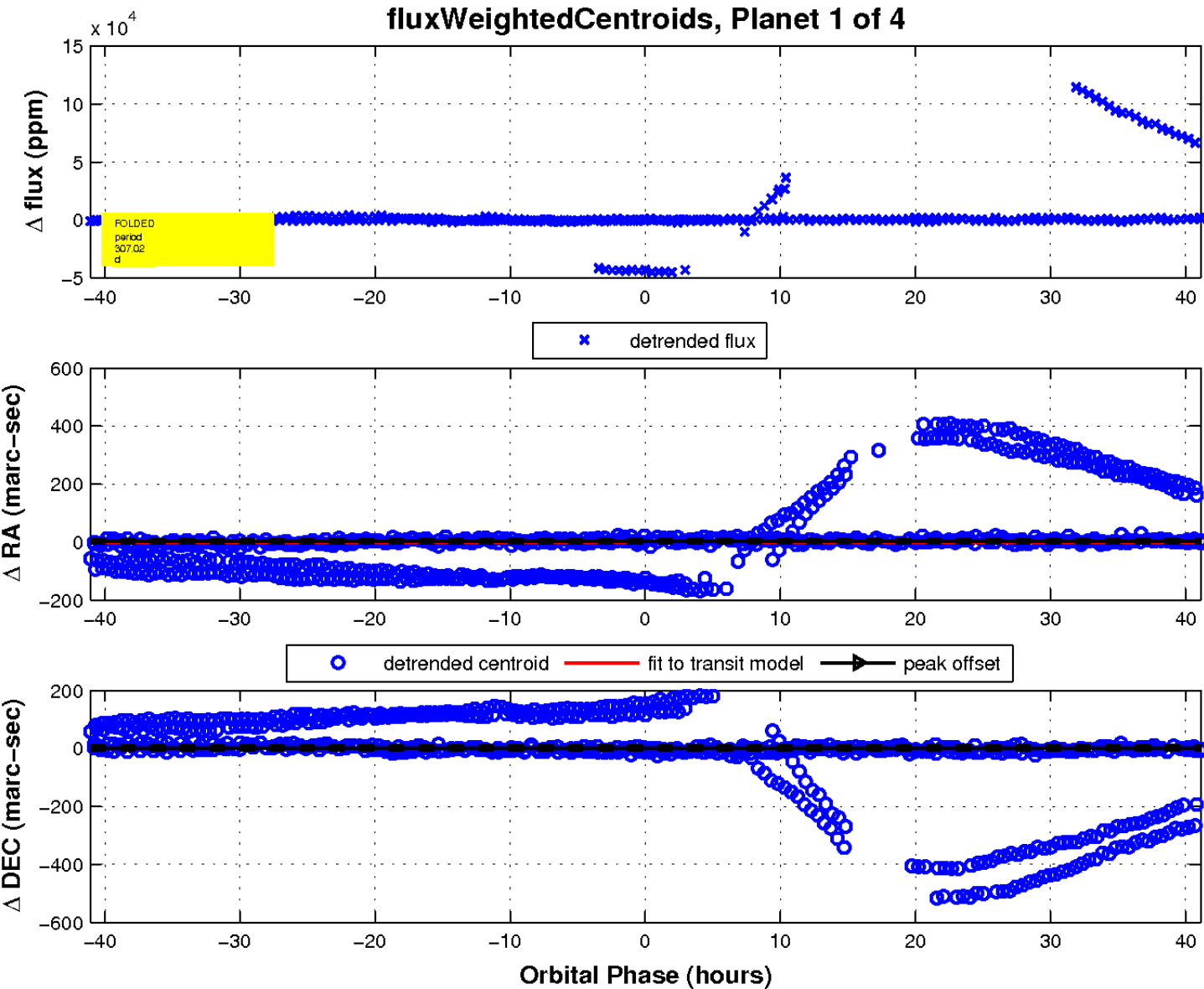
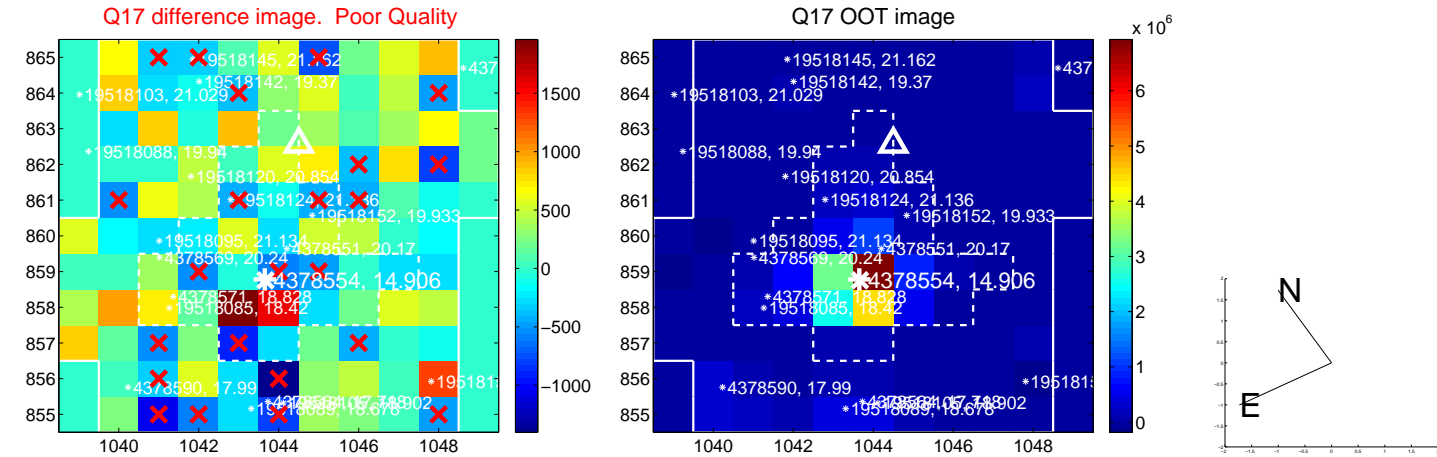
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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

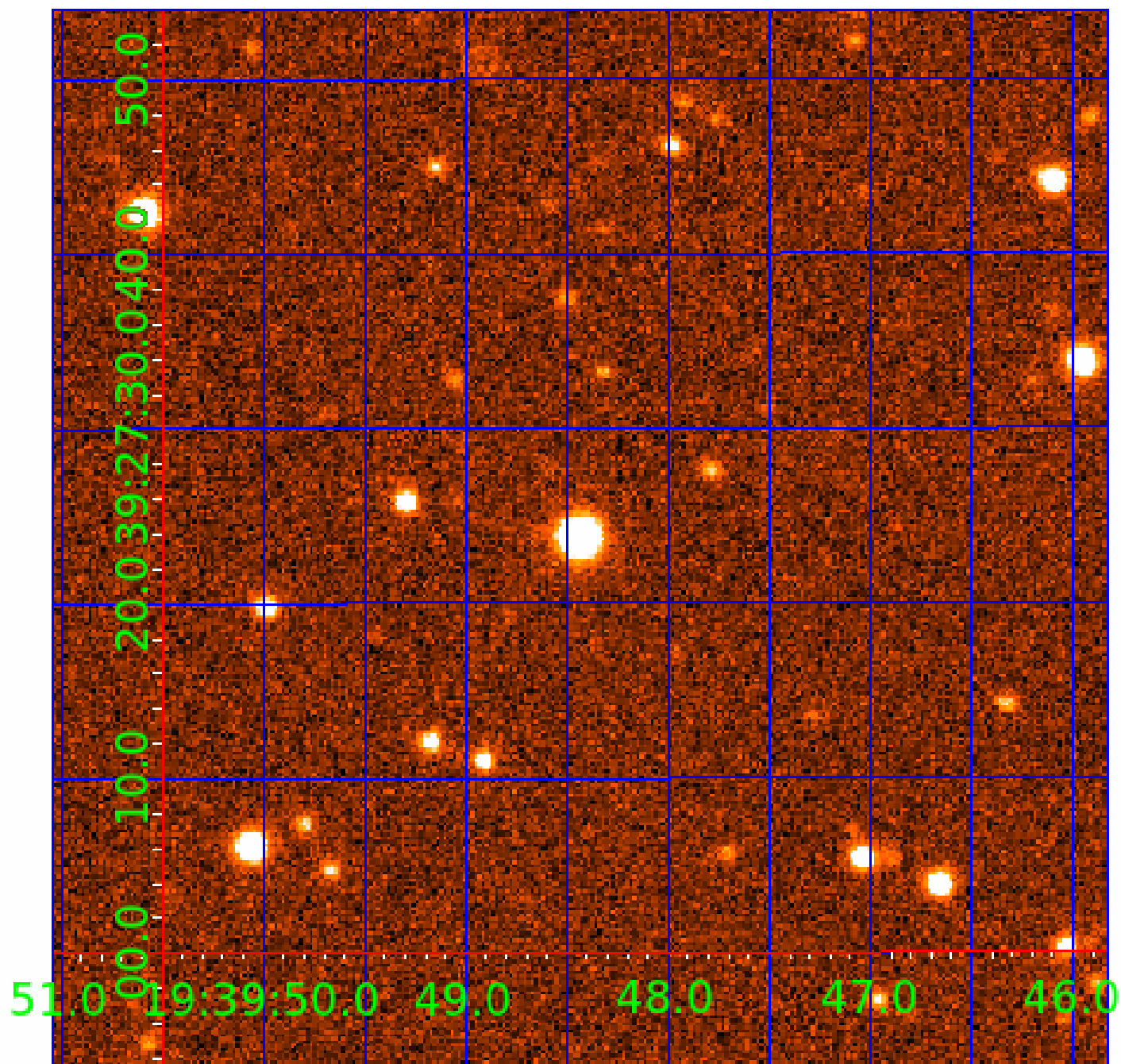


white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



UKIRT Image

Declination



KIC 004378554

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}) |
|--------------|----------|------|---------------|--------------|-------------|------------------|-------|------|-----------------------------|-----------------|------------------------|------------------------|
| 004378554-01 | OBS | No | 307.021050 | 339.851572 | 26902.9 | 15.000 | 312.9 | -1.0 | 0.87 | 5845 | 14.26 | 1.03 |
| 004378554-02 | OBS | No | 301.108177 | 342.265251 | 29745.4 | 52.605 | 213.2 | 68.2 | 0.87 | 5845 | 26.22 | 1.05 |
| 004378554-03 | OBS | No | 300.591290 | 358.173664 | 17280.1 | 15.000 | 146.6 | -1.0 | 0.87 | 5845 | 11.42 | 1.06 |
| 004378554-04 | OBS | No | 209.707241 | 298.587602 | 19840.7 | 84.939 | 124.8 | 86.5 | 0.87 | 5845 | 21.66 | 1.71 |

Robovetter Results

| TCE | Run Type | Disp | Score | N | S | C | E | Comments |
|--------------|----------|------|-------|---|---|---|---|--|
| 004378554-01 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | INDIV_TRANS_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS |
| 004378554-02 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS |
| 004378554-03 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS |
| 004378554-04 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | INDIV_TRANS_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS |

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

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

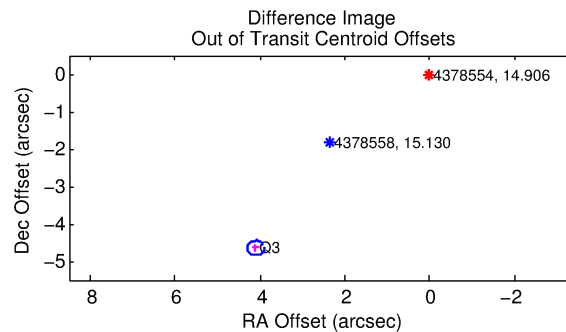
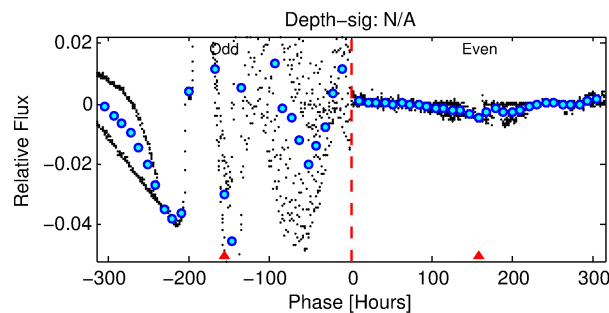
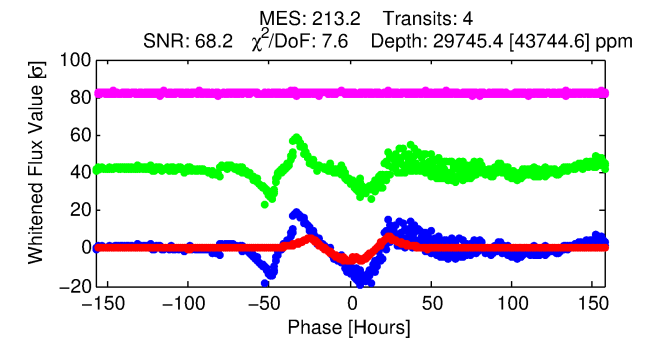
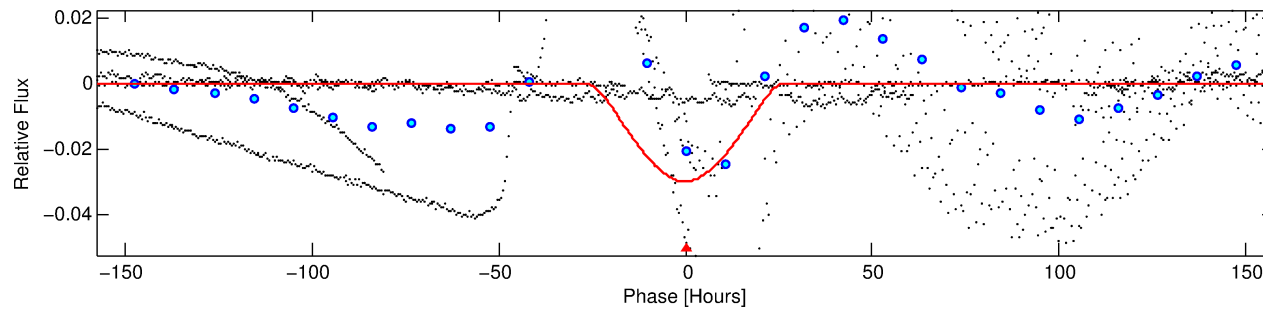
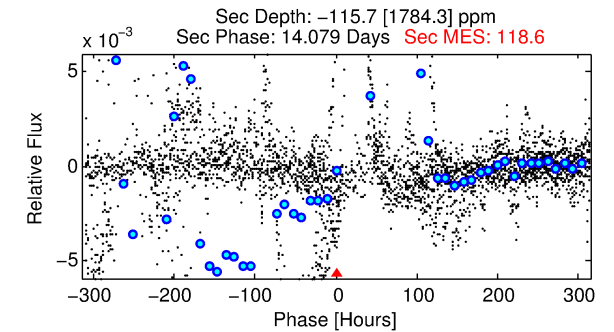
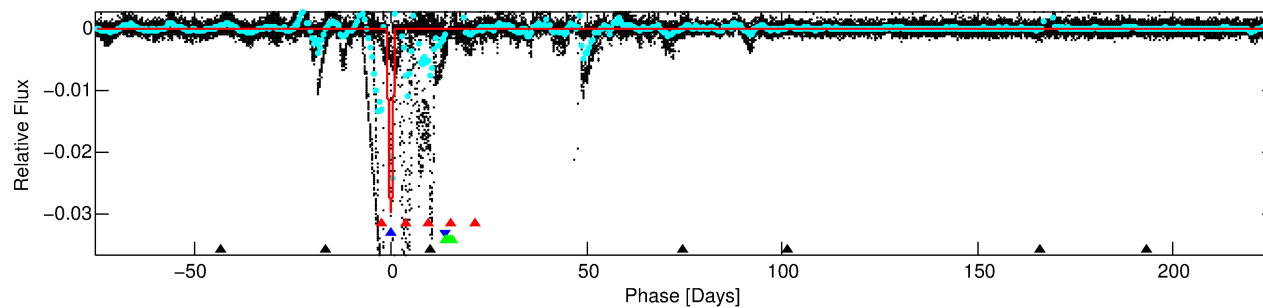
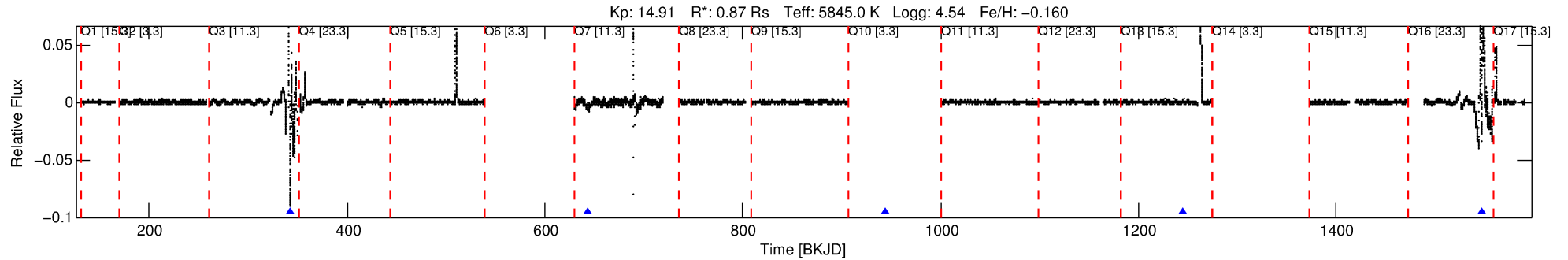
See http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col for comment definitions.

Ephemeris Match Information For 004378554-02

No Significant Match Found

DV One-Page Summary

KIC: 4378554 Candidate: 2 of 4 Period: 301.108 d



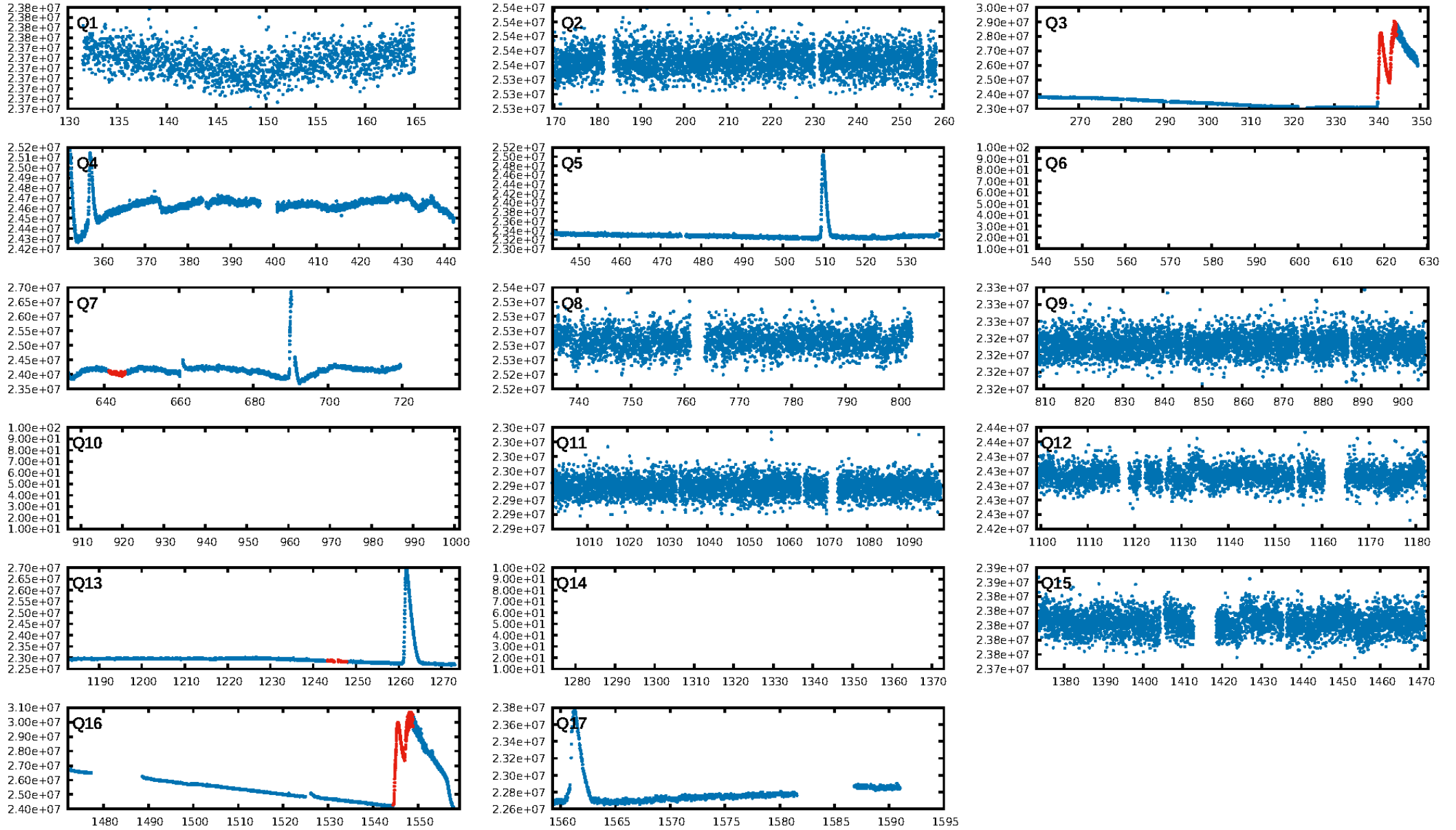
DV Fit Results:

Period = 301.10818 [0.00697] d
Epoch = 342.2653 [0.0177] BKJD
Rp/R* = 0.2749 [0.2563]
a/R* = 34.60 [1.96]
b = 1.00 [0.09]
Seff = 1.06 [0.41]
Teq = 258 [25] K
Rp = 26.22 [25.70] Re
a = 0.8700 [0.2203] AU
Ag = N/A
Teffp = N/A

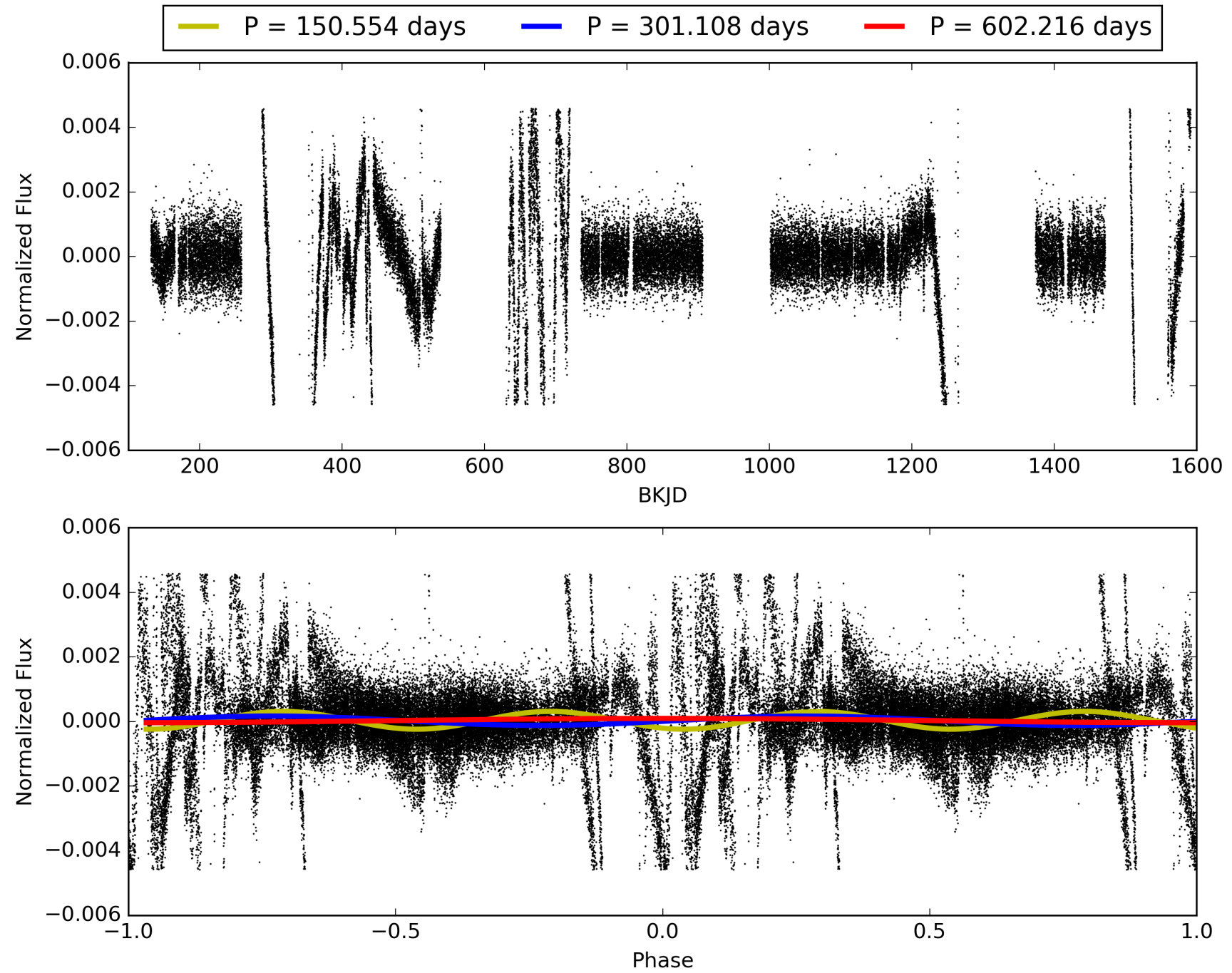
DV Diagnostic Results:

ShortPeriod-sig: 17.9% [0.23σ]
LongPeriod-sig: 99.1% [2.59σ]
ModelChiSquare2-sig: 0.0%
ModelChiSquareGof-sig: 0.0%
Bootstrap-pfa: 1.55e-57
RollingBand-fgt: 1.00 [4/4]
GhostDiagnostic-chr: 5.259
Centroid-sig: 0.0%
Centroid-so: 2.397 arcsec [3.77σ]
OotOffset-rm: 6.197 arcsec [92.86σ]
KicOffset-rm: 6.567 arcsec [98.42σ]
OotOffset-st: 0/1/0/0 [1]
KicOffset-st: 0/1/0/0 [1]
DiffImageQuality-fgm: 1.00 [1/1]
DiffImageOverlap-fno: 0.00 [0/1]

TCE 004378554-02, PDC Light Curves

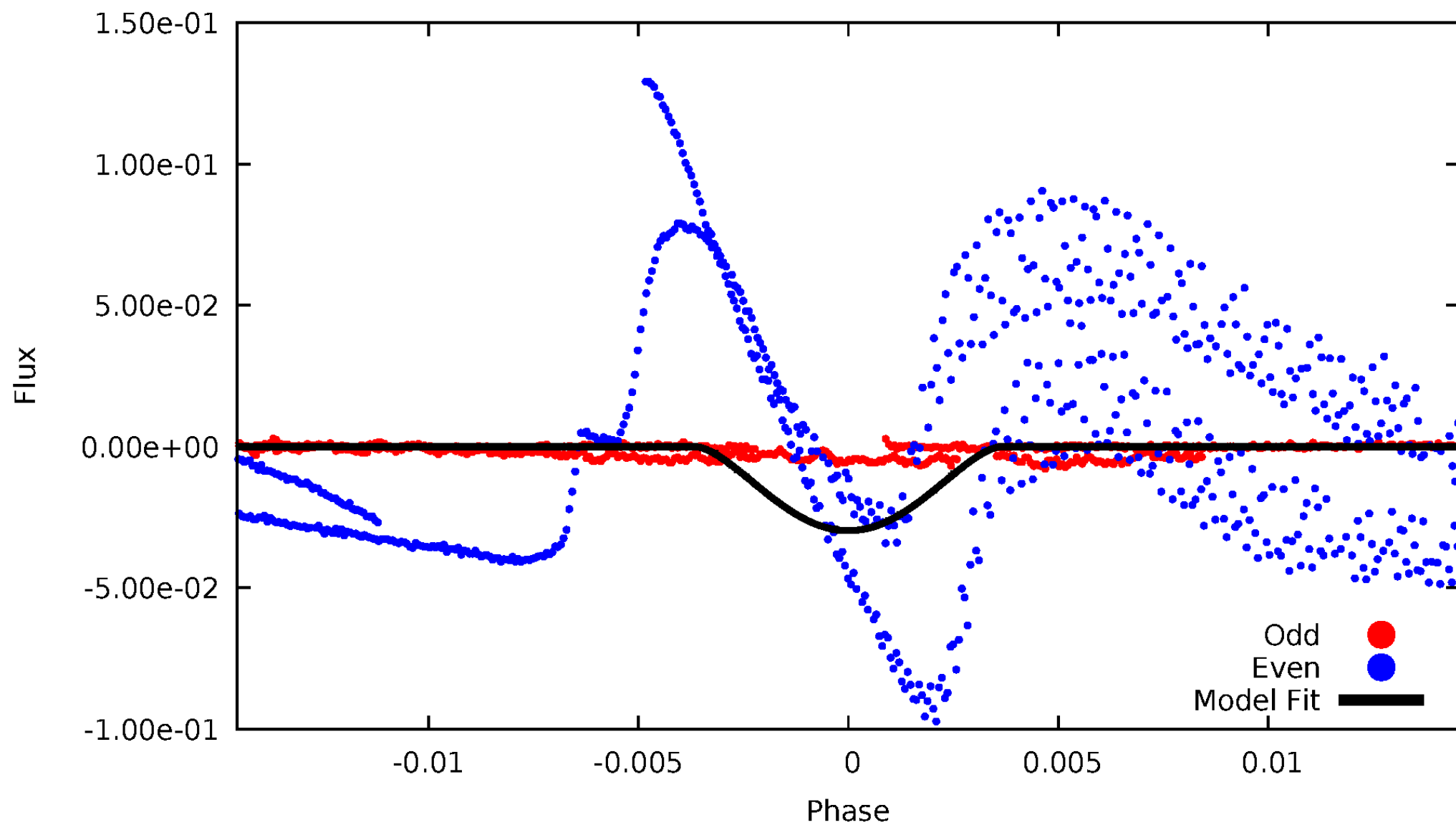


TCE 004378554-02



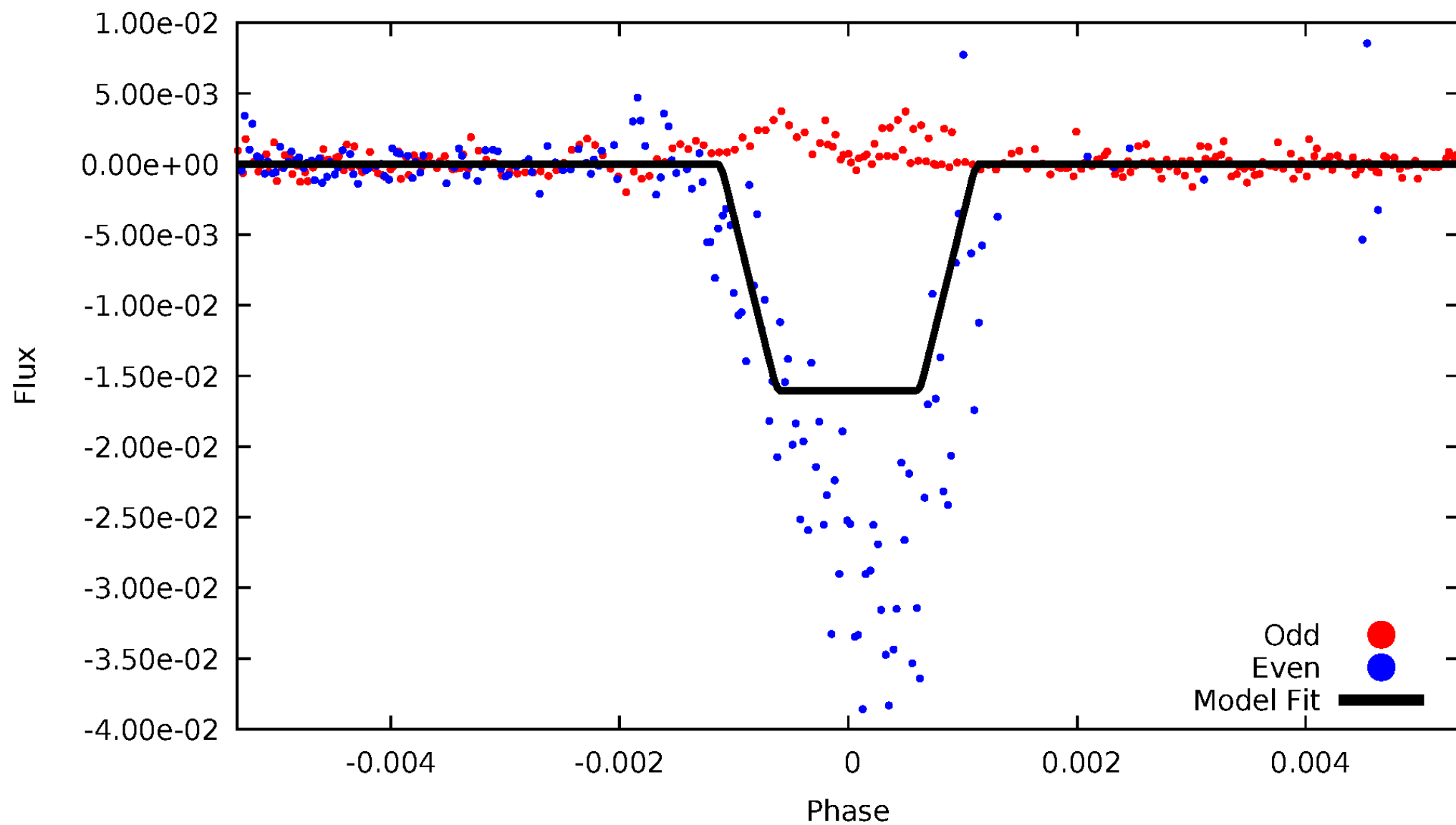
DV Odd/Even

TCE 004378554-02



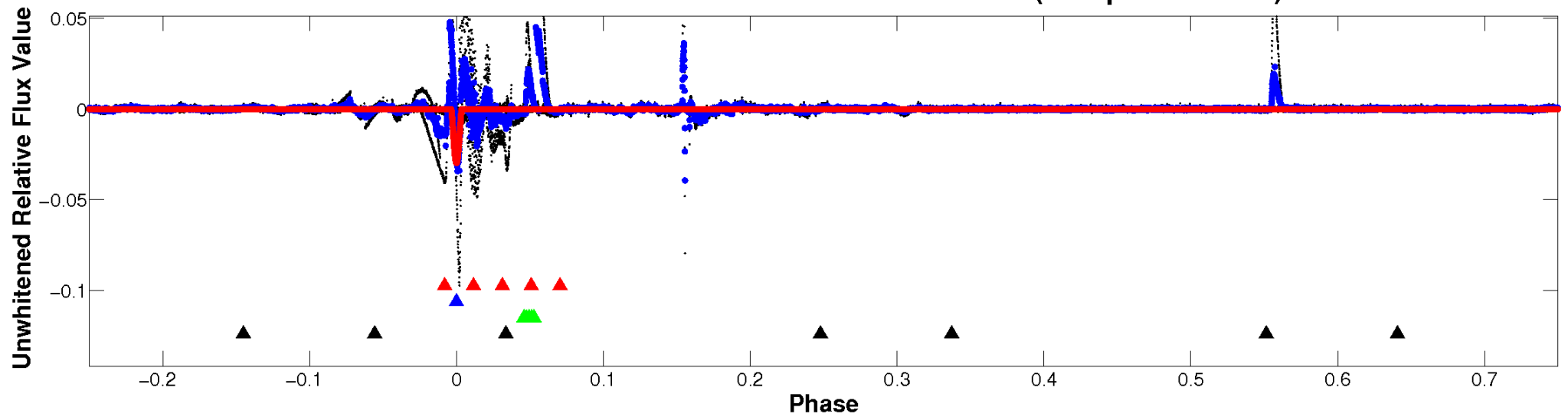
ALT Odd/Even

TCE 004378554-02

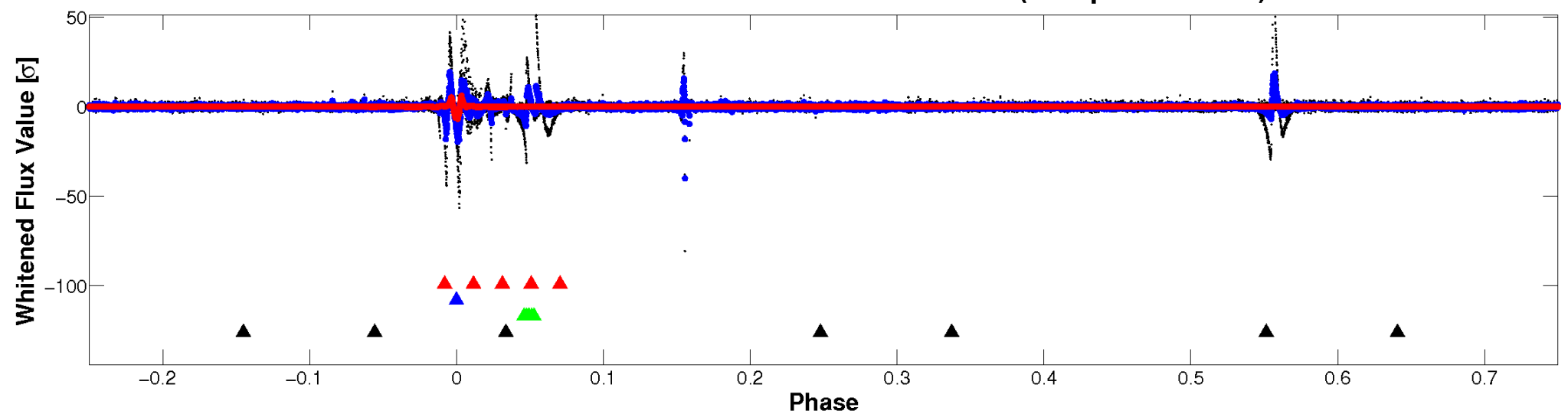


Non-Whitened Vs. Whitened Light Curve

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

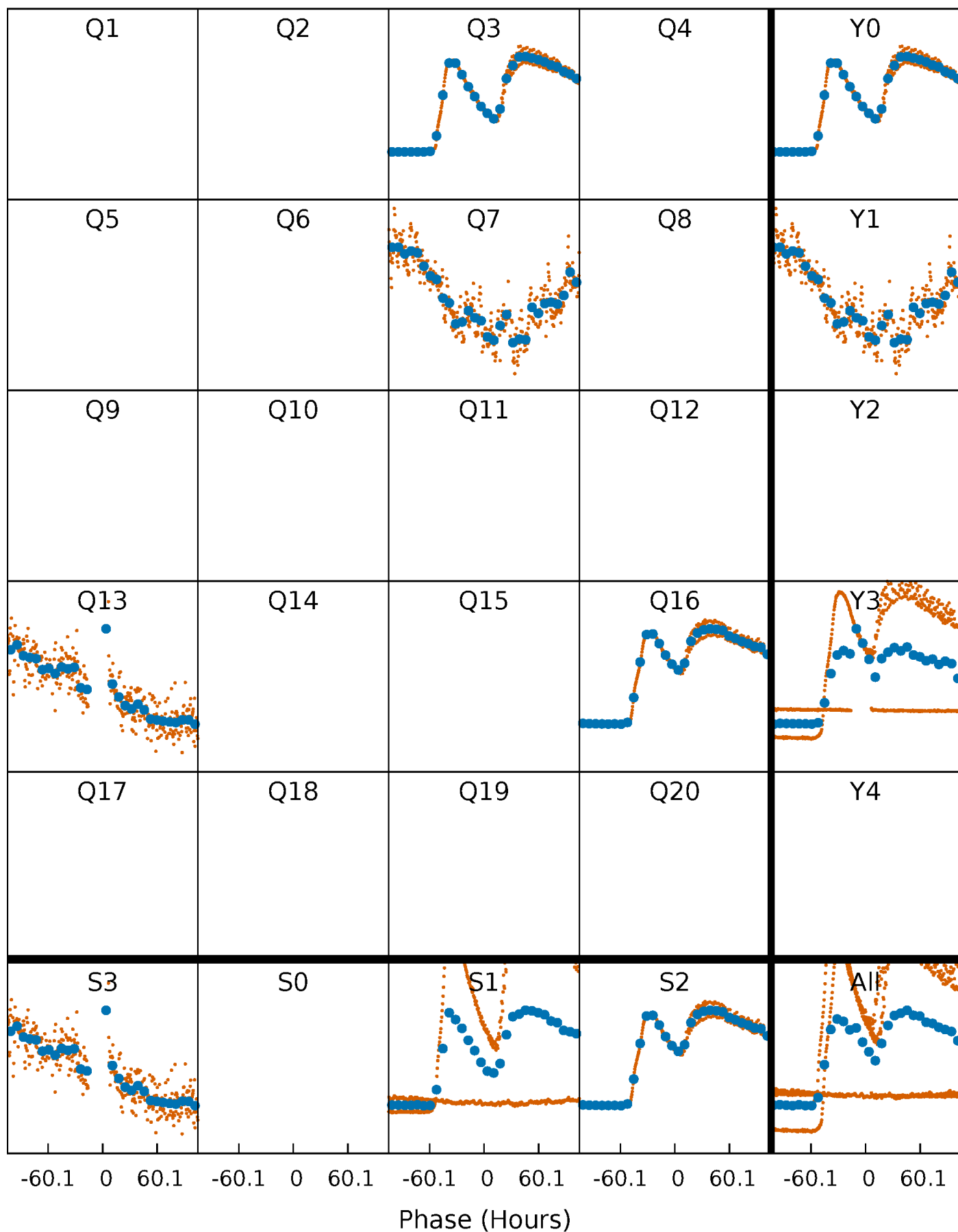


Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



PDC Quarter-Phased Transit Curves

TCE 004378554-02 P=301.108177 Days $T_0=342.265251$ (BKJD)



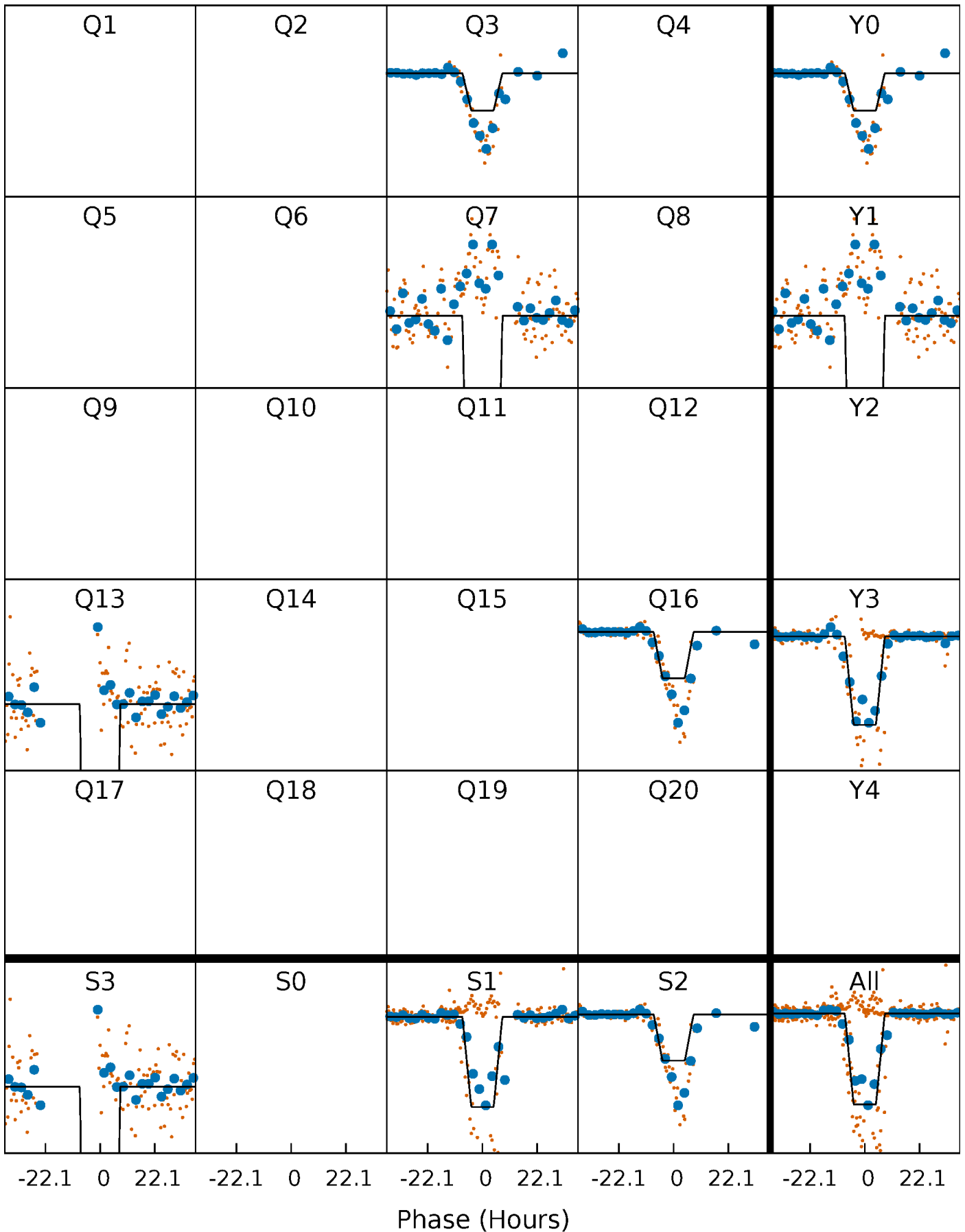
DV Quarter-Phased Transit Curves

TCE 004378554-02 P=301.108177 Days $T_0=342.265251$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

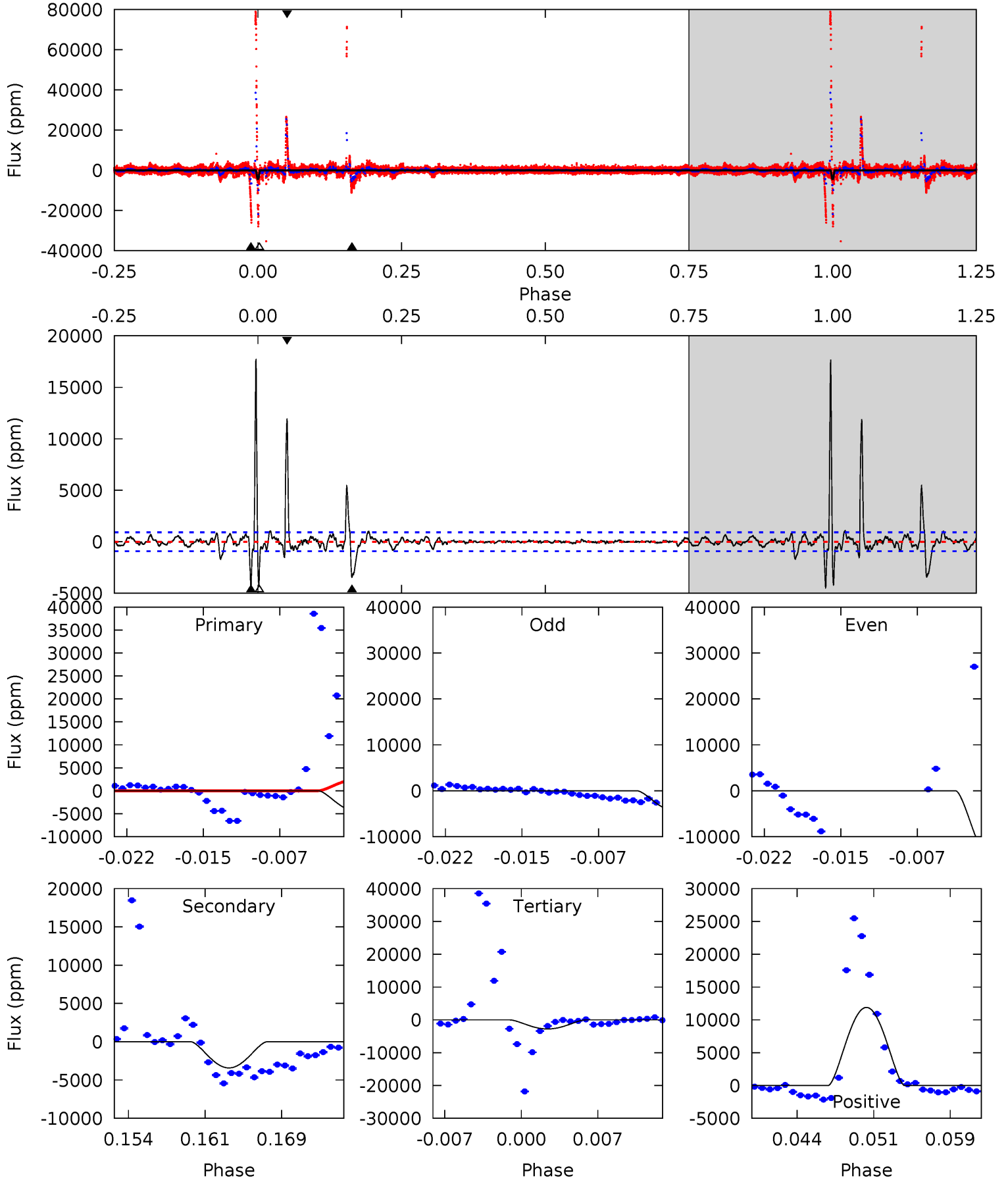
TCE 004378554-02 P=301.020395 Days $T_0=342.858276$ (BKJD)



DV Model-Shift Uniqueness Test

004378554-02, P = 301.108177 Days, E = 41.157074 Days

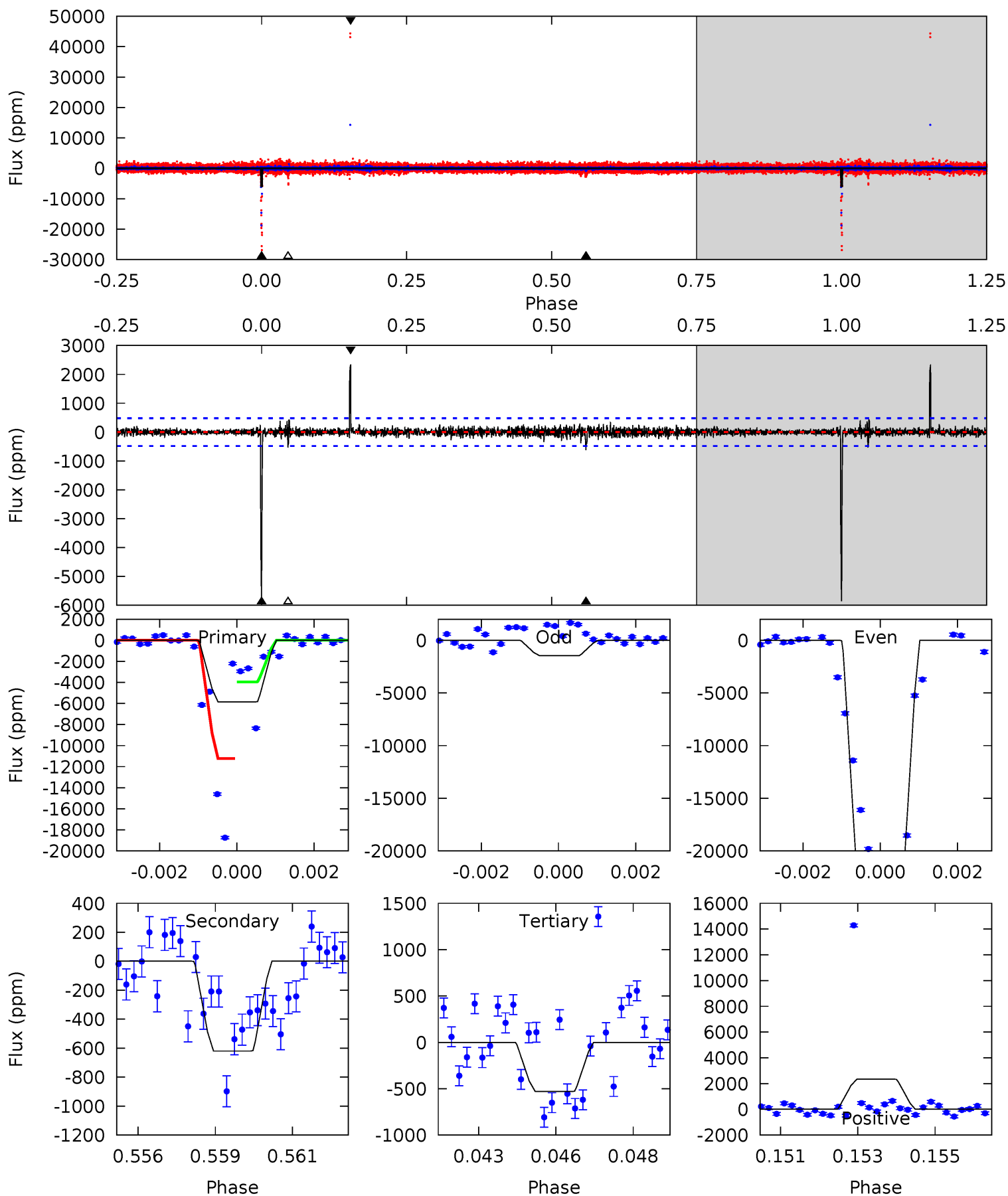
| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|-----|
| 24.6 | 18.8 | 15.3 | 65.6 | 5.09 | 2.68 | 4.60 | 9.26 | -41.0 | 3.54 | -46.7 | 15.7 | 4.69 | 0.80 | 0 |



Alt Model-Shift Uniqueness Test

004378554-02, P = 301.020395 Days, E = 41.837881 Days

| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|-----|
| 64.5 | 6.83 | 5.83 | 25.8 | 5.30 | 3.05 | 1.10 | 58.7 | 38.7 | 1.00 | -18.9 | 71.5 | 1.01 | 0.29 | 0 |



Stellar Parameters For KIC 004378554

| | $T_{\text{eff}}(K)$ | $\log(g)$ | [Fe/H] | R (R_{\odot}) | M (M_{\odot}) | p_{\star} ($\text{g}\cdot\text{cm}^{-3}$) |
|--------|----------------------|---------------------------|----------------------------|---------------------------|---------------------------|---|
| | 5845^{+158}_{-176} | $4.541^{+0.038}_{-0.200}$ | $-0.160^{+0.300}_{-0.300}$ | $0.874^{+0.264}_{-0.082}$ | $0.968^{+0.108}_{-0.120}$ | $2.042^{+0.417}_{-1.074}$ |
| | +3%/-3% | +1%/-4% | +188%/-188% | +30%/-9% | +11%/-12% | +20%/-53% |
| 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 004378554-02 / KOI

| Detrend | Depth (ppm) | R_p (R_{\oplus}) | T_{max} (K) | T_{obs} (K) | A_{obs} |
|---------|-----------------|---------------------------|-------------------|-----------------------|------------------------|
| DV | -3419 ± 181 | $31.17^{+27.77}_{-19.30}$ | 371^{+26}_{-18} | 3146^{+1245}_{-482} | 1422^{+8824}_{-1024} |
| Alt. | -620 ± 91 | $21.92^{+22.20}_{-13.96}$ | 369^{+26}_{-16} | 2747^{+973}_{-445} | 520^{+3367}_{-394} |

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 $A_{obs} \gg 1.0$

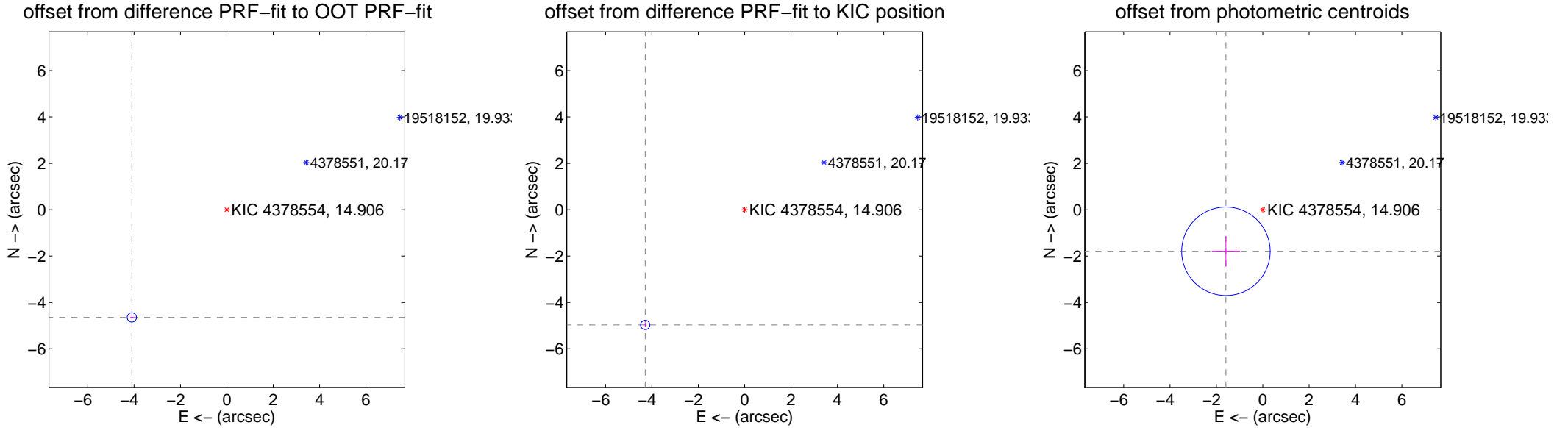
DV Centroid Data

Supplemental centroid analysis for 004378554-02. Kepler magnitude: 14.91. Transit SNR 68.19

There are 1 quarters with good PRF difference image offsets

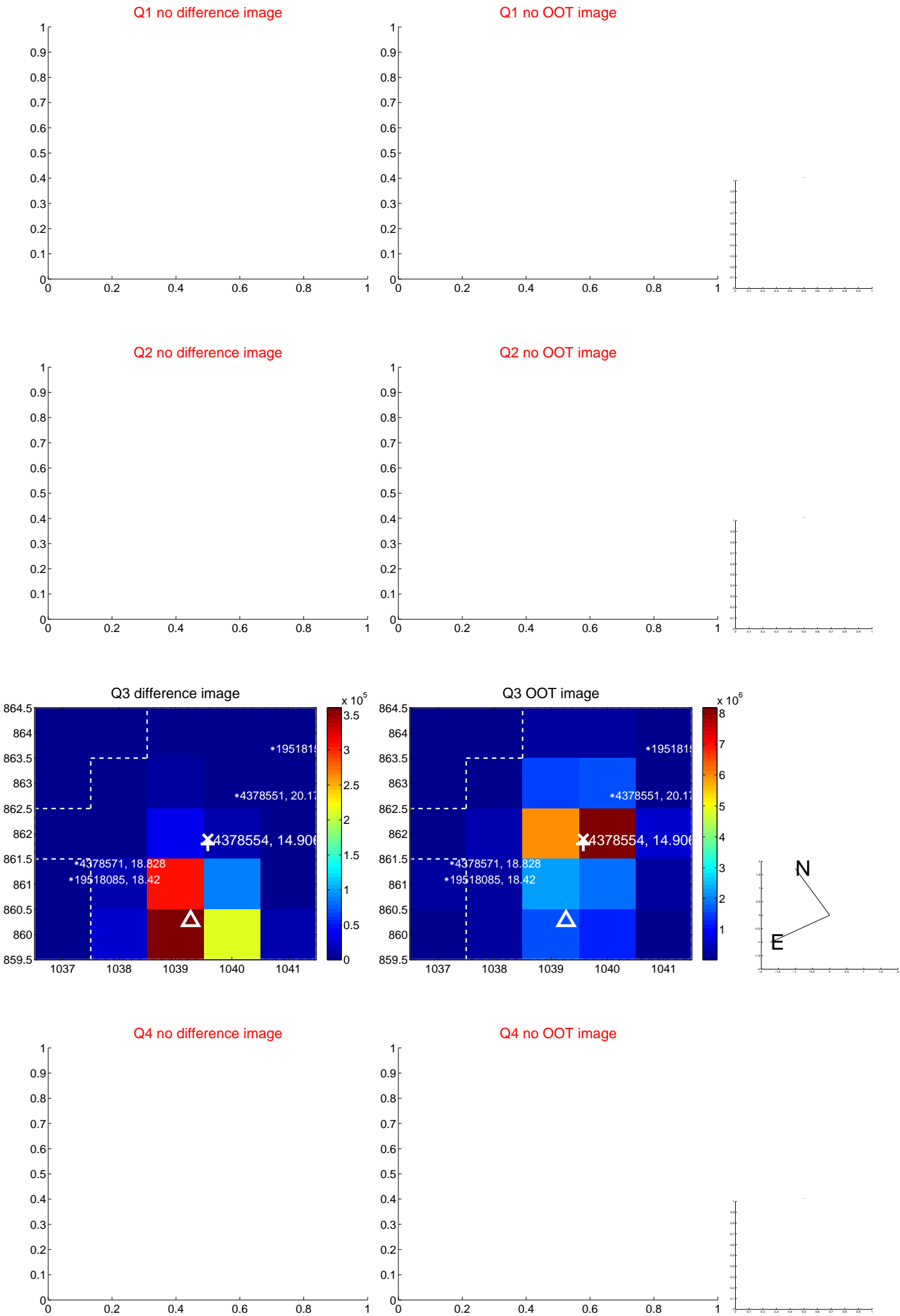
The direct PRF centroid is offset from the target star catalog position by about 0.38 arcsec

| | Distance in arcsec | Distance / σ | Δ RA | Δ Dec |
|---|--------------------|---------------------|-------------------|--------------------|
| PRF-fit source offset from OOT | 6.197 ± 0.067 | 92.86 | 4.098 ± 0.067 | -4.648 ± 0.067 |
| PRF-fit source offset from KIC position | 6.567 ± 0.067 | 98.42 | 4.290 ± 0.067 | -4.973 ± 0.067 |
| photometric centroid source offset | 2.40 ± 0.64 | 3.77 | 1.59 ± 0.61 | -1.79 ± 0.66 |



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 ×: 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.



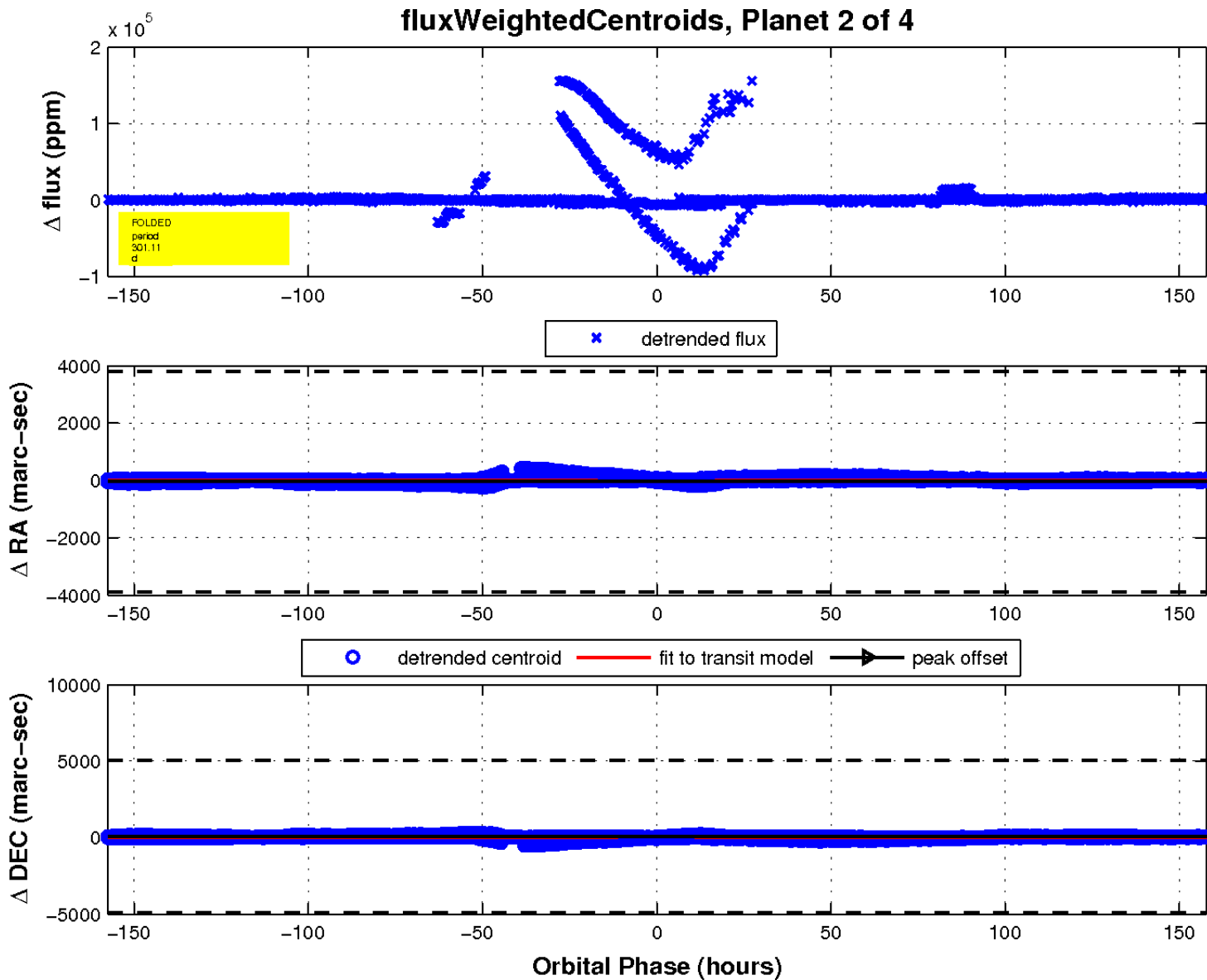
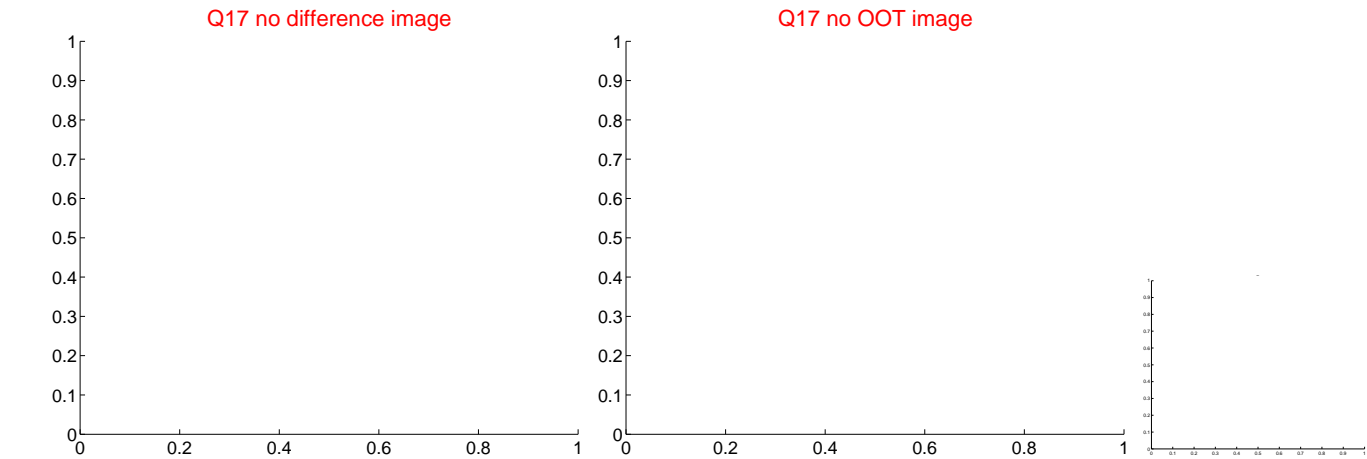
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



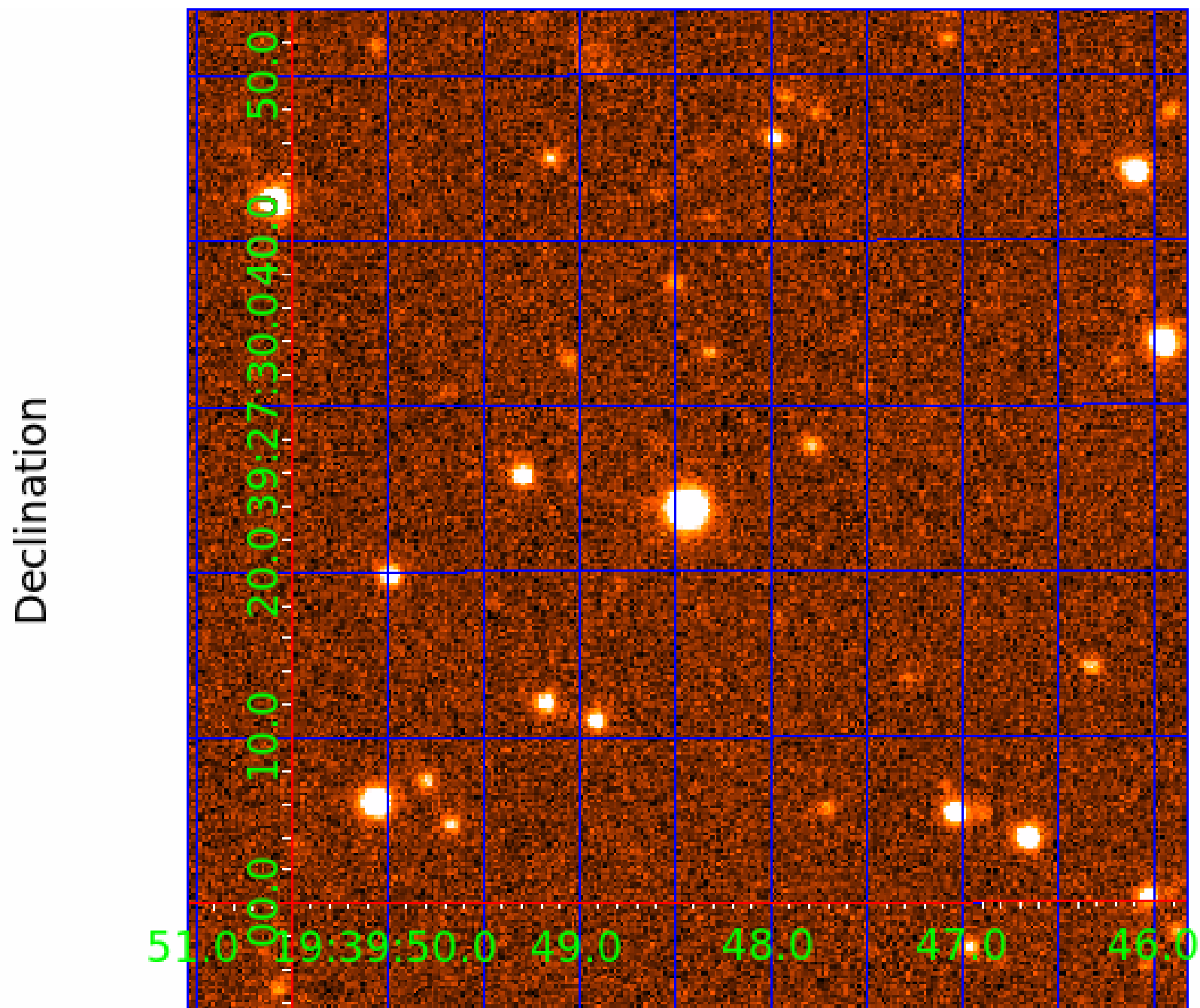
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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



UKIRT Image



KIC 004378554

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}) |
|--------------|----------|------|---------------|--------------|-------------|------------------|-------|------|-----------------------------|-----------------|------------------------|------------------------|
| 004378554-01 | OBS | No | 307.021050 | 339.851572 | 26902.9 | 15.000 | 312.9 | -1.0 | 0.87 | 5845 | 14.26 | 1.03 |
| 004378554-02 | OBS | No | 301.108177 | 342.265251 | 29745.4 | 52.605 | 213.2 | 68.2 | 0.87 | 5845 | 26.22 | 1.05 |
| 004378554-03 | OBS | No | 300.591290 | 358.173664 | 17280.1 | 15.000 | 146.6 | -1.0 | 0.87 | 5845 | 11.42 | 1.06 |
| 004378554-04 | OBS | No | 209.707241 | 298.587602 | 19840.7 | 84.939 | 124.8 | 86.5 | 0.87 | 5845 | 21.66 | 1.71 |

Robovetter Results

| TCE | Run Type | Disp | Score | N | S | C | E | Comments |
|--------------|----------|------|-------|---|---|---|---|--|
| 004378554-01 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | INDIV_TRANS_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS |
| 004378554-02 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS |
| 004378554-03 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS |
| 004378554-04 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | INDIV_TRANS_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS |

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

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

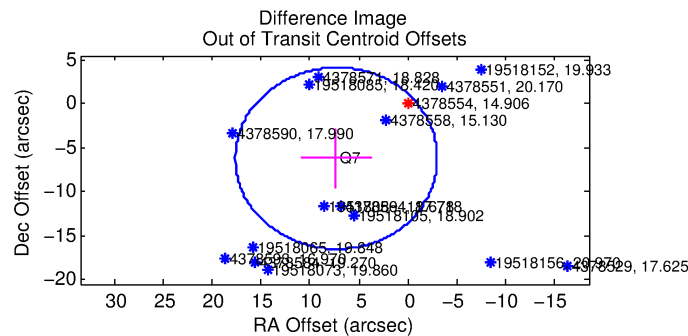
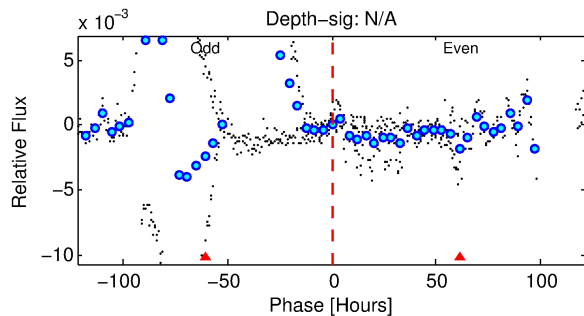
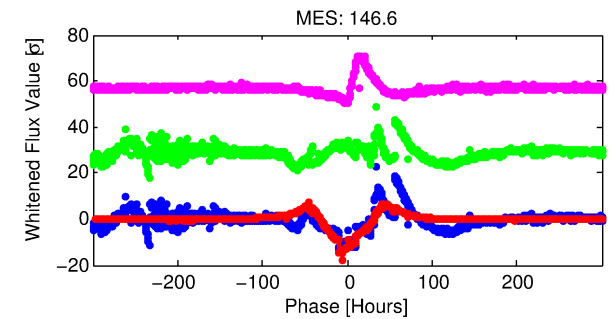
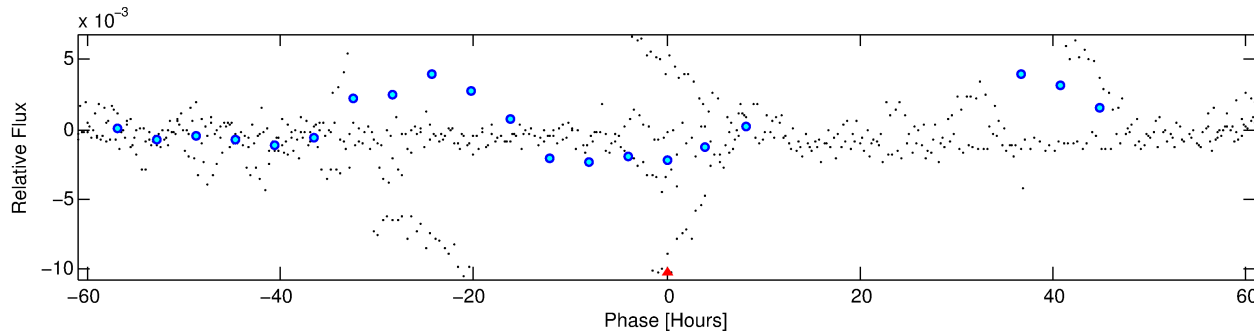
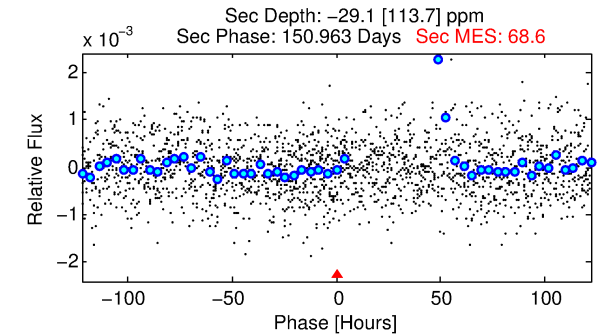
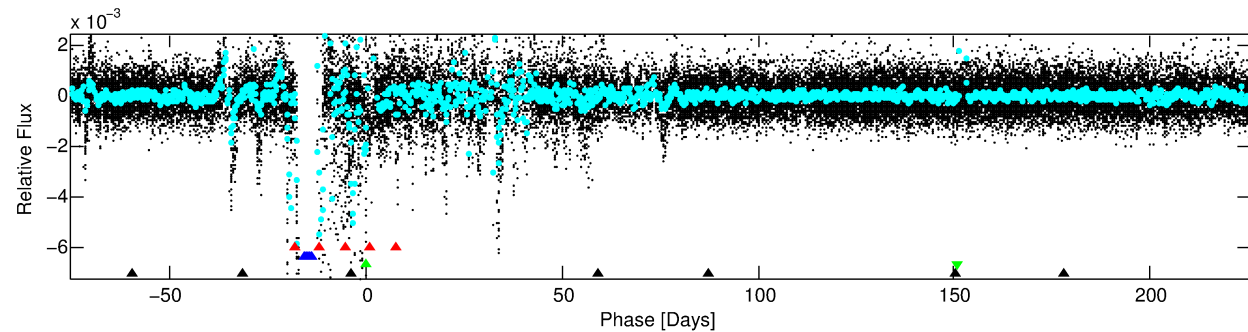
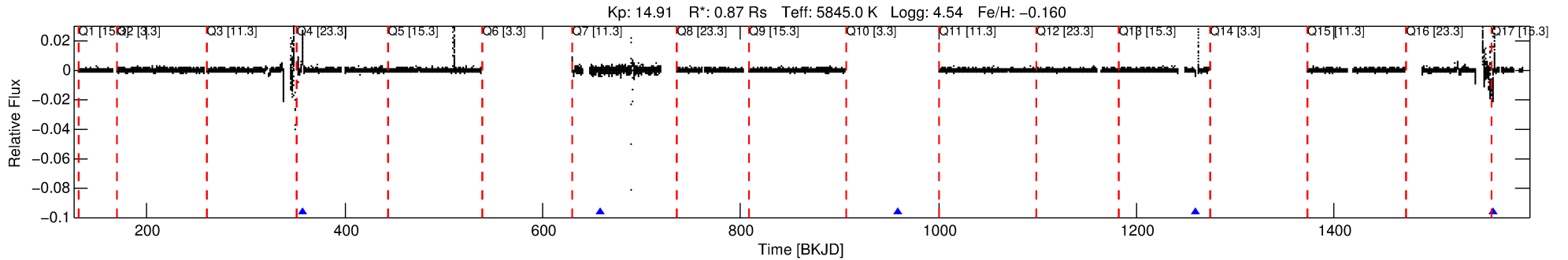
See http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col for comment definitions.

Ephemeris Match Information For 004378554-03

No Significant Match Found

DV One-Page Summary

KIC: 4378554 Candidate: 3 of 4 Period: 300.591 d



TPS TCE Results:

Period = 300.59129 d
Epoch = 358.1737 BKJD

DV fit results are unavailable

DV Diagnostic Results:

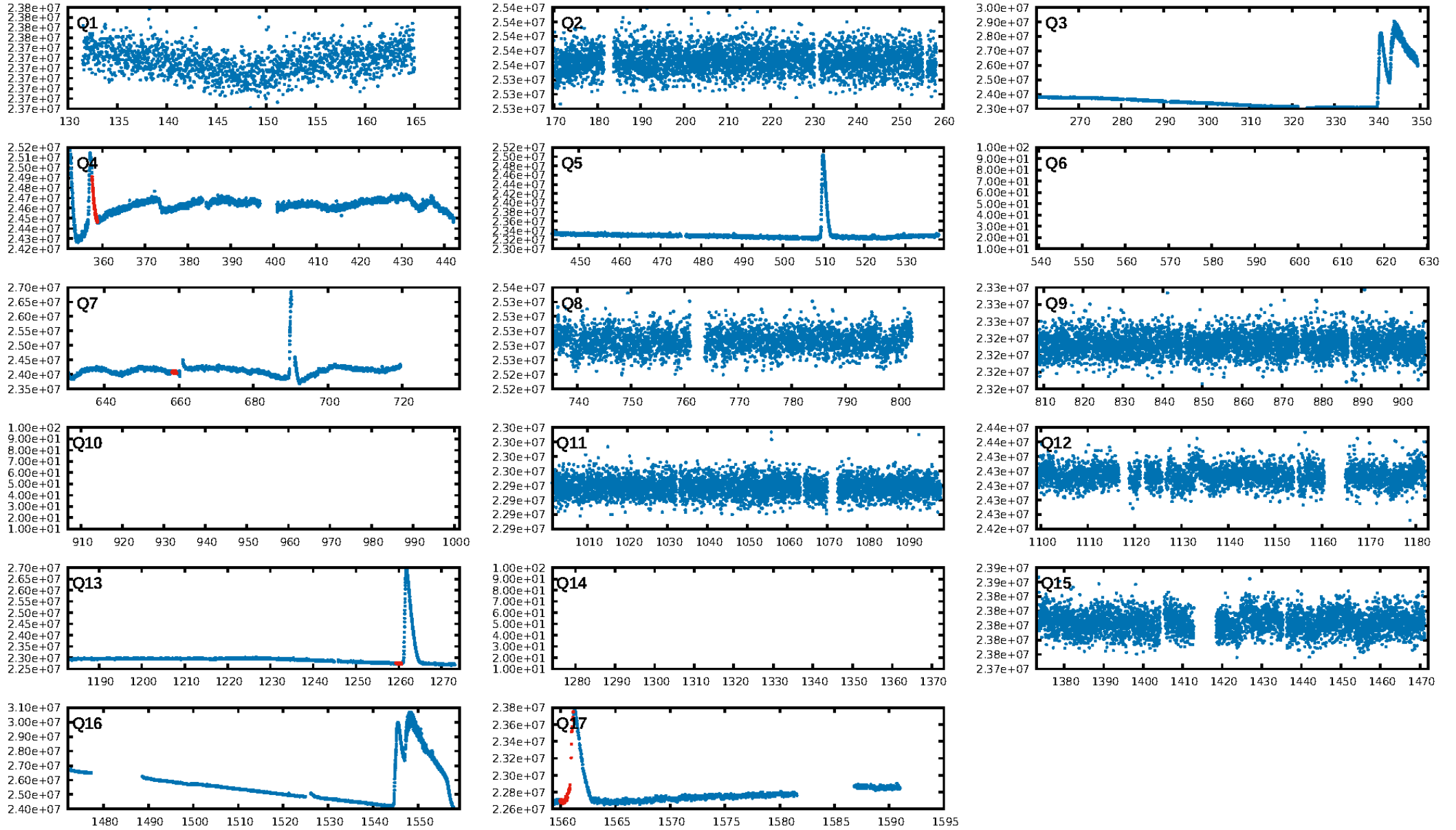
ShortPeriod-sig: 100.0% [25.29σ]
LongPeriod-sig: 17.9% [0.23σ]
ModelChiSquare2-sig: N/A
ModelChiSquareGof-sig: N/A
Bootstrap-pfa: 7.11e-35
RollingBand-fgt: 1.00 [3/3]
GhostDiagnostic-chr: -3.806

Centroid-sig: 48.3%
Centroid-so: 1.060 arcsec [1.21σ]
OotOffset-rm: 9.579 arcsec [2.78σ]
KicOffset-rm: 9.491 arcsec [2.76σ]
OotOffset-st: 0/1/0/0 [1]
KicOffset-st: 0/1/0/0 [1]
DiffImageQuality-fgm: 0.00 [0/1]
DiffImageOverlap-fno: 0.67 [2/3]

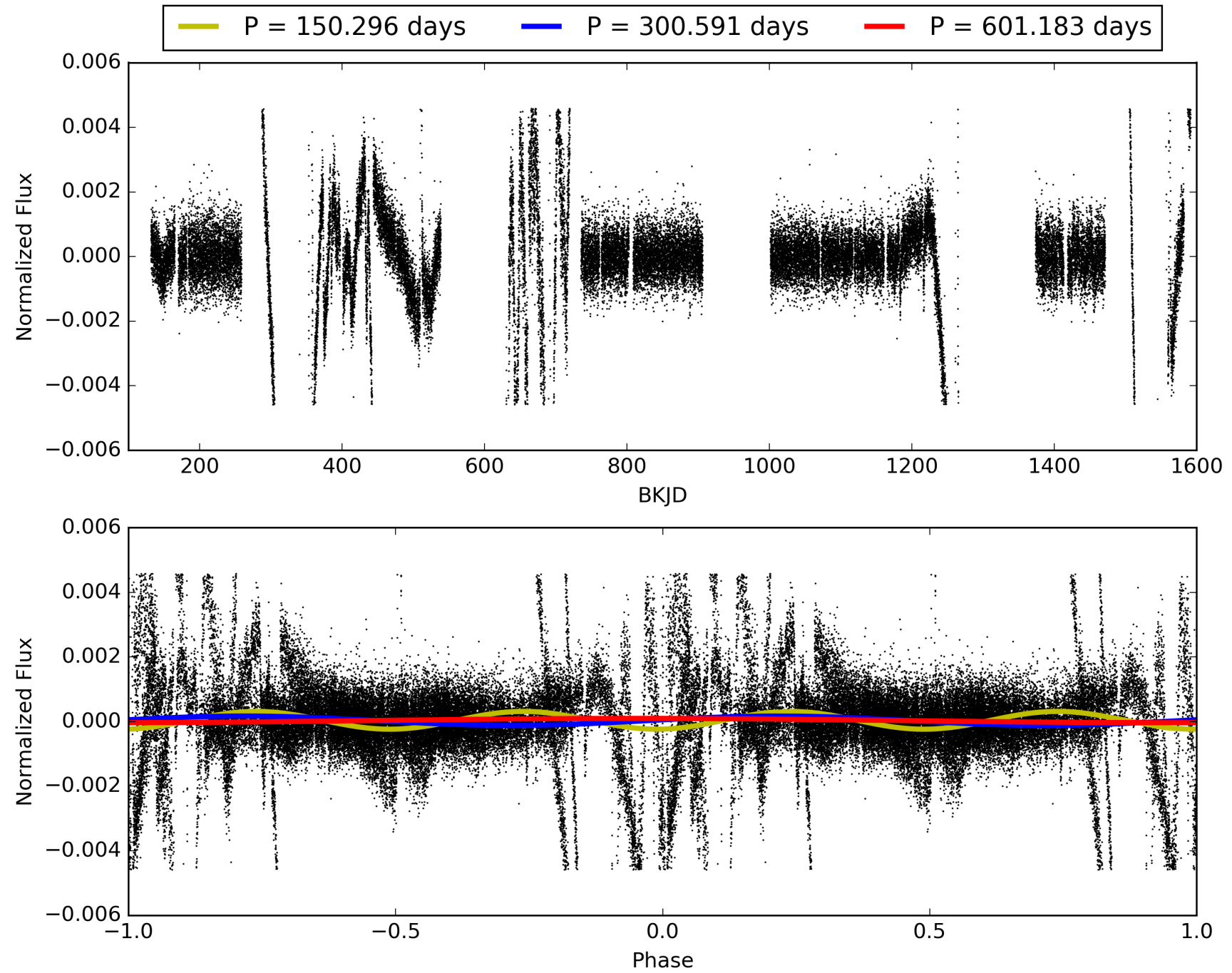
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 18:03:45 Z

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

TCE 004378554-03, PDC Light Curves

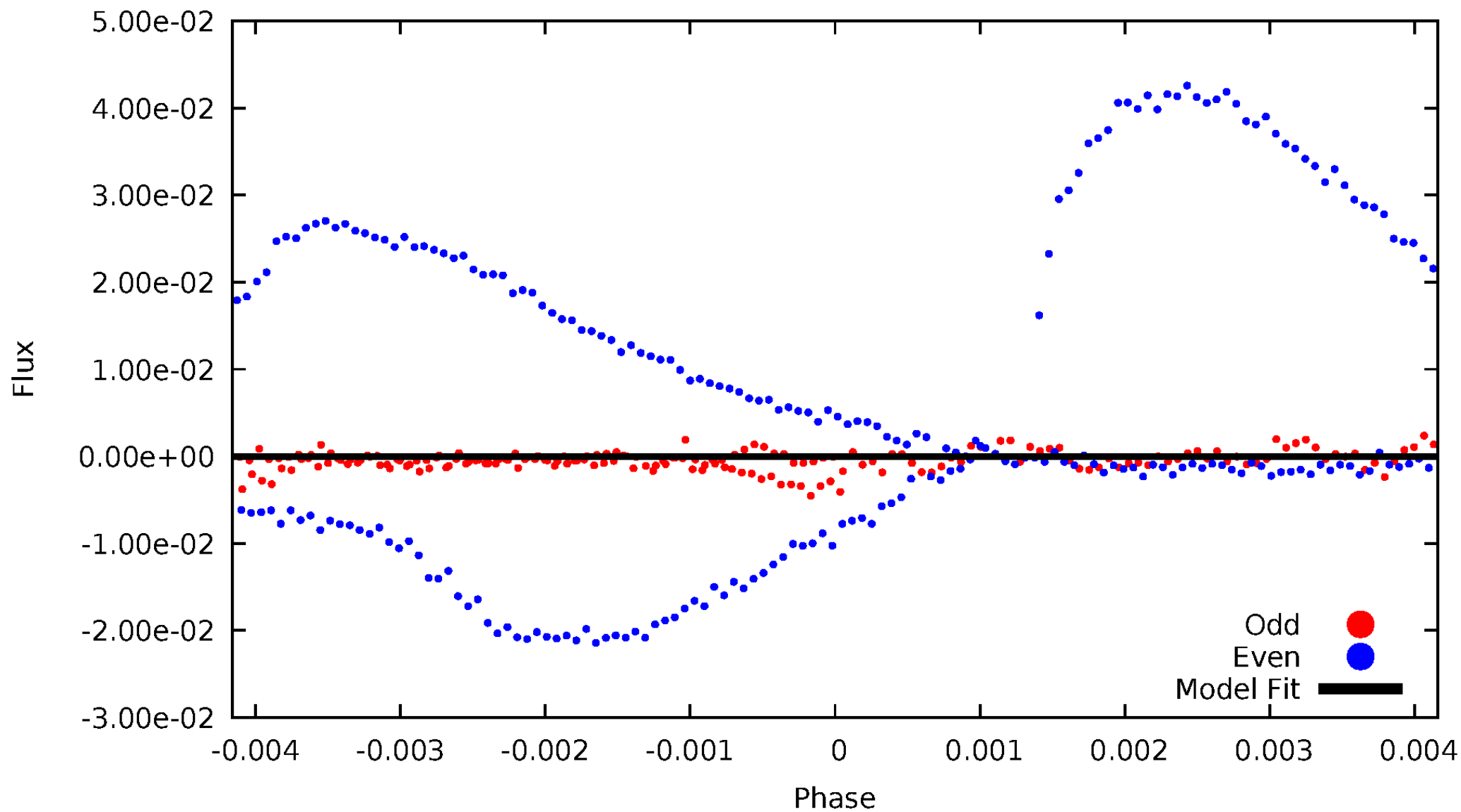


TCE 004378554-03



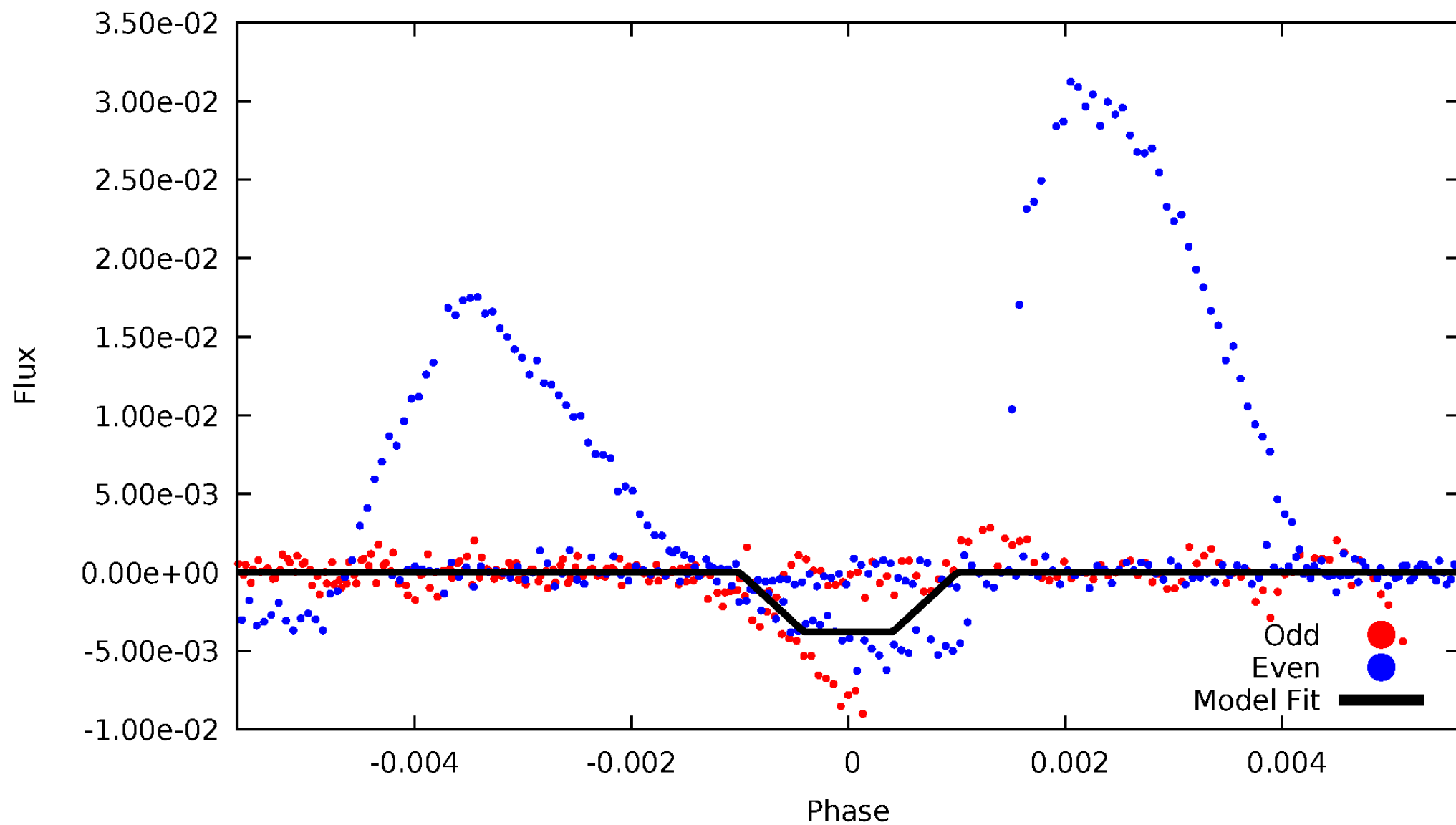
DV Odd/Even

TCE 004378554-03



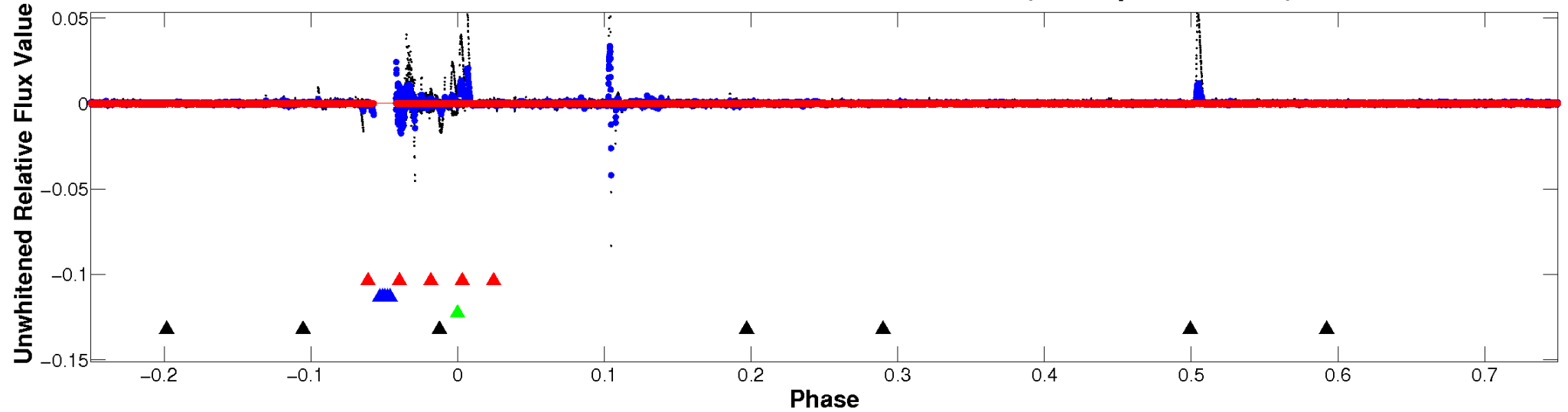
ALT Odd/Even

TCE 004378554-03



Non-Whitened Vs. Whitened Light Curve

Planet 3 : Phased Unwhitened Flux Time Series (TPS Epoch/Period)

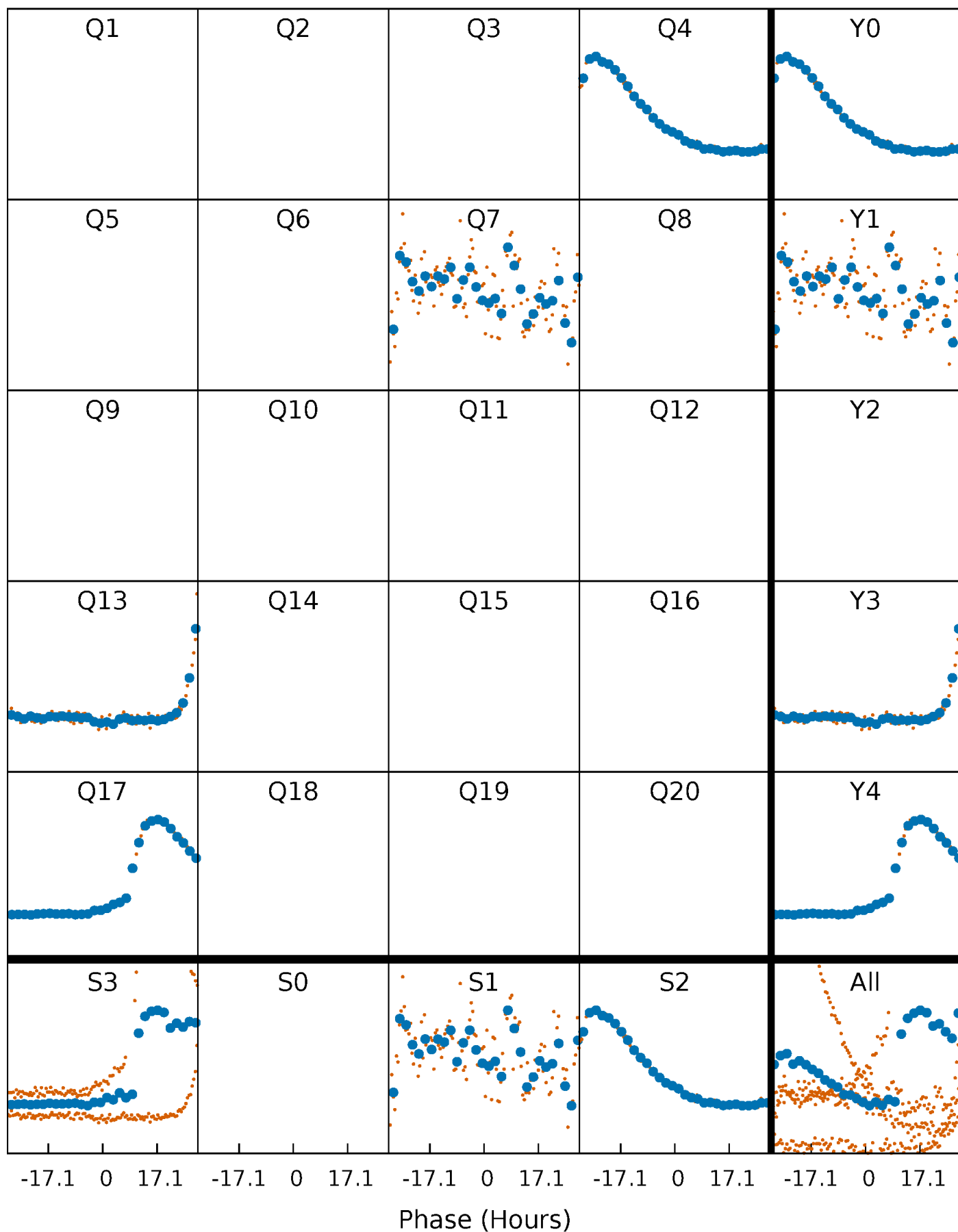


Planet 3 : Phased Whitened Flux Time Series (TPS Epoch/Period)



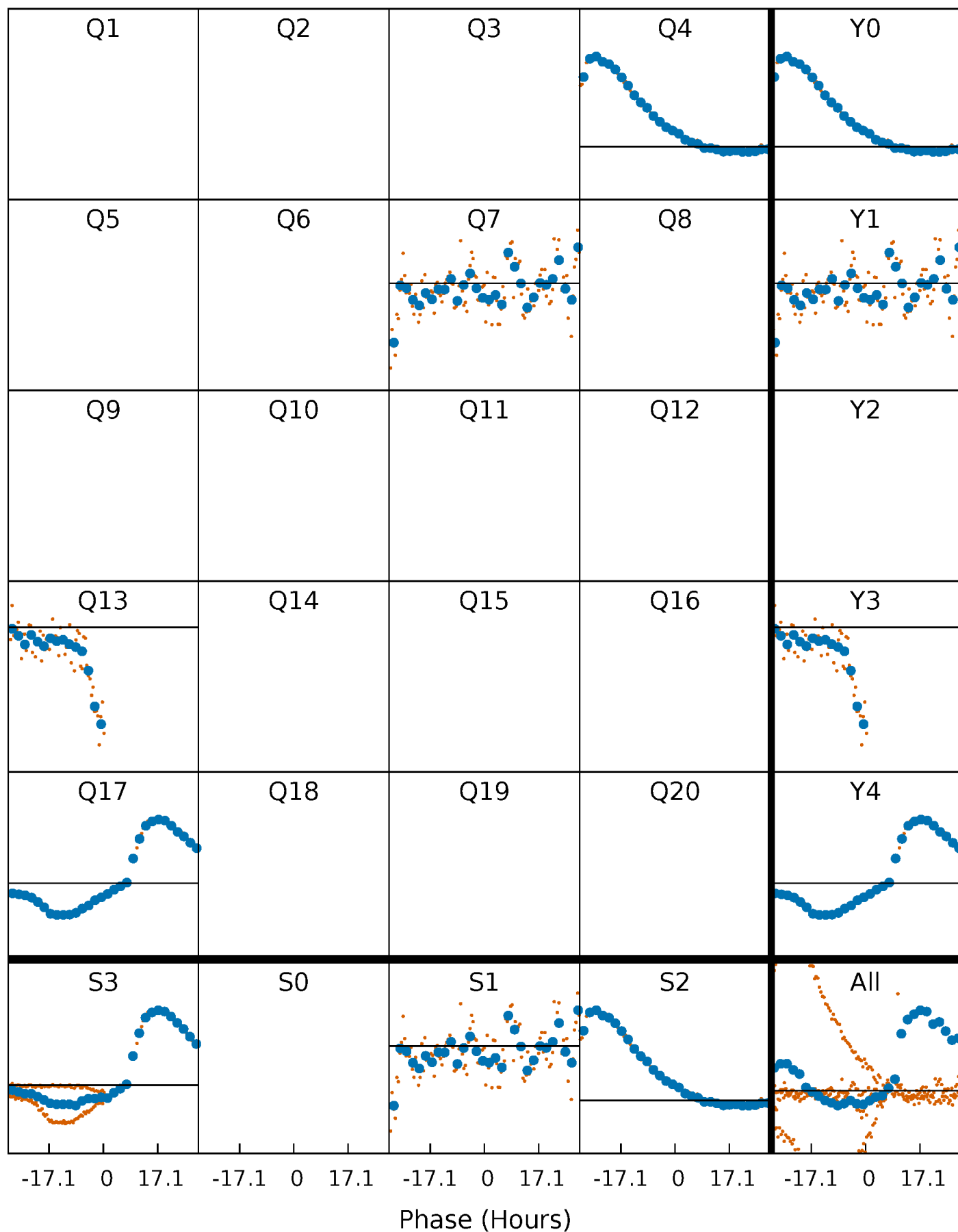
PDC Quarter-Phased Transit Curves

TCE 004378554-03 $P=300.591290$ Days $T_0=358.173664$ (BKJD)



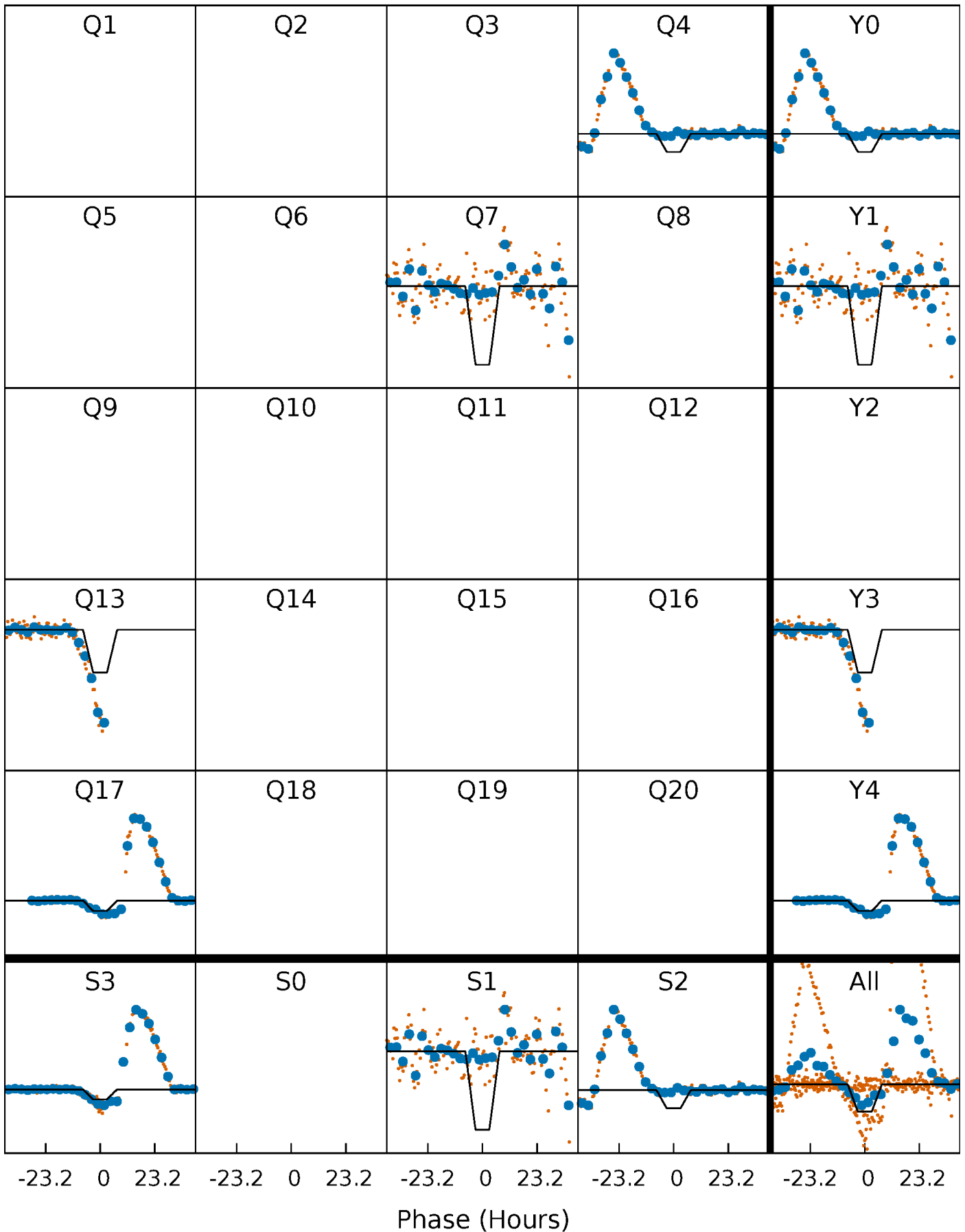
DV Quarter-Phased Transit Curves

TCE 004378554-03 $P=300.591290$ Days $T_0=358.173664$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

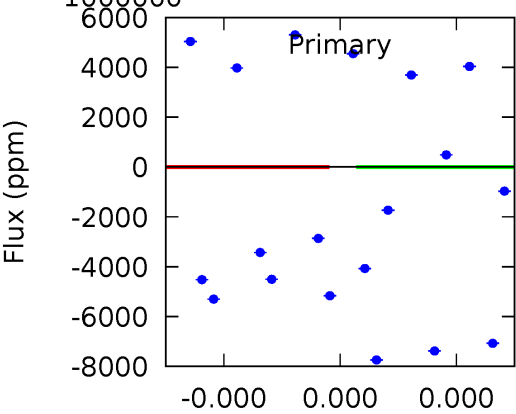
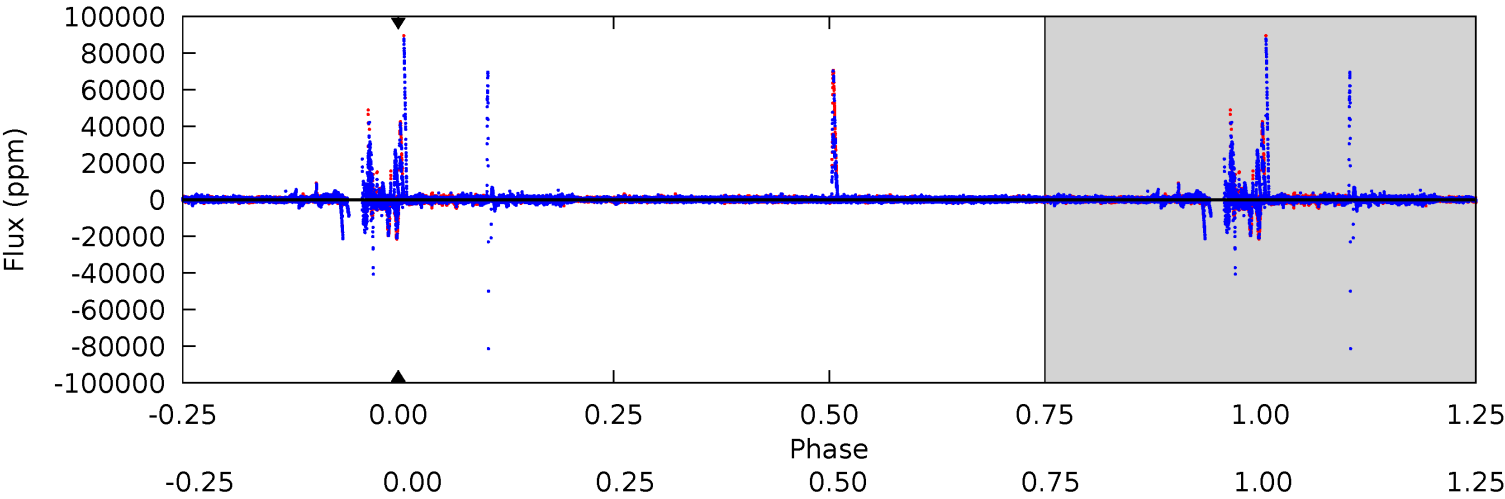
TCE 004378554-03 P=300.591290 Days $T_0=358.144129$ (BKJD)



DV Model-Shift Uniqueness Test

004378554-03, P = 300.591290 Days, E = 57.582374 Days

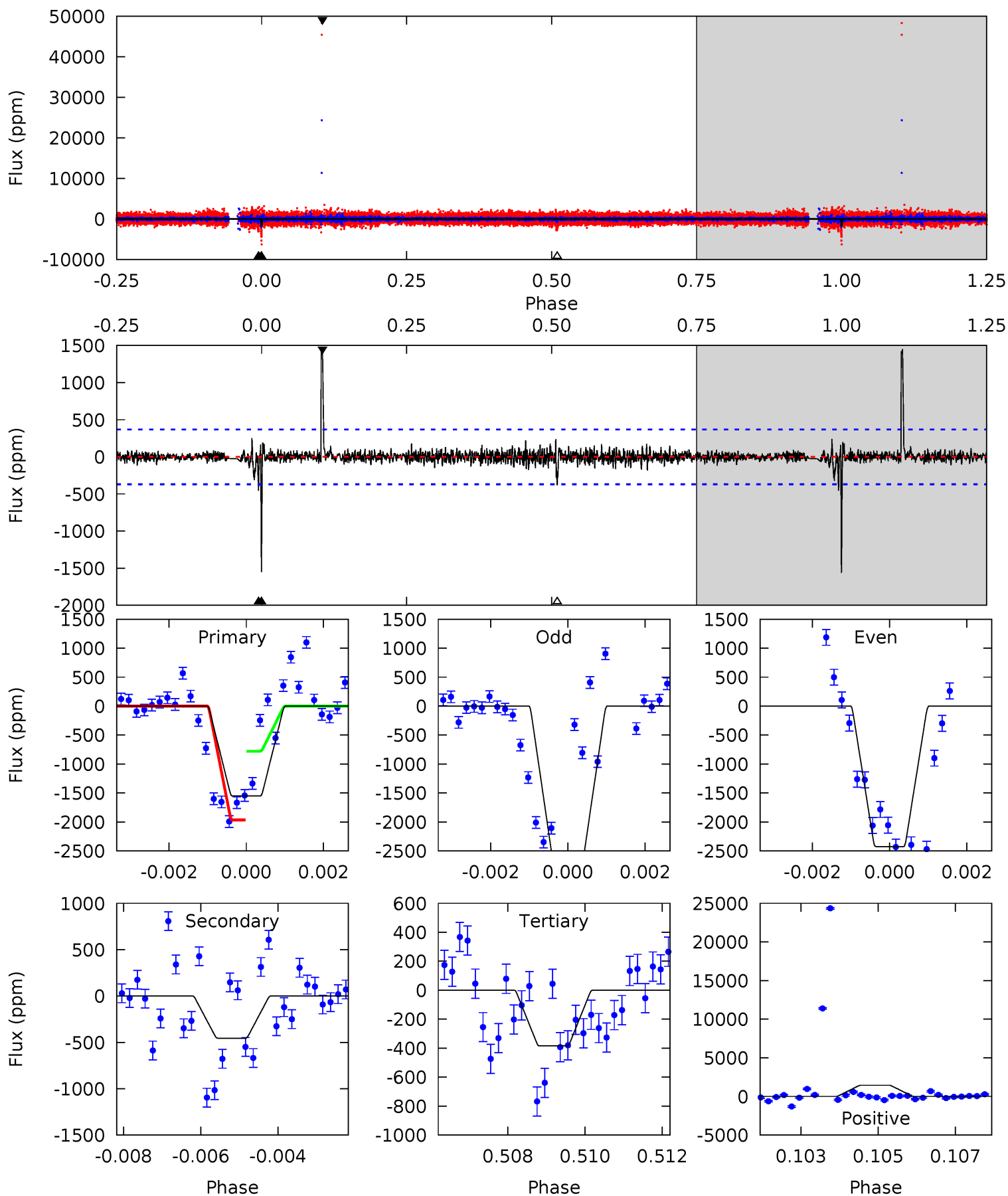
| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|-----|-----|-----|-----|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|-----|-------|-----|
| 0 | 0 | 0 | 0 | 1.00 | 1.00 | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |



Alt Model-Shift Uniqueness Test

004378554-03, P = 300.591290 Days, E = 57.552839 Days

| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|-----|
| 22.4 | 6.55 | 5.53 | 20.9 | 5.32 | 3.08 | 1.04 | 16.8 | 1.50 | 1.02 | -14.3 | 0.24 | 1.20 | 0.48 | 0 |



Stellar Parameters For KIC 004378554

| | $T_{\text{eff}}(K)$ | $\log(g)$ | [Fe/H] | R (R_{\odot}) | M (M_{\odot}) | p_{\star} ($\text{g}\cdot\text{cm}^{-3}$) |
|--------|----------------------|---------------------------|----------------------------|---------------------------|---------------------------|---|
| | 5845^{+158}_{-176} | $4.541^{+0.038}_{-0.200}$ | $-0.160^{+0.300}_{-0.300}$ | $0.874^{+0.264}_{-0.082}$ | $0.968^{+0.108}_{-0.120}$ | $2.042^{+0.417}_{-1.074}$ |
| | +3%/-3% | +1%/-4% | +188%/-188% | +30%/-9% | +11%/-12% | +20%/-53% |
| 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 004378554-03 / KOI

| Detrend | Depth (ppm) | R_p (R_{\oplus}) | T_{max} (K) | T_{obs} (K) | A_{obs} |
|---------|-----------------|-------------------------|-------------------|--------------------------|---|
| DV | 0 ± 1000000 | $13.00^{+9.35}_{-8.37}$ | 369^{+24}_{-15} | -3939^{+16805}_{-7287} | $-4942.663^{+458729.324}_{-322267.159}$ |
| Alt. | -455 ± 69 | $9.51^{+8.68}_{-6.17}$ | 369^{+25}_{-16} | 3345^{+1395}_{-581} | 2036^{+13968}_{-1483} |

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

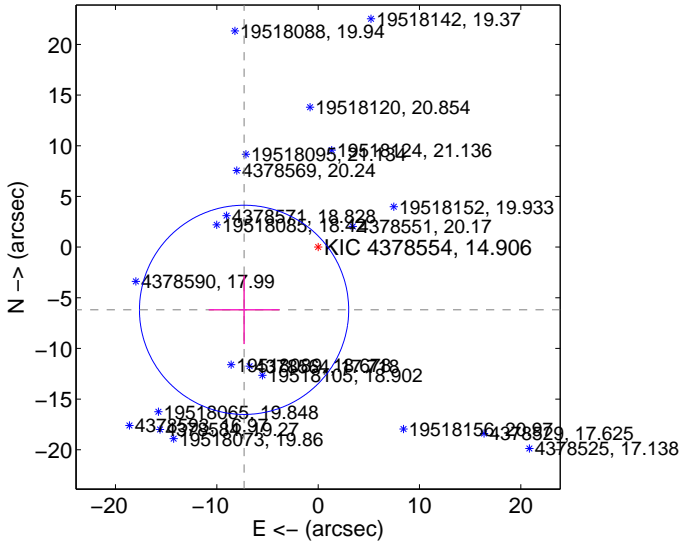
Supplemental centroid analysis for 004378554-03. Kepler magnitude: 14.91. Transit SNR -1.00

There are 0 quarters with good PRF difference image offsets

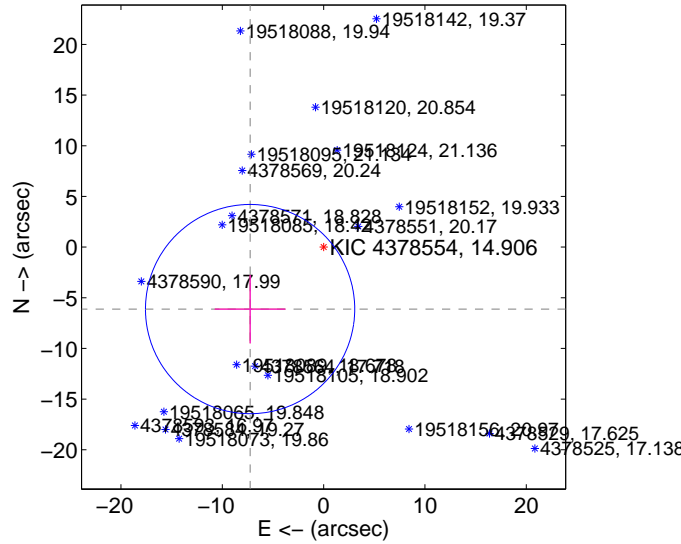
The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

| | Distance in arcsec | Distance / σ | Δ RA | Δ Dec |
|---|--------------------|---------------------|-------------------|--------------------|
| PRF-fit source offset from OOT | 9.579 ± 3.441 | 2.78 | 7.310 ± 3.485 | -6.191 ± 3.379 |
| PRF-fit source offset from KIC position | 9.491 ± 3.442 | 2.76 | 7.256 ± 3.485 | -6.117 ± 3.379 |
| photometric centroid source offset | 1.06 ± 0.88 | 1.21 | 1.05 ± 0.87 | 0.17 ± 0.93 |

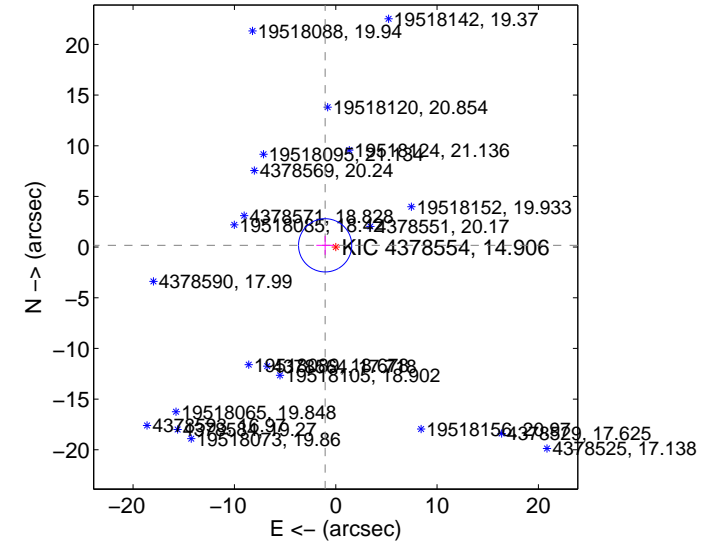
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

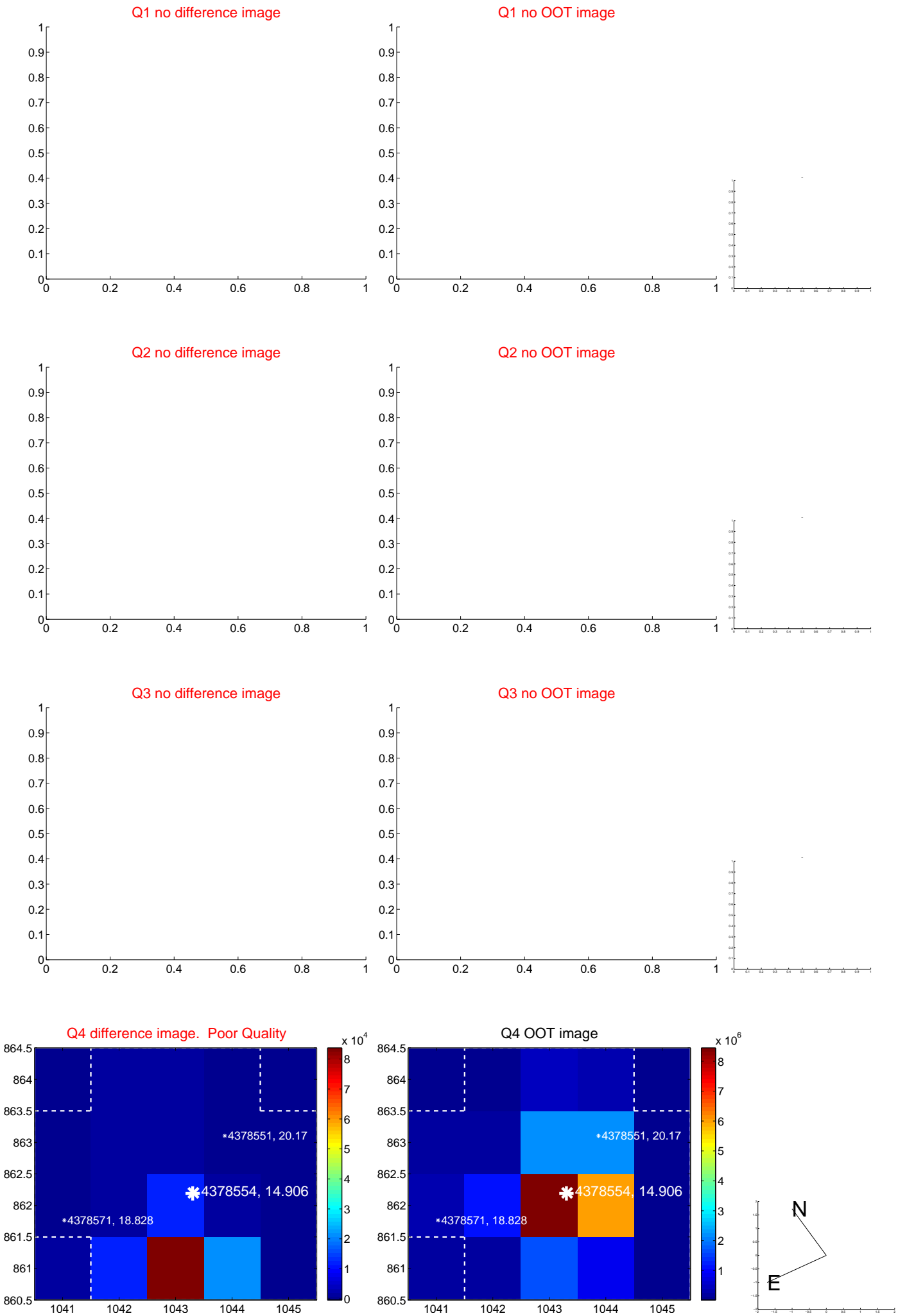


offset from photometric centroids



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 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.

Q5 no difference image



Q5 no OOT image



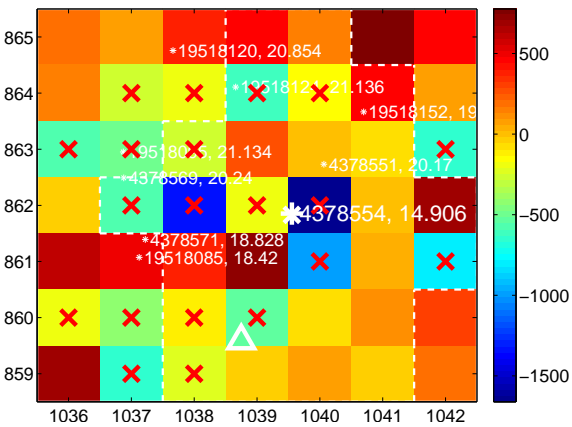
Q6 no difference image



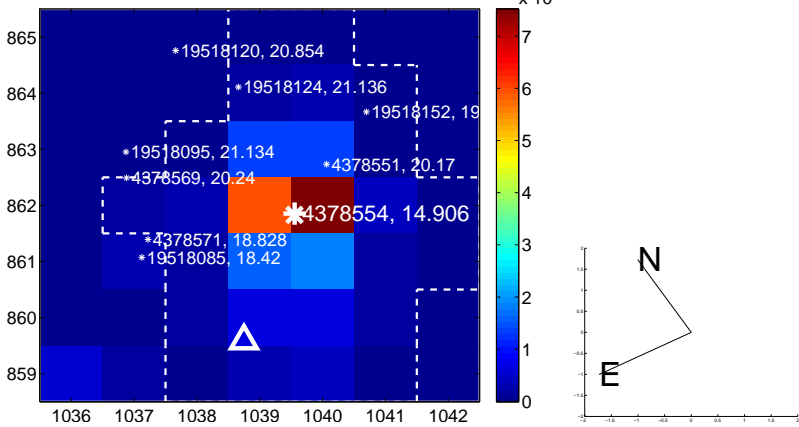
Q6 no OOT image



Q7 difference image. Poor Quality



Q7 OOT image



Q8 no difference image



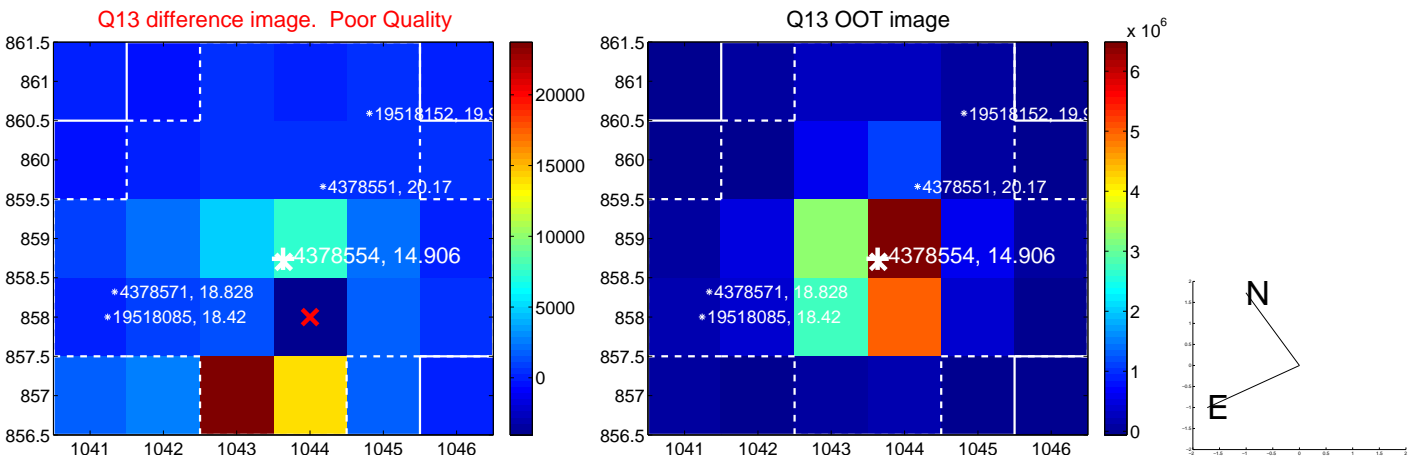
Q8 no OOT image



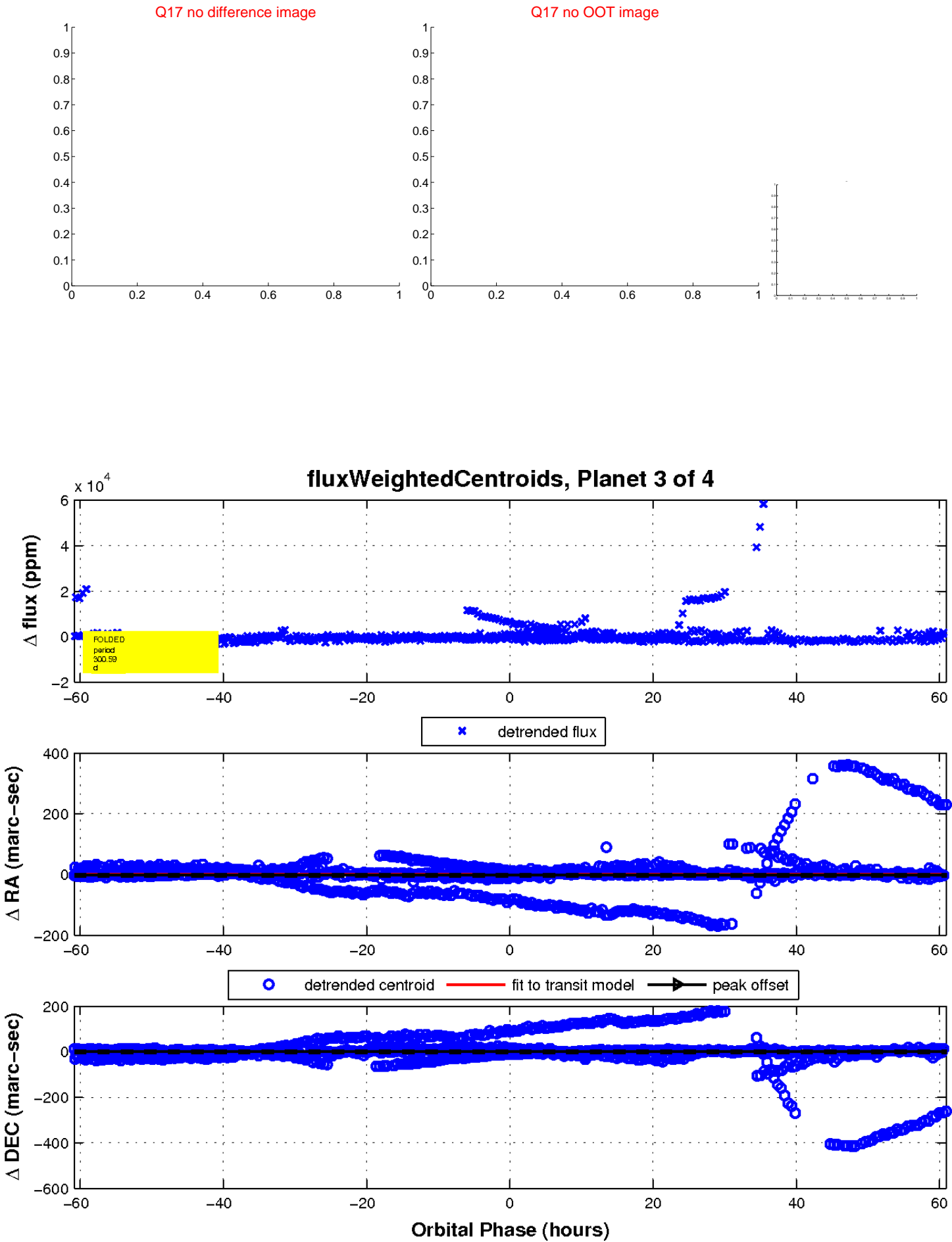
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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

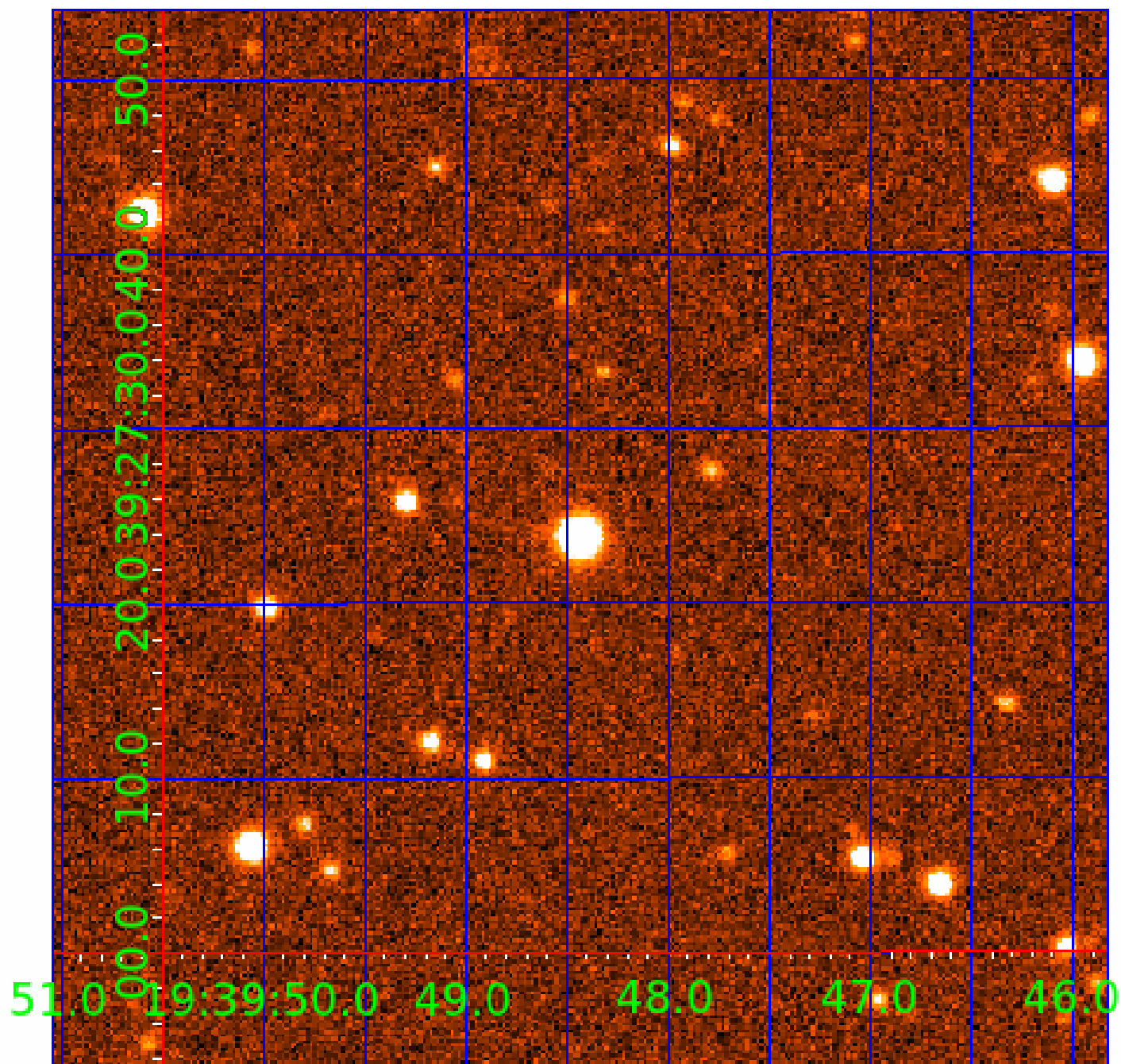


white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



UKIRT Image

Declination



KIC 004378554

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}) |
|--------------|----------|------|---------------|--------------|-------------|------------------|-------|------|-----------------------------|-----------------|------------------------|------------------------|
| 004378554-01 | OBS | No | 307.021050 | 339.851572 | 26902.9 | 15.000 | 312.9 | -1.0 | 0.87 | 5845 | 14.26 | 1.03 |
| 004378554-02 | OBS | No | 301.108177 | 342.265251 | 29745.4 | 52.605 | 213.2 | 68.2 | 0.87 | 5845 | 26.22 | 1.05 |
| 004378554-03 | OBS | No | 300.591290 | 358.173664 | 17280.1 | 15.000 | 146.6 | -1.0 | 0.87 | 5845 | 11.42 | 1.06 |
| 004378554-04 | OBS | No | 209.707241 | 298.587602 | 19840.7 | 84.939 | 124.8 | 86.5 | 0.87 | 5845 | 21.66 | 1.71 |

Robovetter Results

| TCE | Run Type | Disp | Score | N | S | C | E | Comments |
|--------------|----------|------|-------|---|---|---|---|--|
| 004378554-01 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | INDIV_TRANS_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS |
| 004378554-02 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS |
| 004378554-03 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS |
| 004378554-04 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | INDIV_TRANS_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS |

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

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

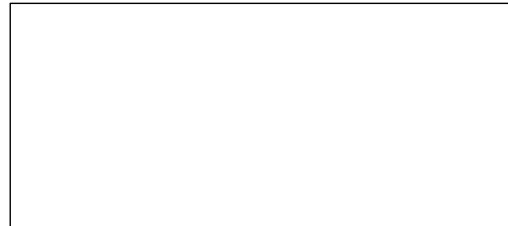
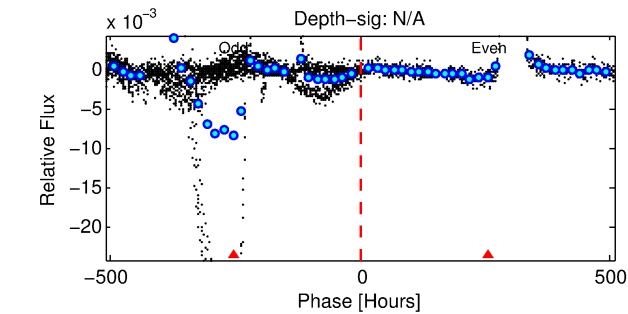
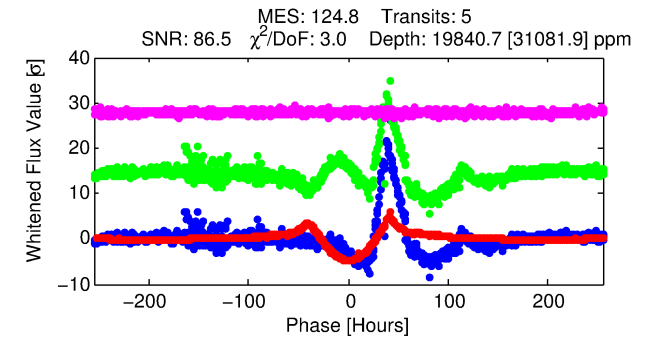
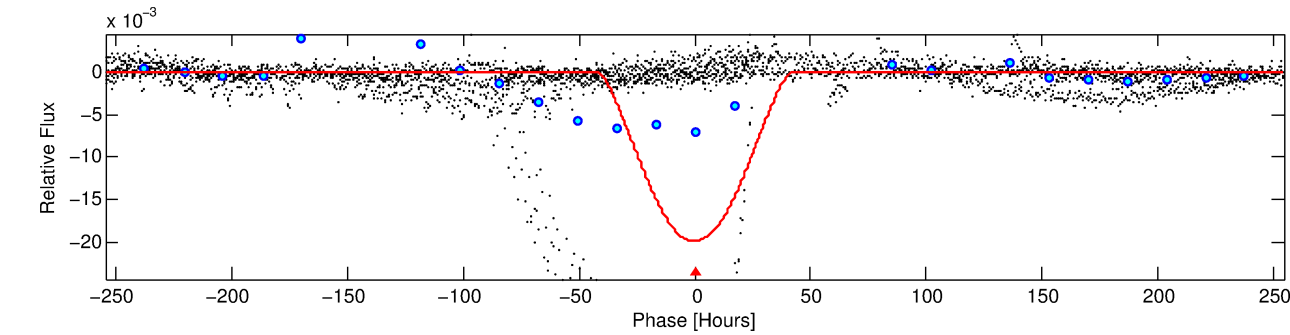
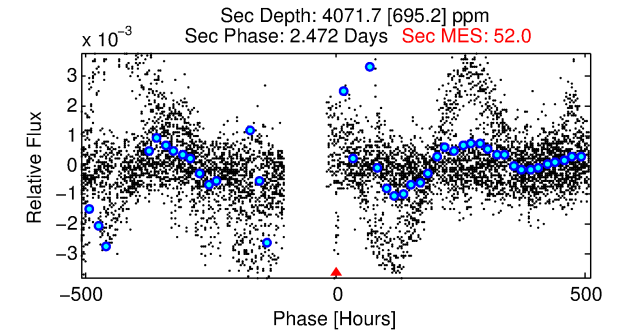
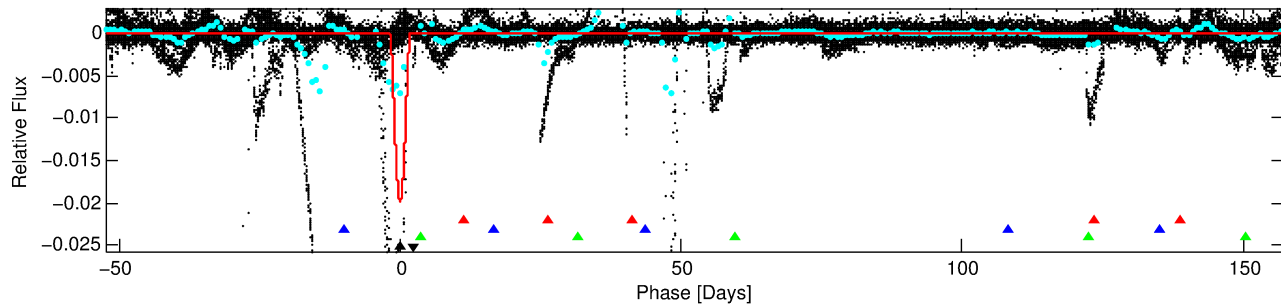
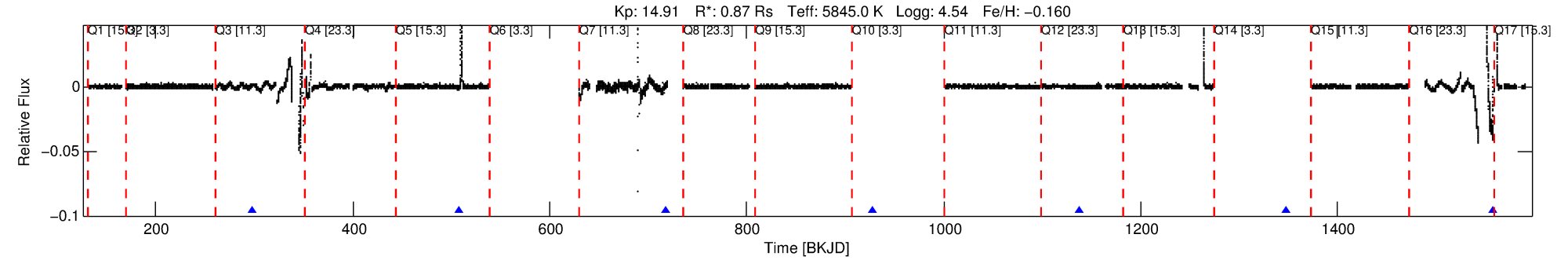
See http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col for comment definitions.

Ephemeris Match Information For 004378554-04

No Significant Match Found

DV One-Page Summary

KIC: 4378554 Candidate: 4 of 4 Period: 209.707 d



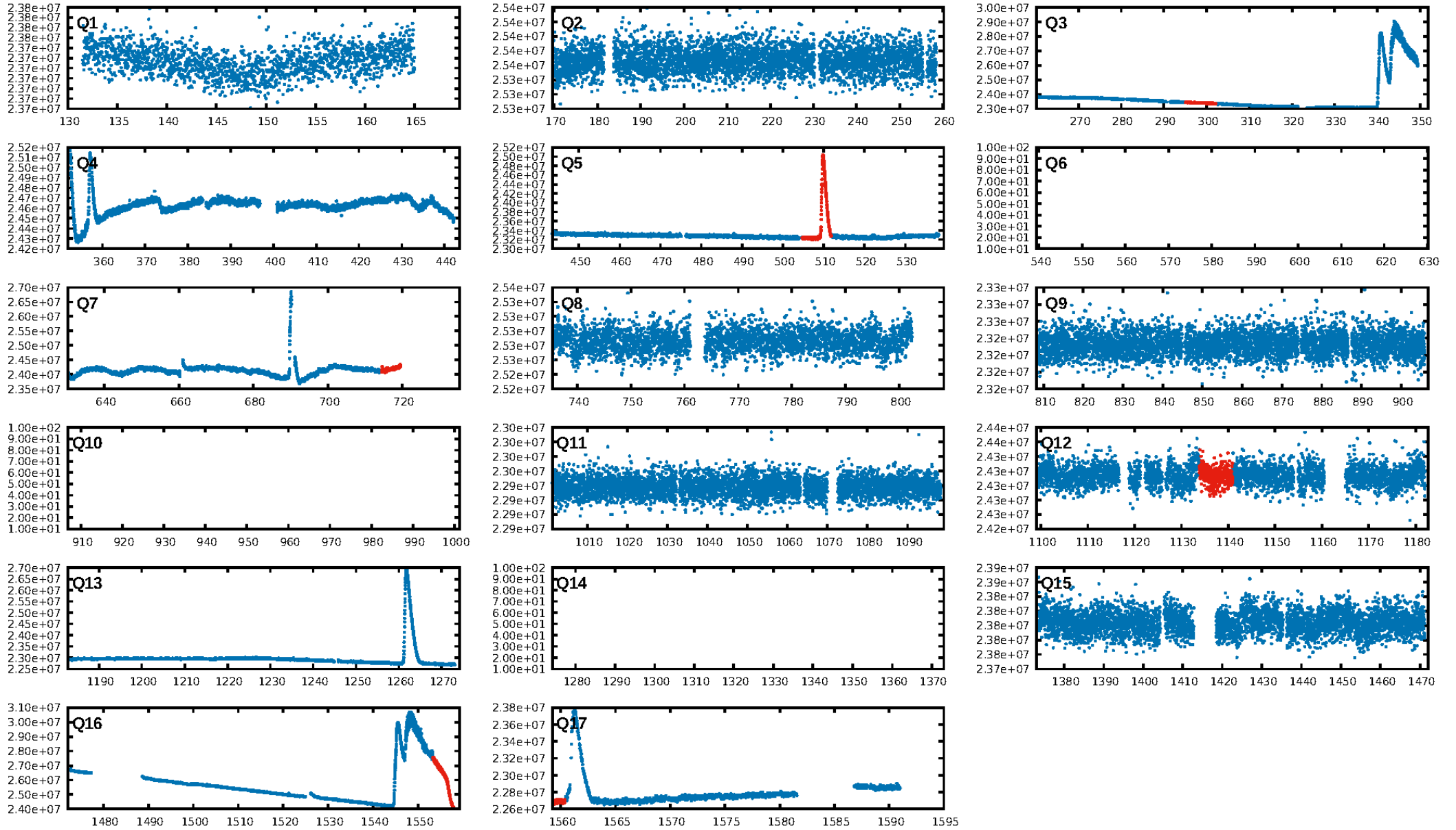
DV Fit Results:

Period = 209.70724 [0.00630] d
Epoch = 298.5876 [0.0167] BKJD
Rp/R* = 0.2271 [0.0847]
a/R* = 13.46 [0.48]
b = 1.00 [0.12]
Seff = 1.71 [0.66]
Teq = 292 [28] K
Rp = 21.66 [10.39] Re
a = 0.6836 [0.1731] AU
Ag = 2231.96 [1894.61] [1.18 σ]
Teff = 3099 [600] K [4.67 σ]

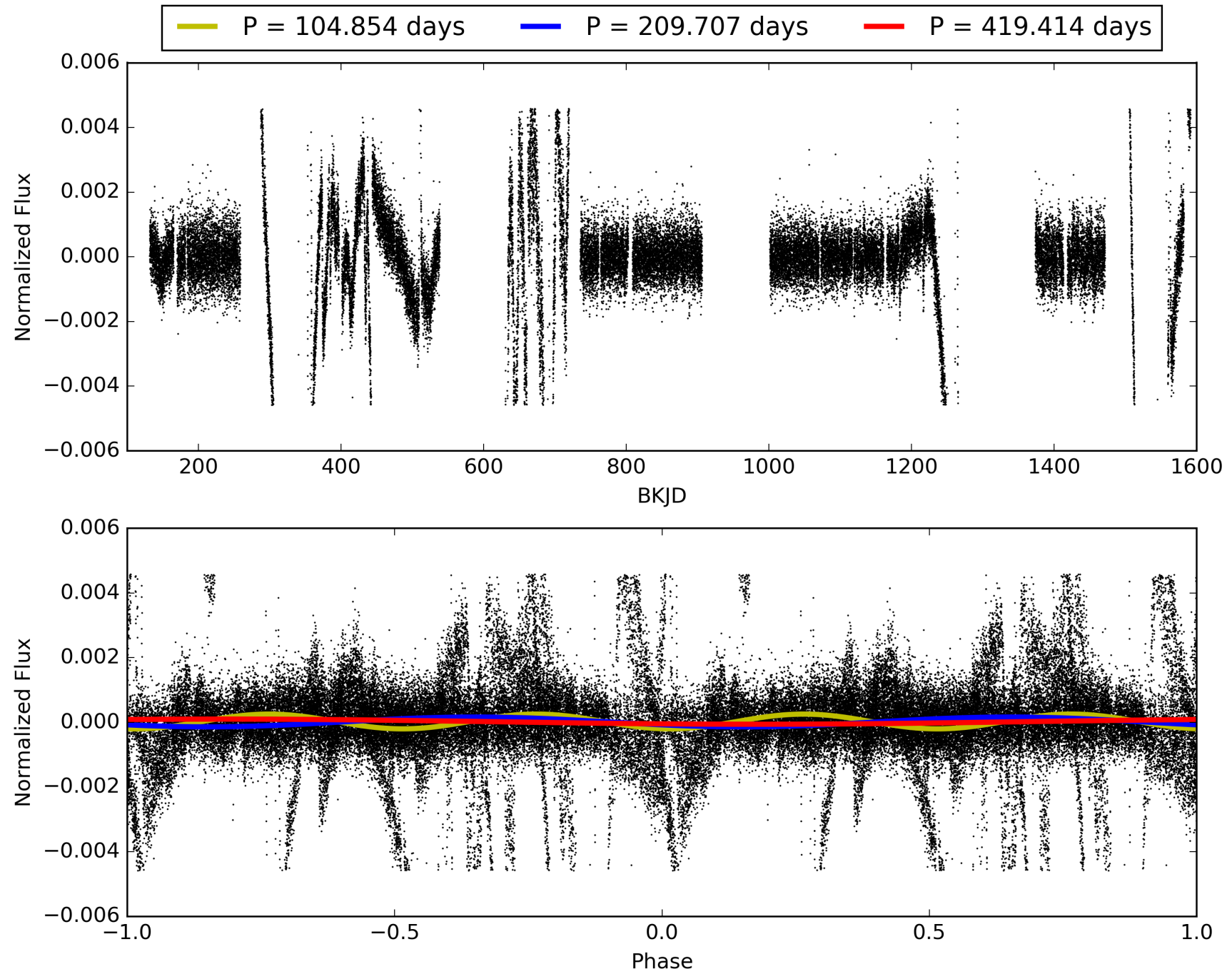
DV Diagnostic Results:

ShortPeriod-sig: N/A
LongPeriod-sig: 100.0% [25.29 σ]
ModelChiSquare2-sig: 0.0%
ModelChiSquareGof-sig: 0.0%
Bootstrap-pfa: 2.08e-52
RollingBand-fgt: 1.00 [5/5]
GhostDiagnostic-chr: -4.616
Centroid-sig: 2.6%
Centroid-so: 0.270 arcsec [2.96 σ]
OotOffset-rm: N/A
KicOffset-rm: N/A
OotOffset-st: 0/0/0/0 [0]
KicOffset-st: 0/0/0/0 [0]
DiffImageQuality-fgm: N/A
DiffImageOverlap-fno: 1.00 [1/1]

TCE 004378554-04, PDC Light Curves

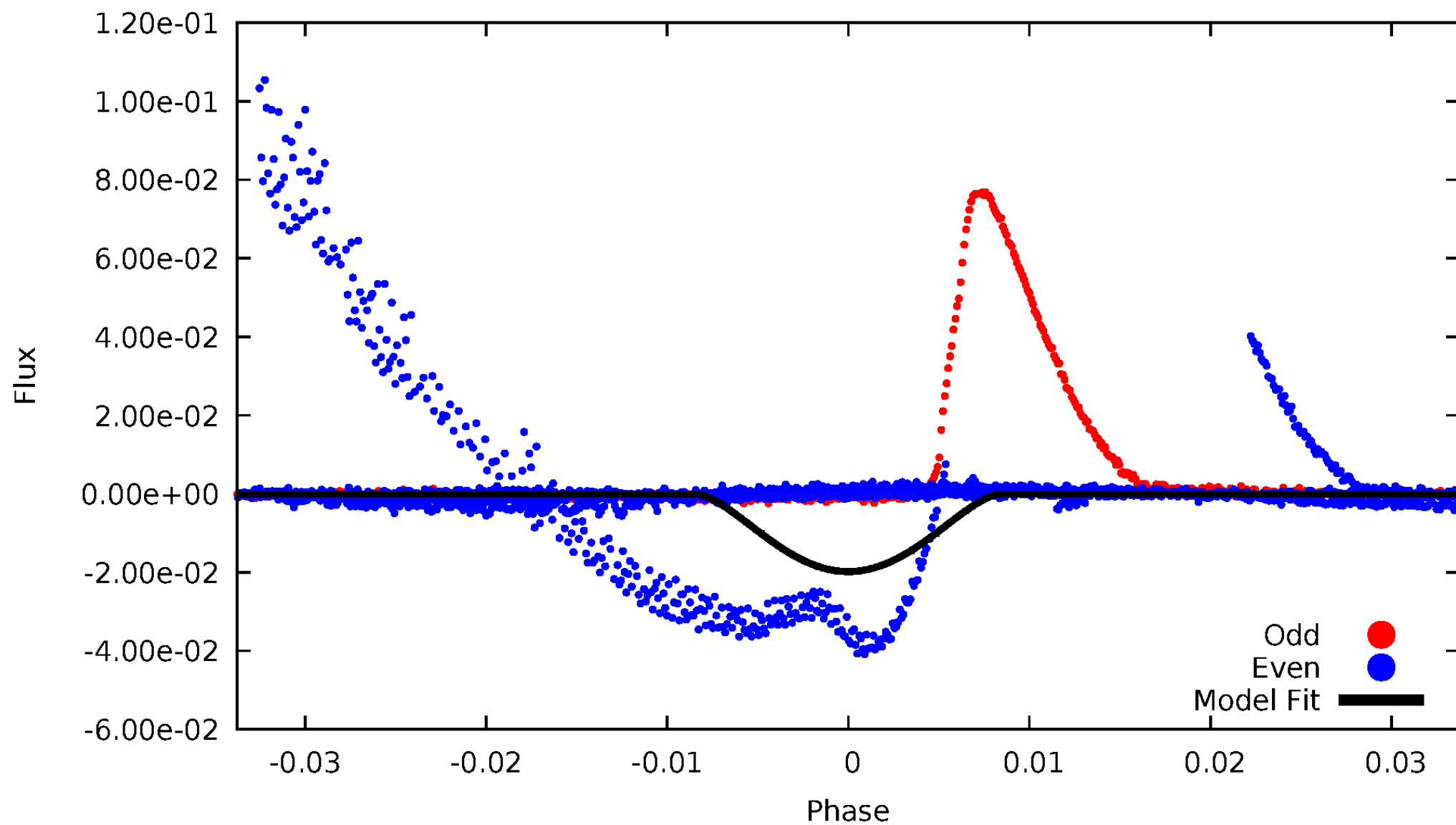


TCE 004378554-04



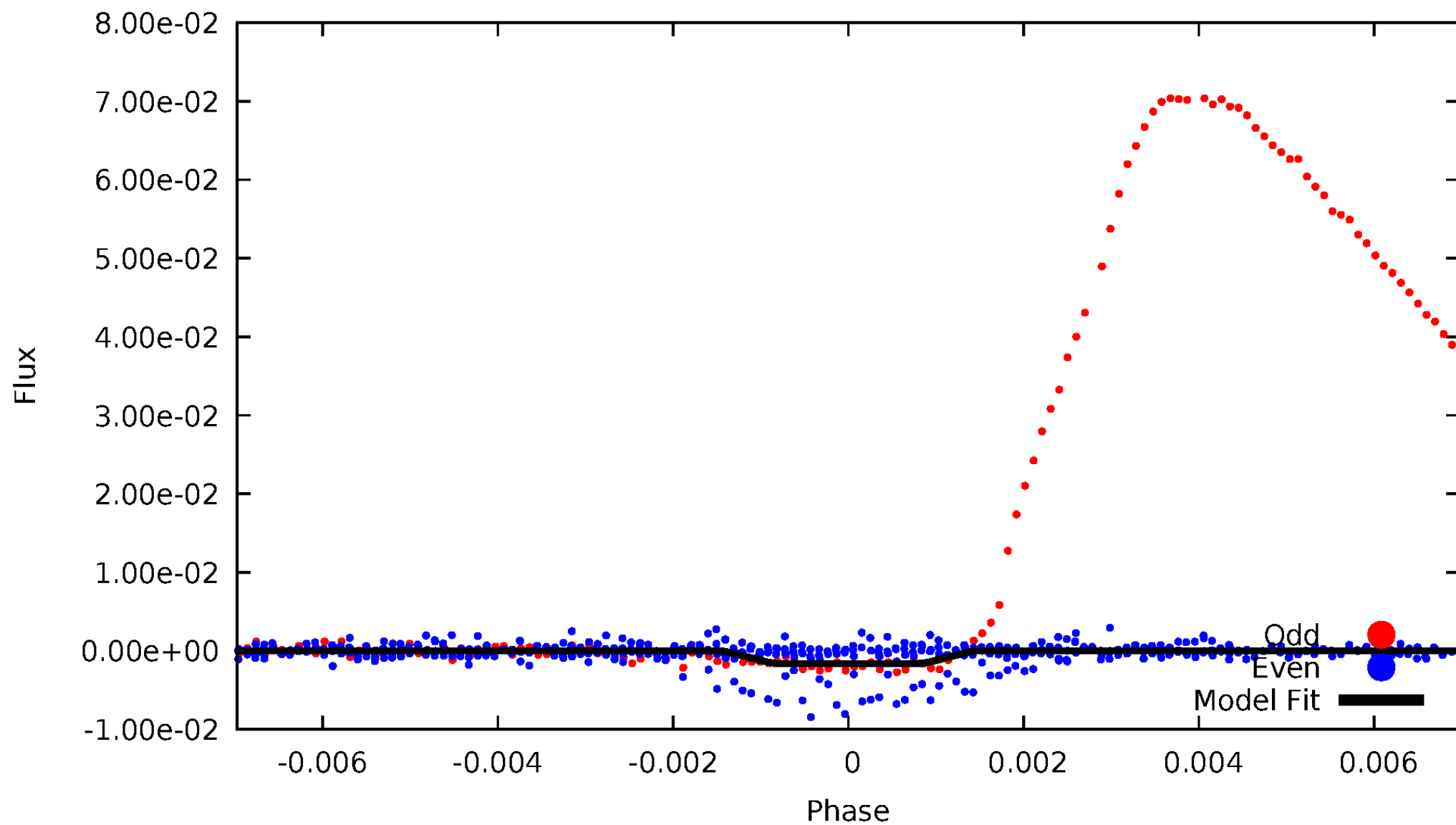
DV Odd/Even

TCE 004378554-04



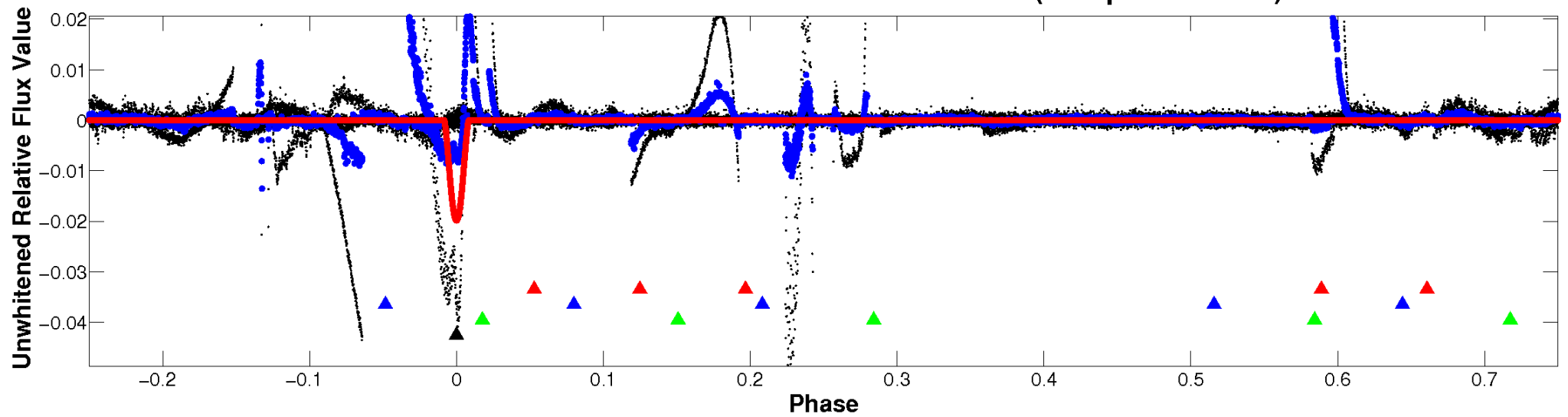
ALT Odd/Even

TCE 004378554-04

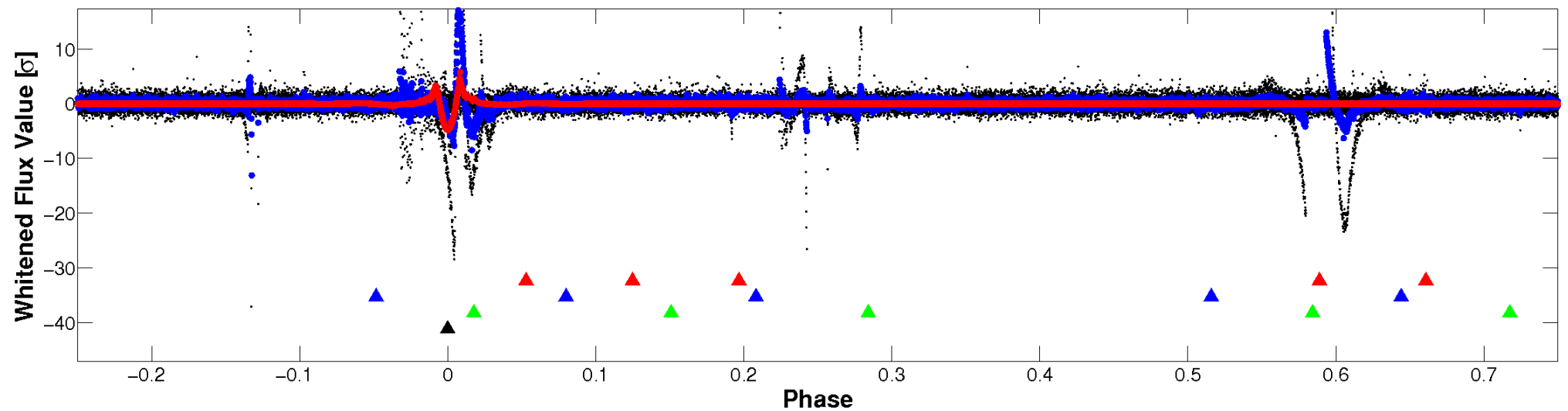


Non-Whitened Vs. Whitened Light Curve

Planet 4 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

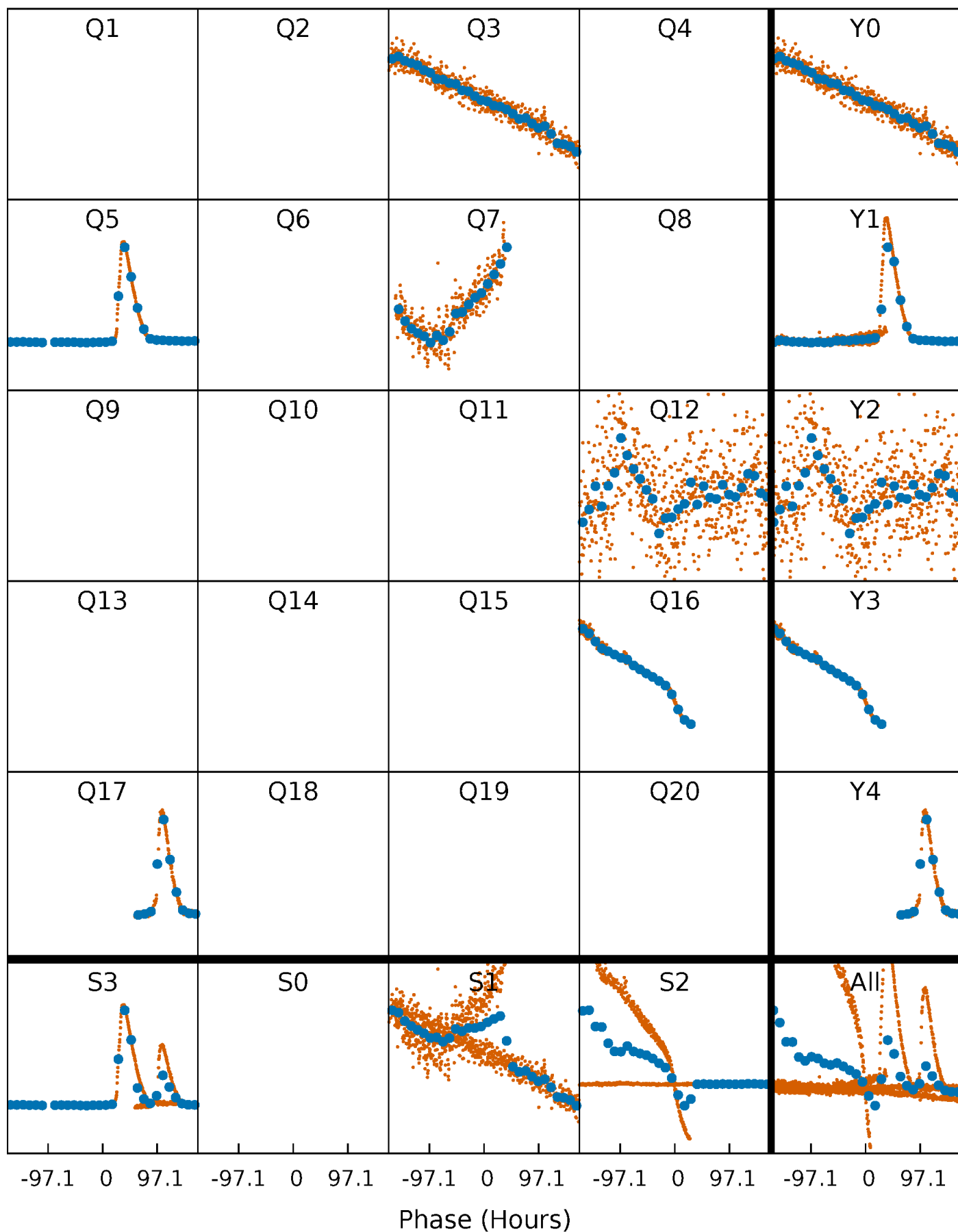


Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



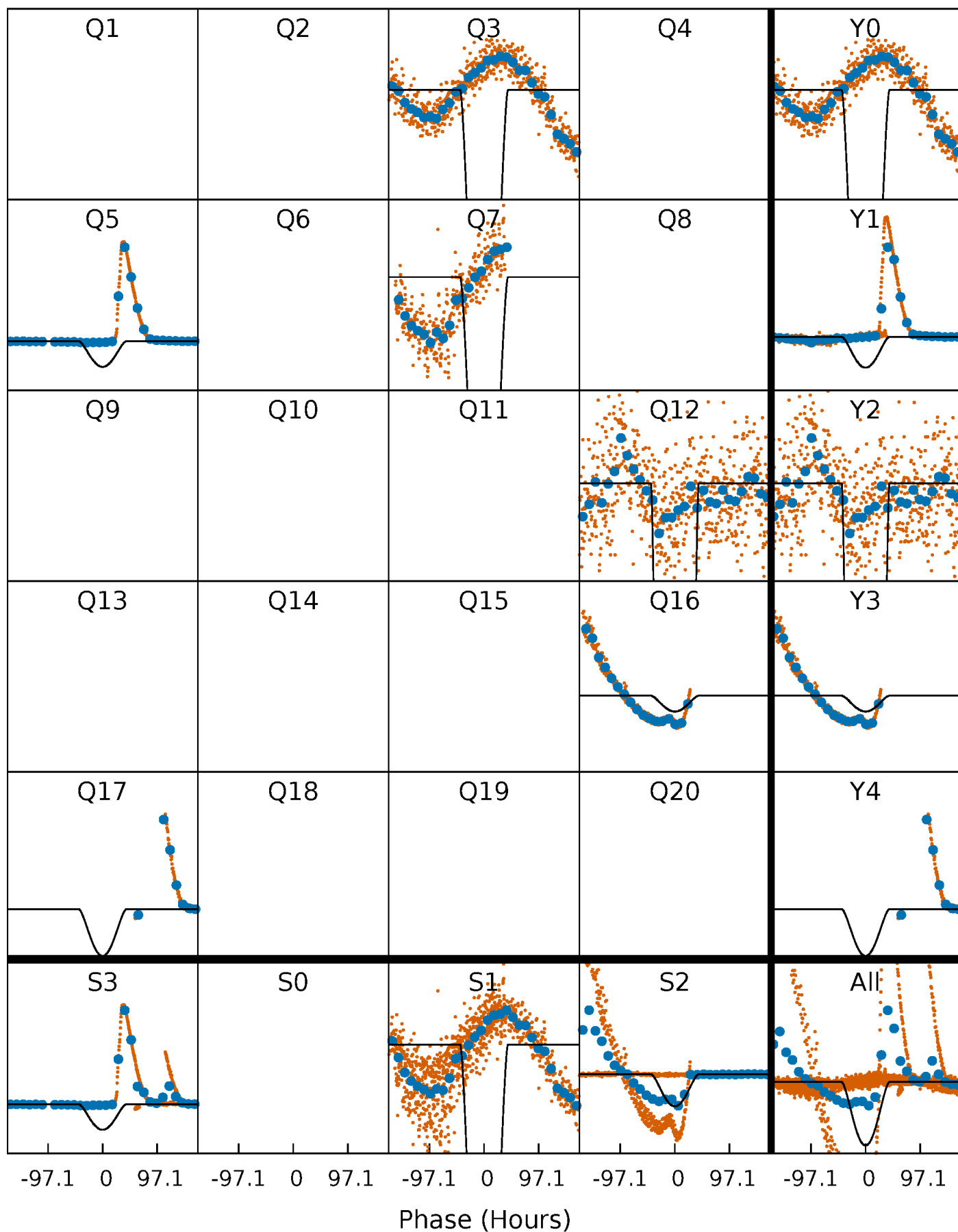
PDC Quarter-Phased Transit Curves

TCE 004378554-04 P=209.707241 Days $T_0=298.587602$ (BKJD)



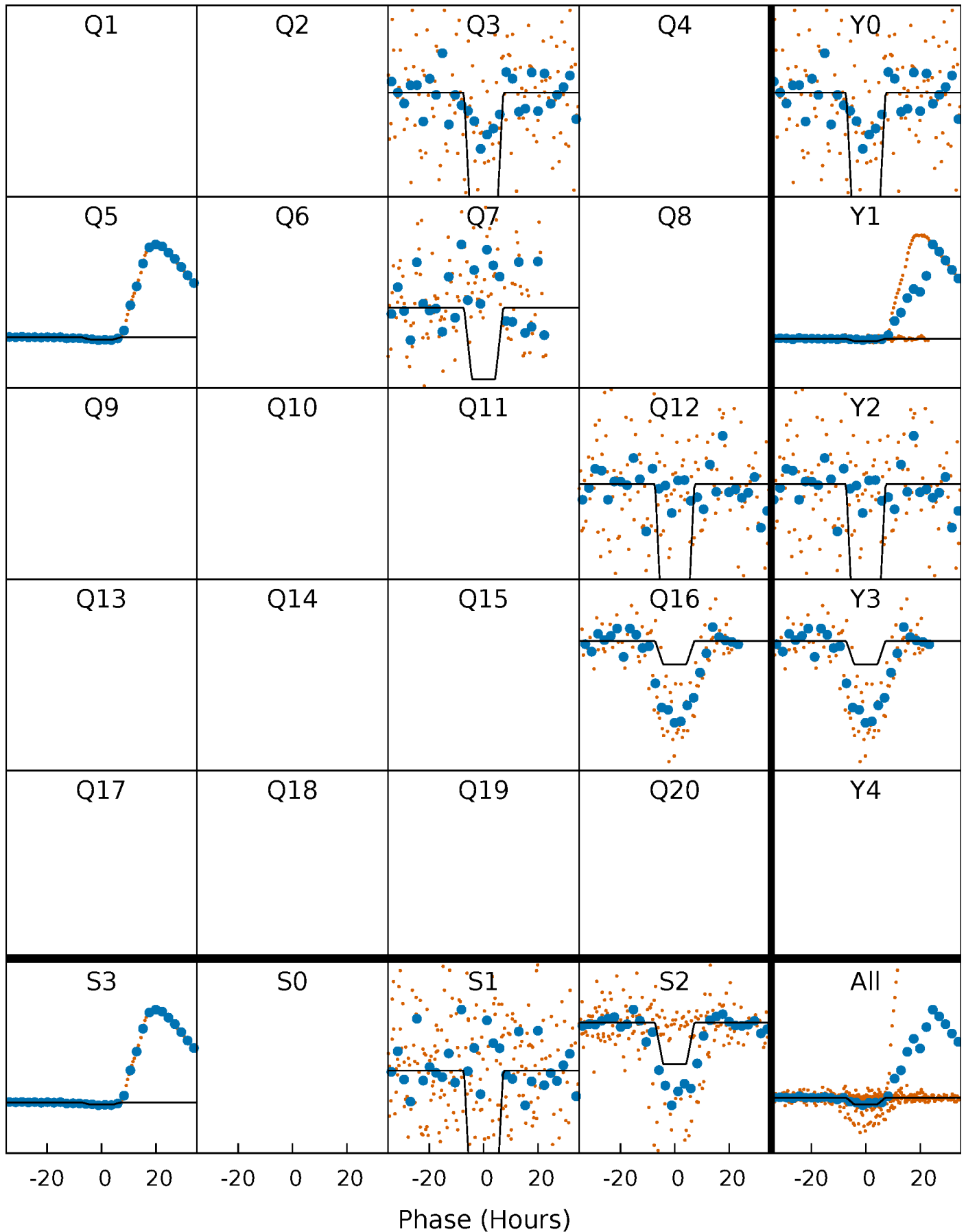
DV Quarter-Phased Transit Curves

TCE 004378554-04 P=209.707241 Days $T_0=298.587602$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

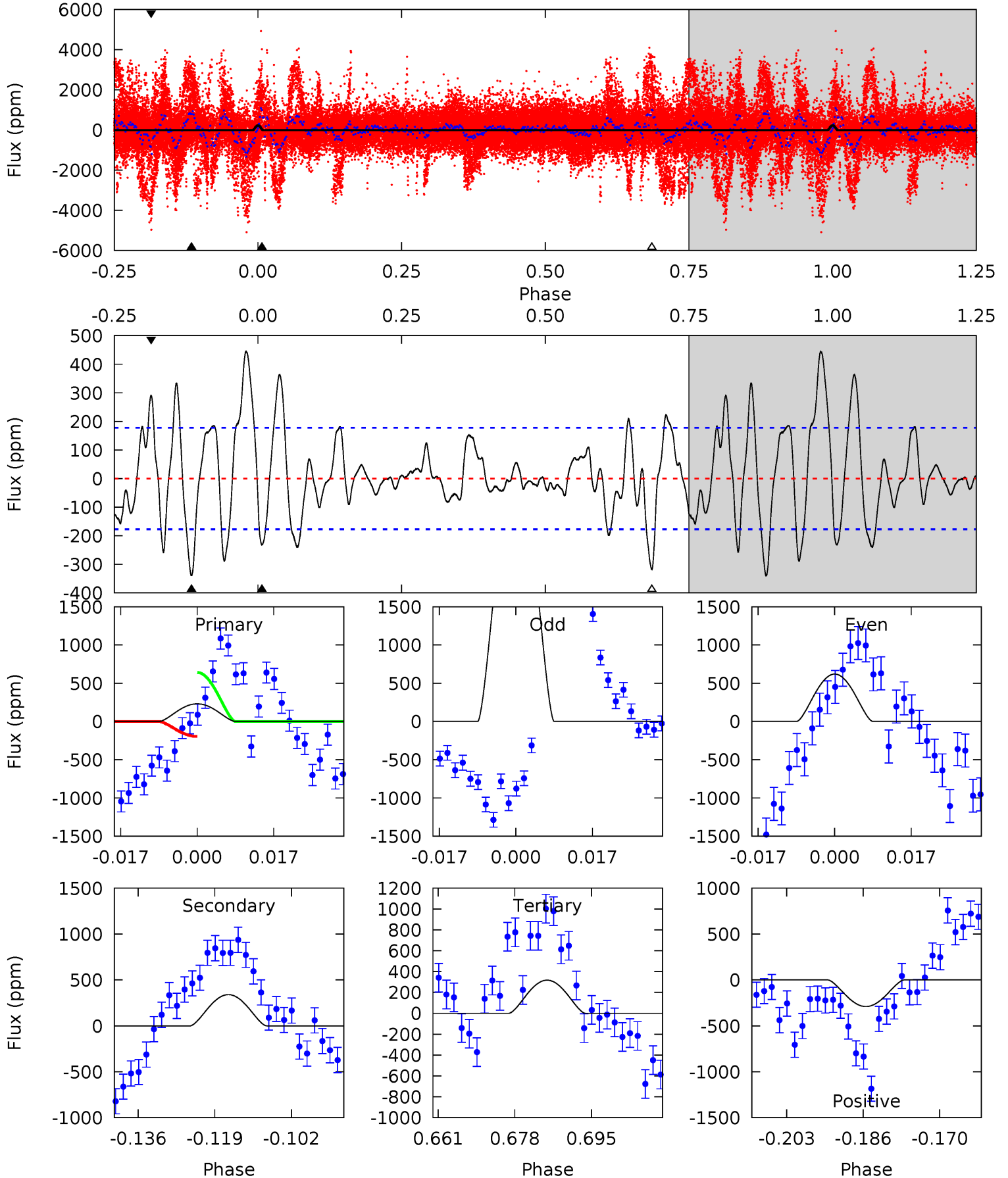
TCE 004378554-04 $P=209.607459$ Days $T_0=299.381520$ (BKJD)



DV Model-Shift Uniqueness Test

004378554-04, P = 209.707241 Days, E = 88.880361 Days

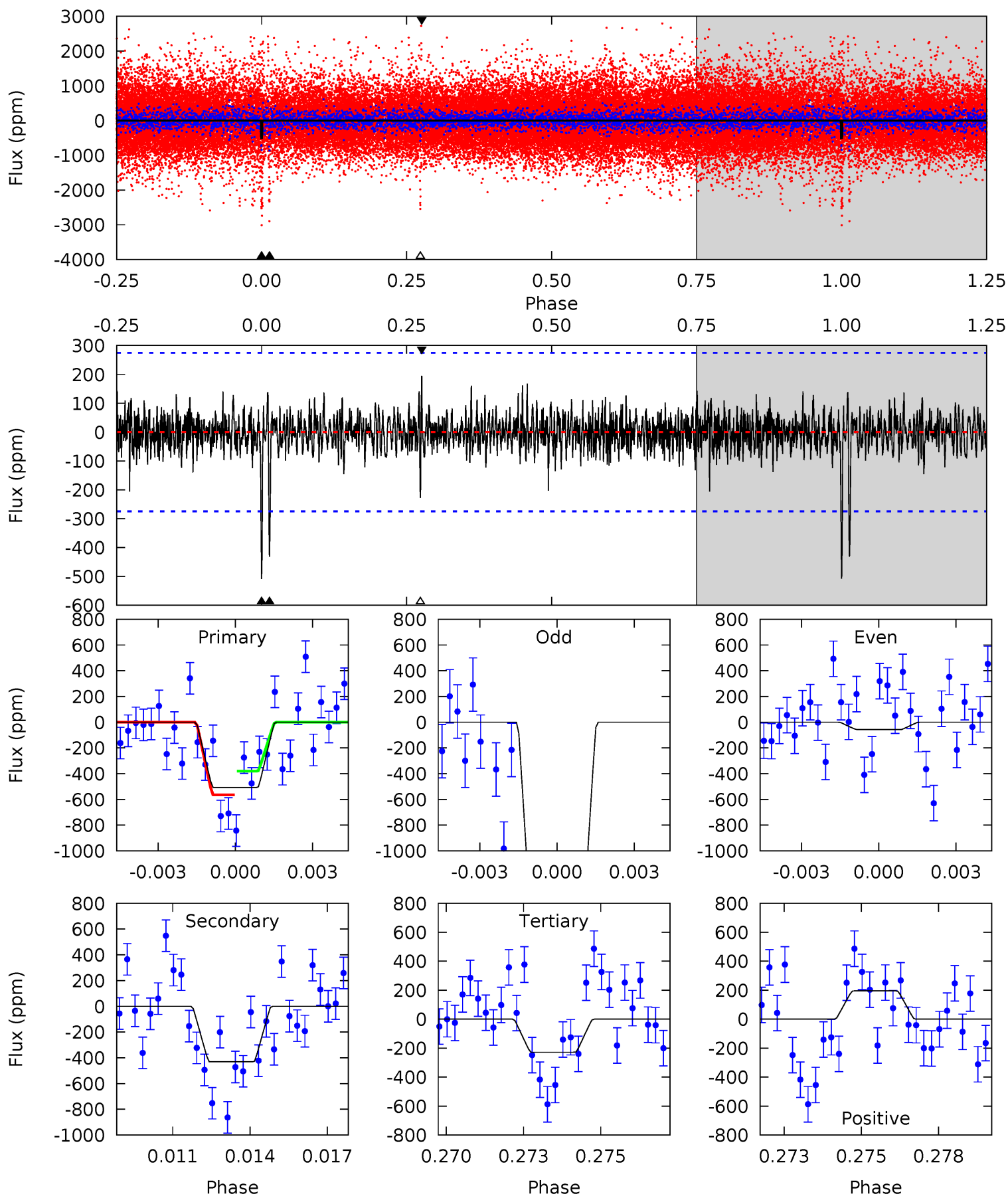
| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|-------|-------|------|
| 6.40 | 9.41 | 8.79 | 8.03 | 4.92 | 2.39 | 3.42 | -2.39 | -1.63 | 0.62 | 1.38 | 36.5 | -8.72 | 0.57 | 6.37 |



Alt Model-Shift Uniqueness Test

004378554-04, P = 209.607459 Days, E = 89.774061 Days

| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 9.74 | 8.27 | 4.37 | 3.74 | 5.26 | 2.98 | 0.91 | 5.37 | 6.00 | 3.90 | 4.53 | 3.40 | 3.47 | 0.28 | 1.77 |



Stellar Parameters For KIC 004378554

| | $T_{\text{eff}}(K)$ | $\log(g)$ | [Fe/H] | R (R_{\odot}) | M (M_{\odot}) | p_{\star} ($\text{g}\cdot\text{cm}^{-3}$) |
|--------|----------------------|---------------------------|----------------------------|---------------------------|---------------------------|---|
| | 5845^{+158}_{-176} | $4.541^{+0.038}_{-0.200}$ | $-0.160^{+0.300}_{-0.300}$ | $0.874^{+0.264}_{-0.082}$ | $0.968^{+0.108}_{-0.120}$ | $2.042^{+0.417}_{-1.074}$ |
| | +3%/-3% | +1%/-4% | +188%/-188% | +30%/-9% | +11%/-12% | +20%/-53% |
| 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 004378554-04 / KOI

| Detrend | Depth (ppm) | R_p (R_{\oplus}) | T_{max} (K) | T_{obs} (K) | A_{obs} |
|---------|---------------|-------------------------|-------------------|-----------------------|-------------------------|
| DV | -340 ± 36 | $23.04^{+8.94}_{-8.64}$ | 417^{+26}_{-18} | 2517^{+312}_{-192} | 167^{+246}_{-83} |
| Alt. | -431 ± 52 | $7.41^{+7.46}_{-4.93}$ | 418^{+28}_{-19} | 3553^{+1953}_{-649} | 1949^{+15695}_{-1455} |

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 $A_{obs} \gg 1.0$

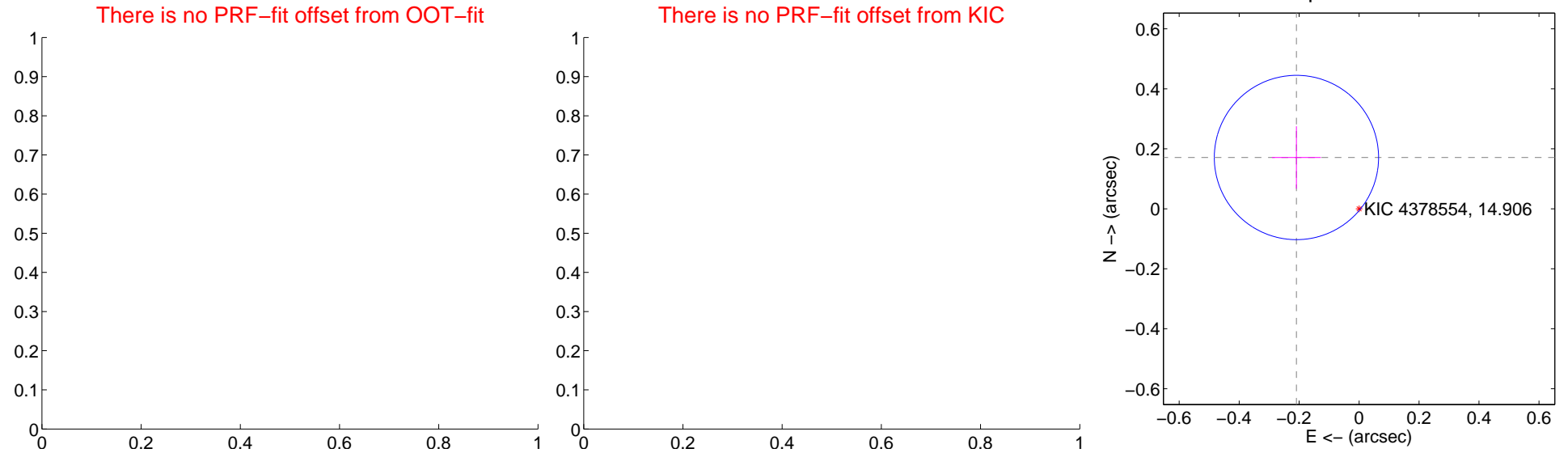
DV Centroid Data

Supplemental centroid analysis for 004378554-04. Kepler magnitude: 14.91. Transit SNR 86.54

There are 0 quarters with good PRF difference image offsets

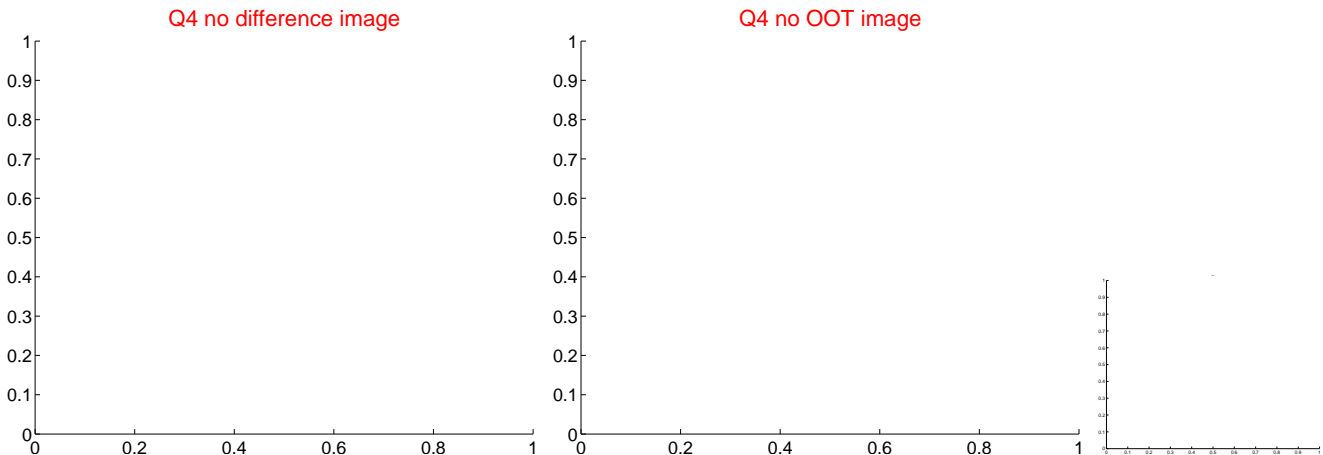
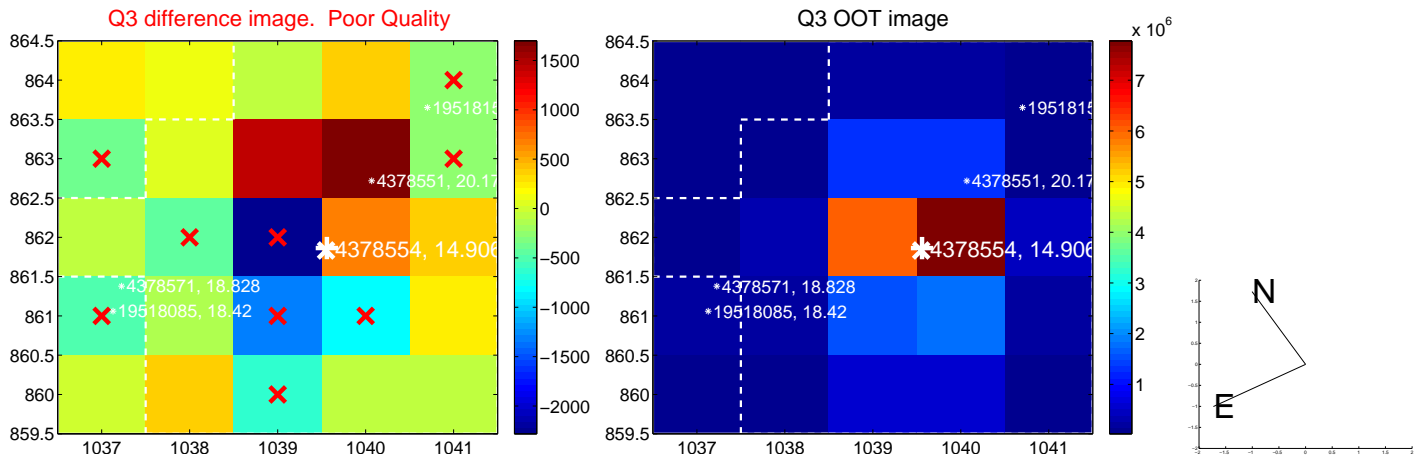
The direct PRF centroid is offset from the target star catalog position by about NaN arcsec

| | Distance in arcsec | Distance / σ | Δ RA | Δ Dec |
|---|--------------------|---------------------|-----------------|-----------------|
| PRF-fit source offset from OOT | — | — | — | — |
| PRF-fit source offset from KIC position | — | — | — | — |
| photometric centroid source offset | 0.27 ± 0.09 | 2.96 | 0.21 ± 0.08 | 0.17 ± 0.10 |



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.



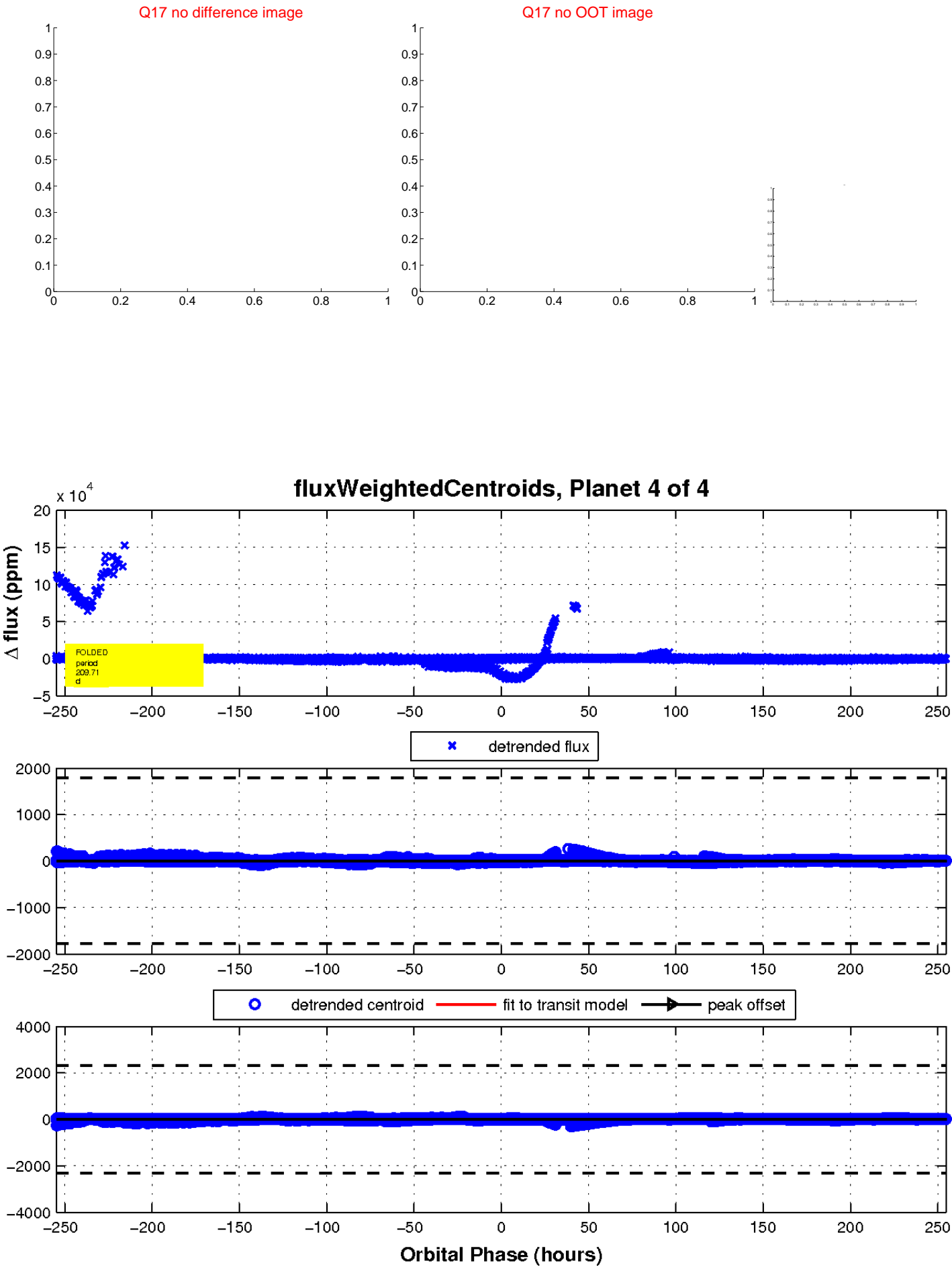
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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.



UKIRT Image

Declination

