

KIC 009716947

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}) |
|--------------|----------|------|---------------|--------------|-------------|------------------|-----|------|-----------------------------|-----------------|------------------------|------------------------|
| 009716947-01 | OBS | No | 1.641488 | 132.198674 | 150.5 | 6.051 | 9.3 | 10.4 | 2.21 | 7517 | 3.43 | 12244.95 |
| 009716947-02 | OBS | No | 0.612950 | 131.654342 | 143.7 | 1.205 | 9.3 | 8.9 | 2.21 | 7517 | 2.76 | 45537.98 |

Robovetter Results

| TCE | Run Type | Disp | Score | N | S | C | E | Comments |
|--------------|----------|------|-------|---|---|---|---|---|
| 009716947-01 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT |
| 009716947-02 | OBS | FP | 0.00 | 1 | 0 | 1 | 0 | TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—HALO_GHOST |

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

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

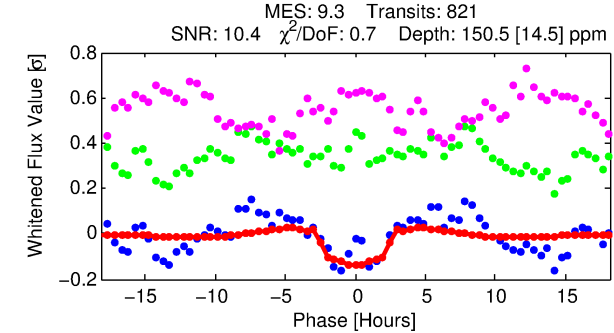
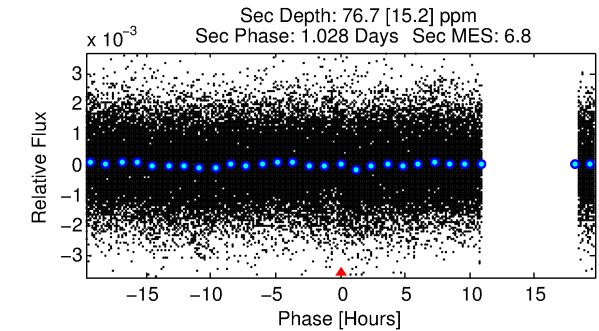
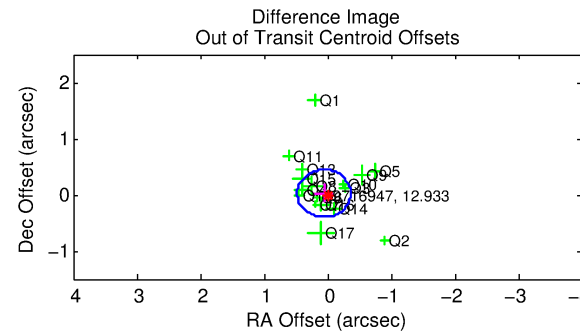
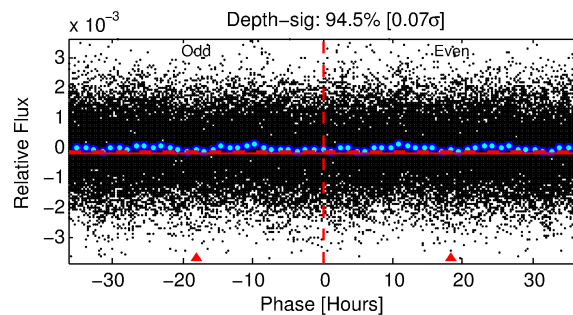
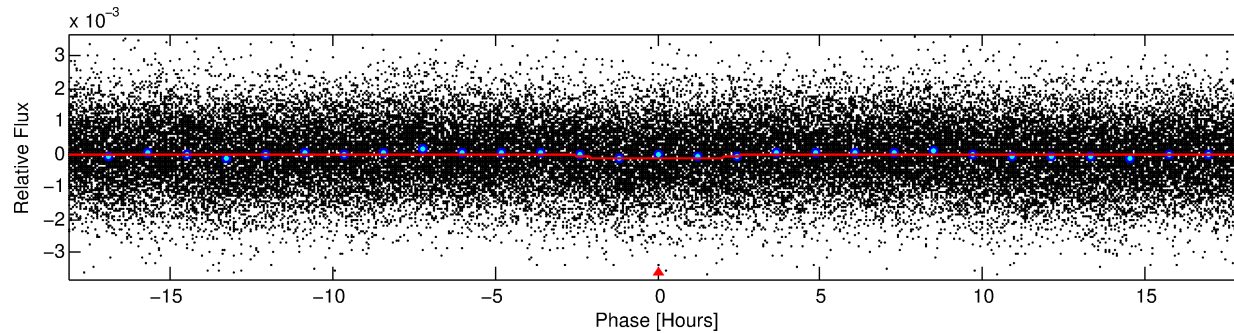
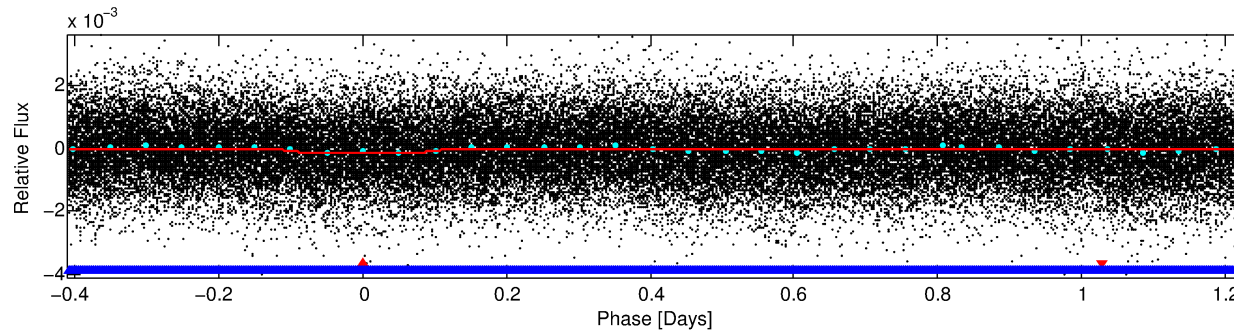
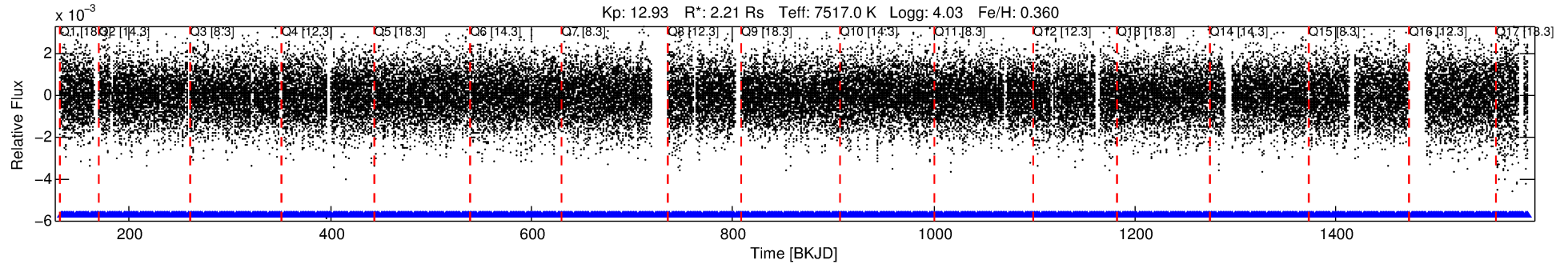
See http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col for comment definitions.

Ephemeris Match Information For 009716947-01

No Significant Match Found

DV One-Page Summary

KIC: 9716947 Candidate: 1 of 2 Period: 1.641 d



DV Fit Results:

Period = 1.64149 [0.00002] d
Epoch = 132.1987 [0.0057] BKJD
Rp/R* = 0.0142 [0.0008]
a/R* = 1.16 [0.04]
b = 0.97 [0.01]
Seff = 12244.95 [4406.01]
Teq = 2682 [241] K
Rp = 3.43 [0.90] Re
a = 0.0337 [0.0072] AU
Ag = 4.08 [1.55] [1.99 σ]
Teffp = 5894 [435] K [6.46 σ]

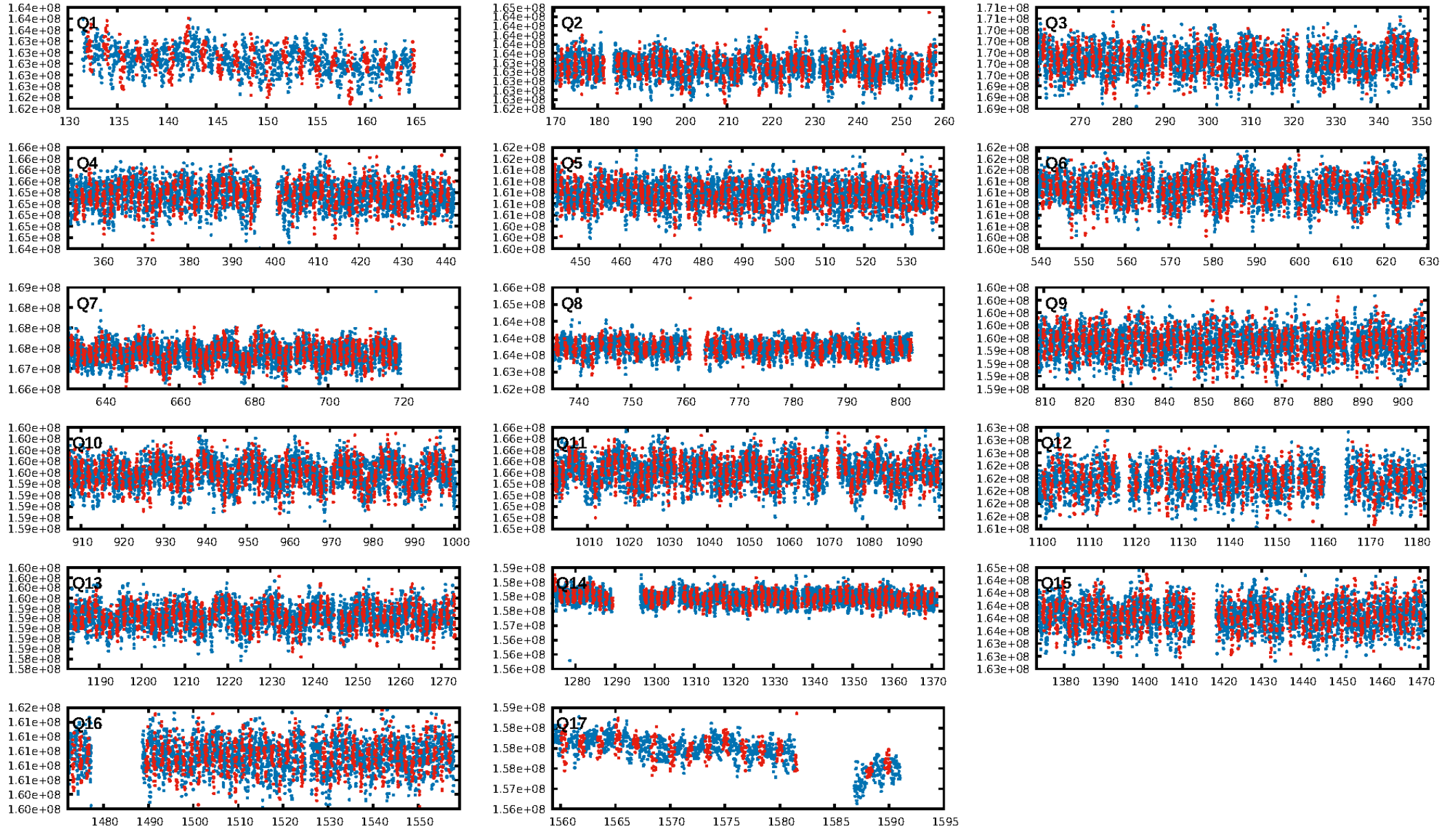
DV Diagnostic Results:

ShortPeriod-sig: 100.0% [4.00 σ]
LongPeriod-sig: N/A
ModelChiSquare2-sig: N/A
ModelChiSquareGof-sig: N/A
Bootstrap-pfa: 1.30e-14
RollingBand-fgt: 1.00 [784/784]
GhostDiagnostic-chr: 2.161
Centroid-sig: 31.4%
Centroid-so: 0.174 arcsec [1.85 σ]
OotOffset-rm: 0.062 arcsec [0.45 σ]
KicOffset-rm: 0.099 arcsec [0.77 σ]
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]

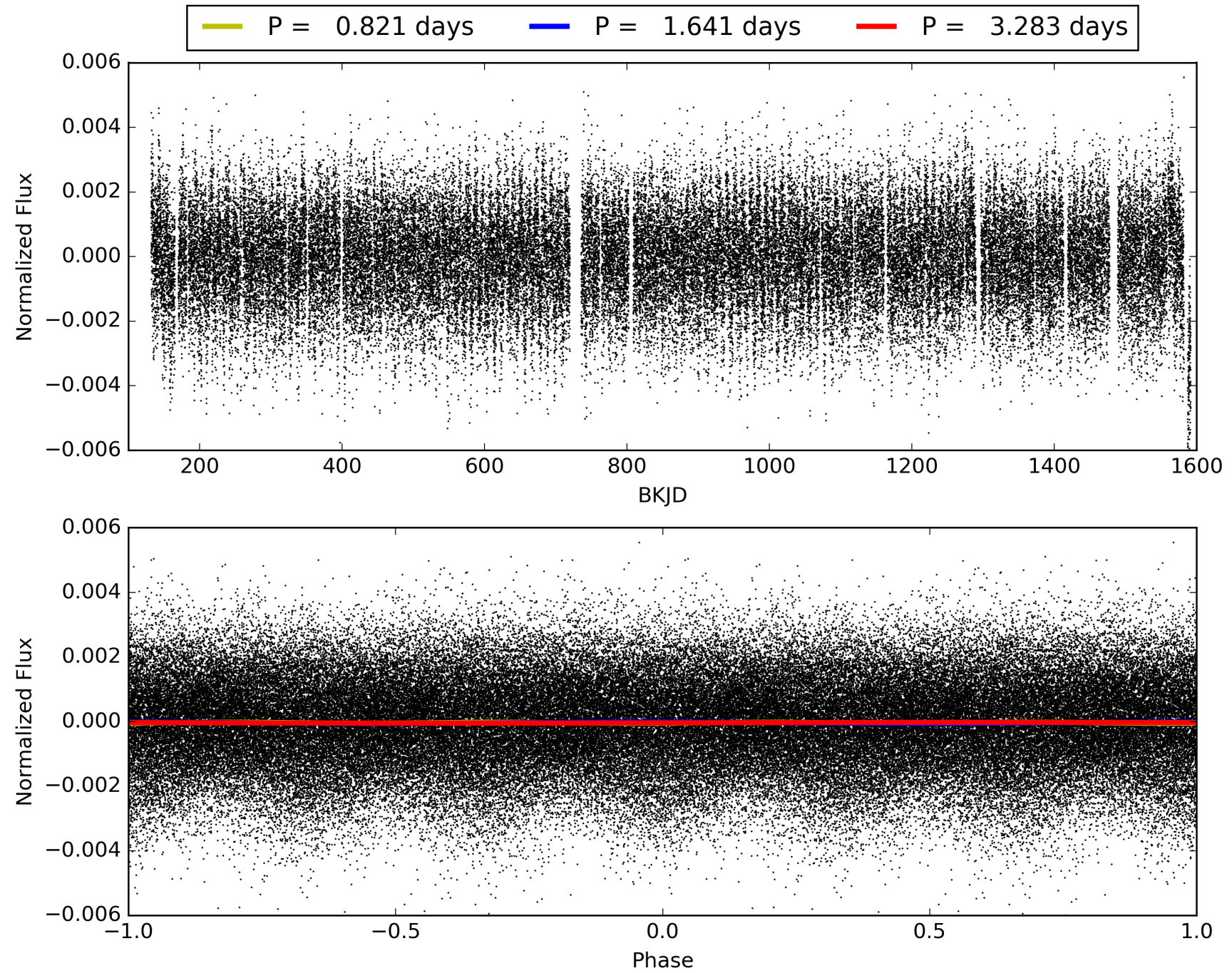
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 18:42:17 Z

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

TCE 009716947-01, PDC Light Curves

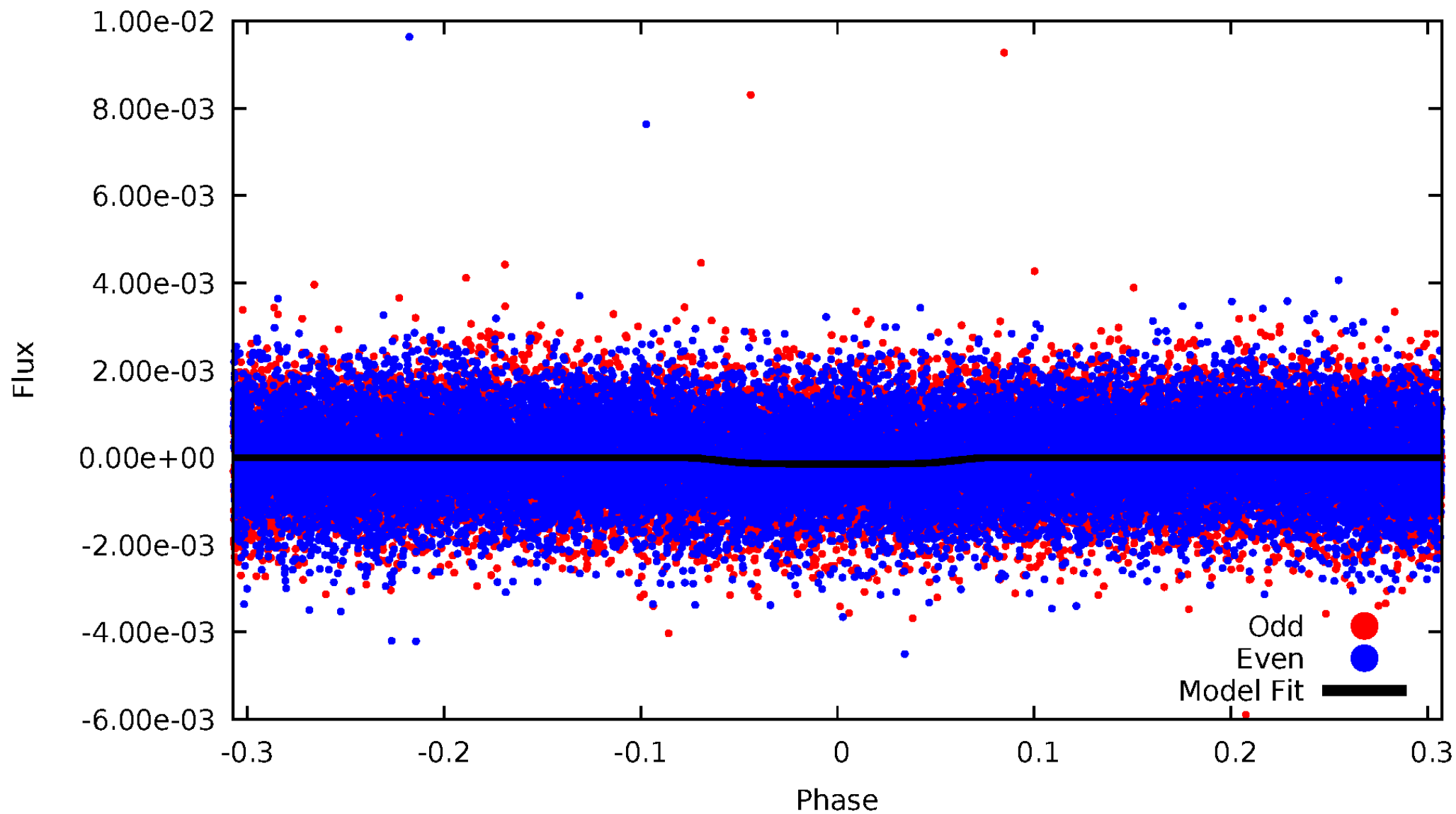


TCE 009716947-01



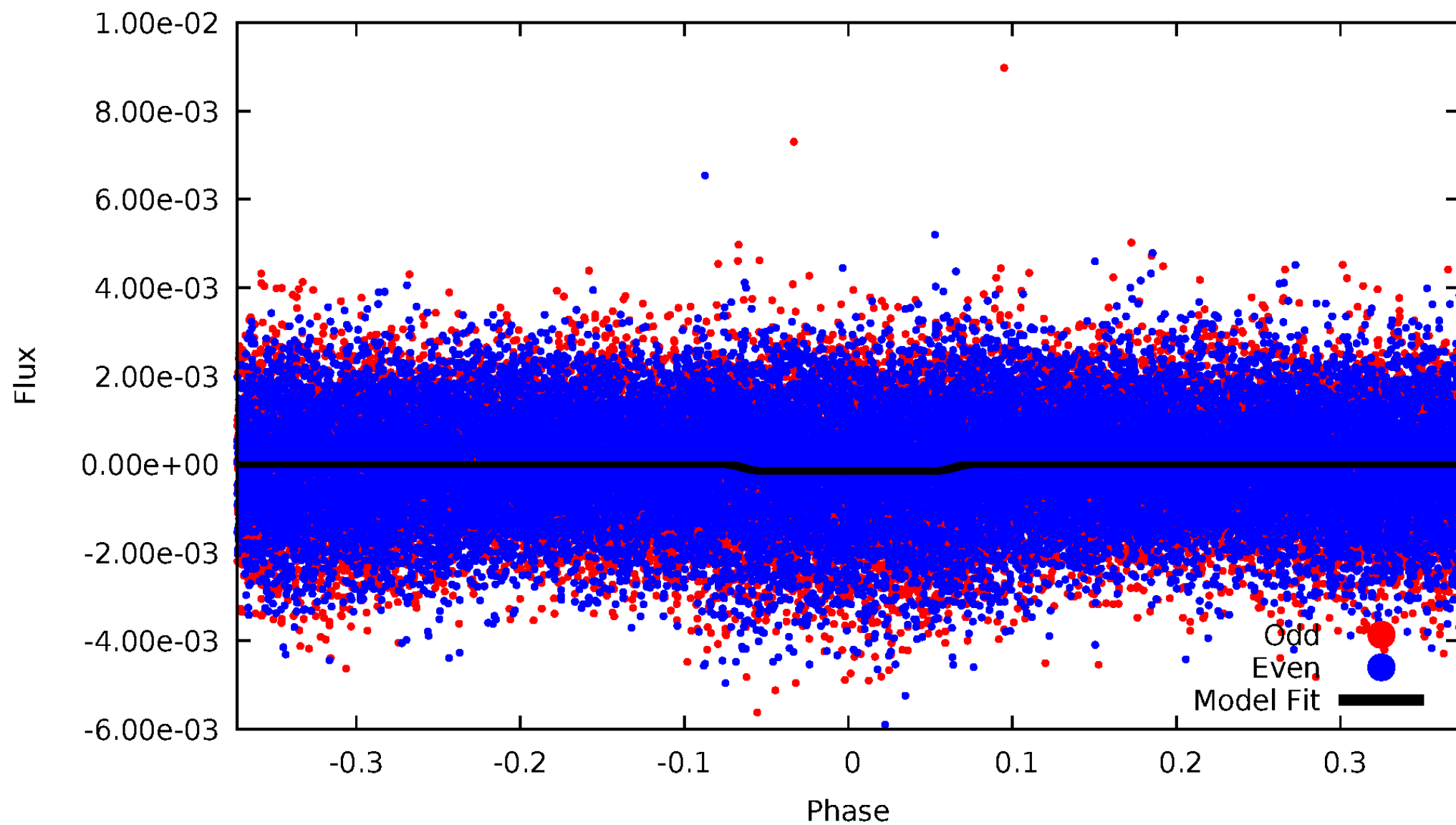
DV Odd/Even

TCE 009716947-01



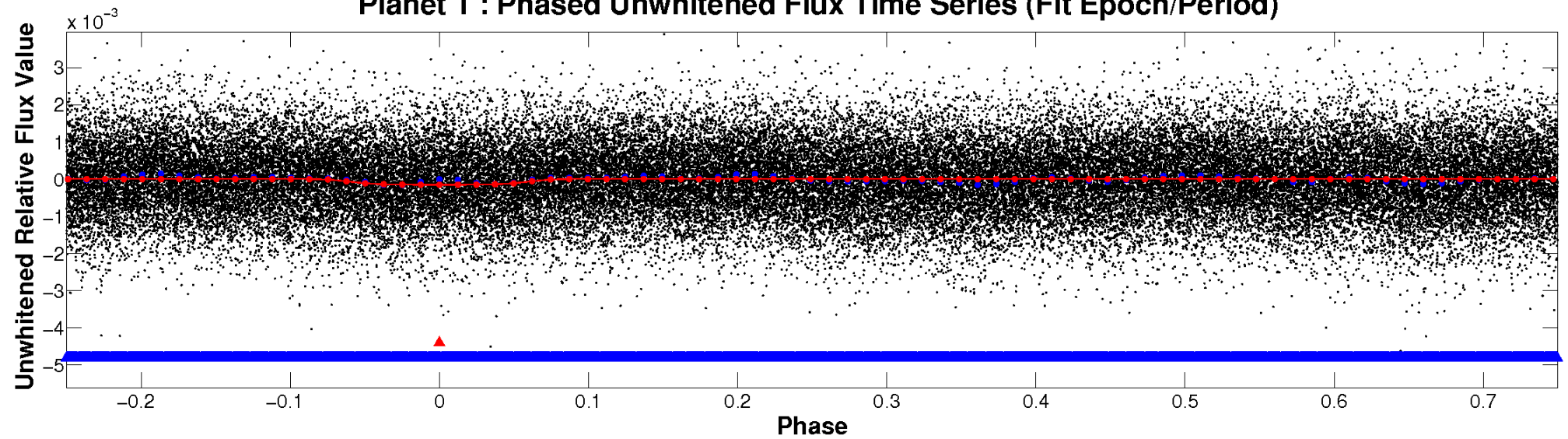
ALT Odd/Even

TCE 009716947-01

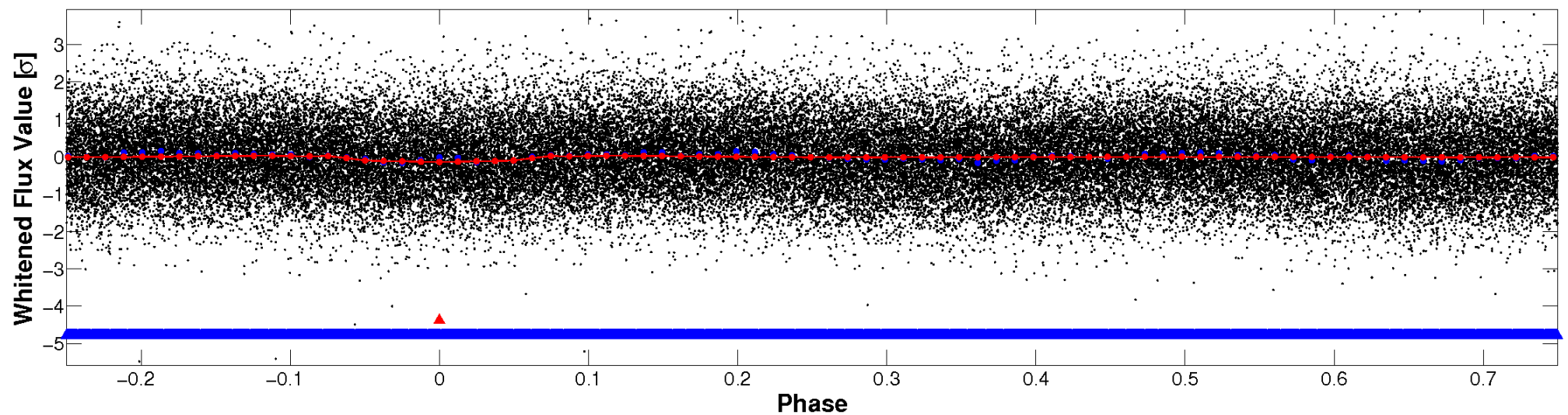


Non-Whitened Vs. Whitened Light Curve

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

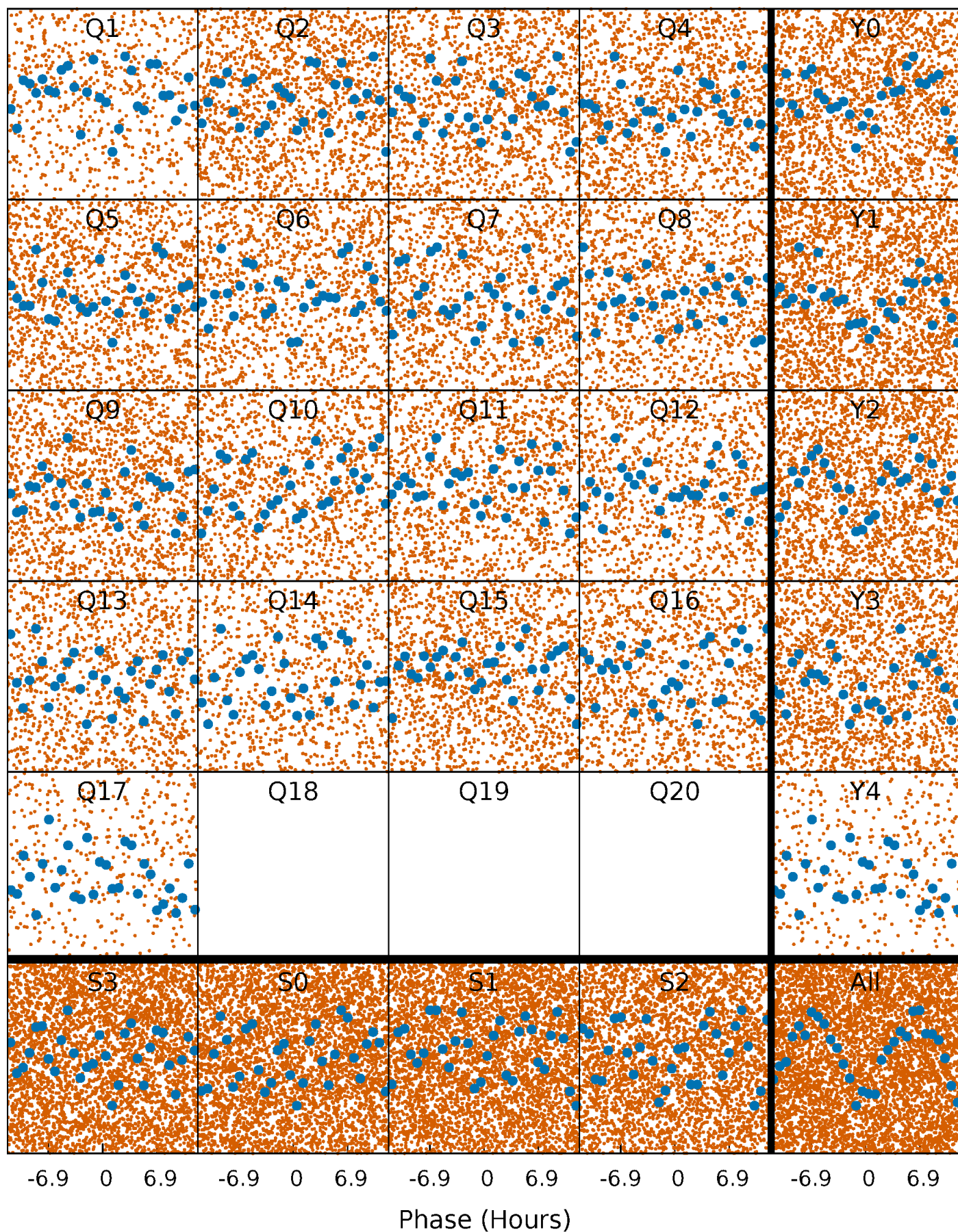


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



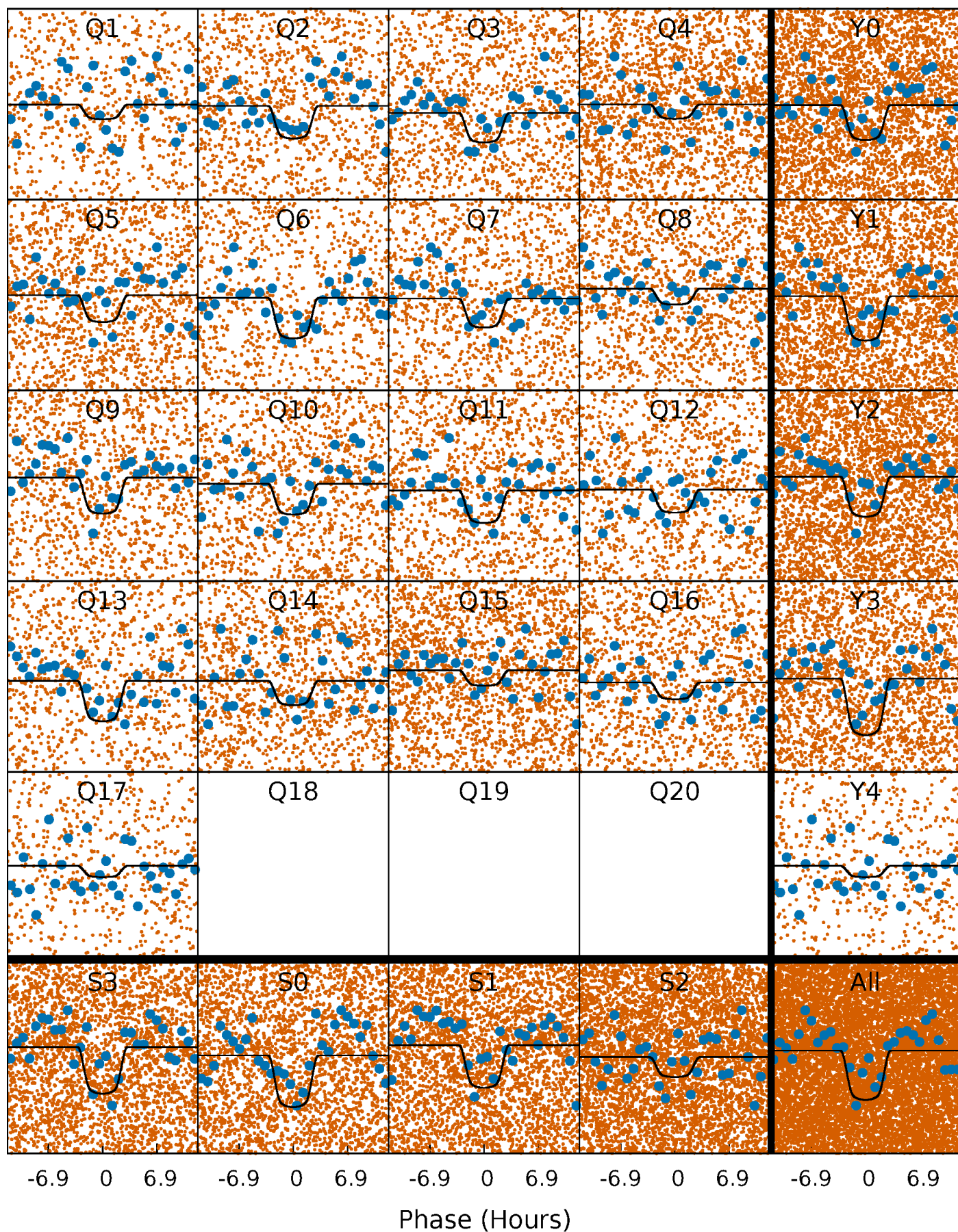
PDC Quarter-Phased Transit Curves

TCE 009716947-01 P= 1.641488 Days $T_0=132.198674$ (BKJD)



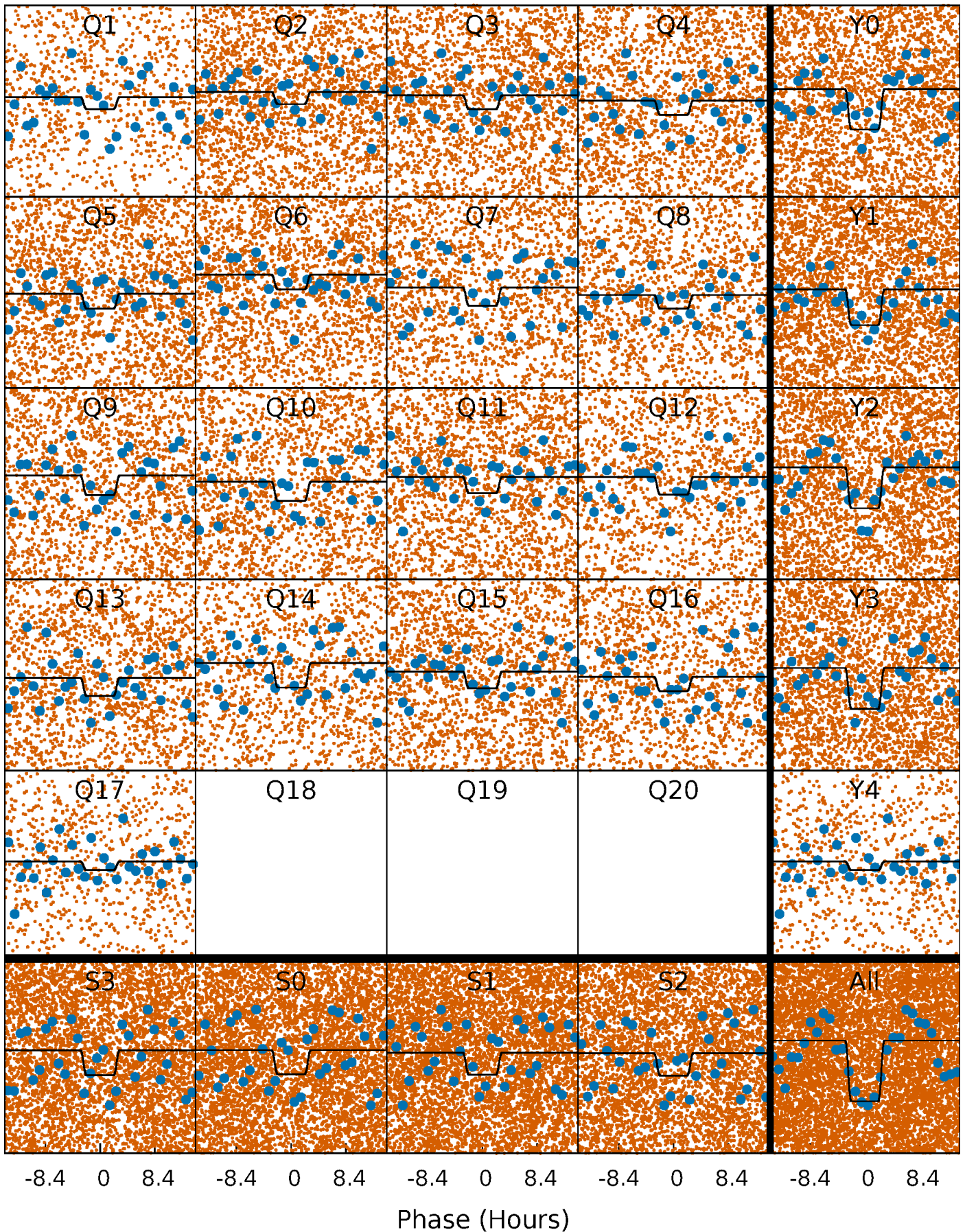
DV Quarter-Phased Transit Curves

TCE 009716947-01 P= 1.641488 Days $T_0=132.198674$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

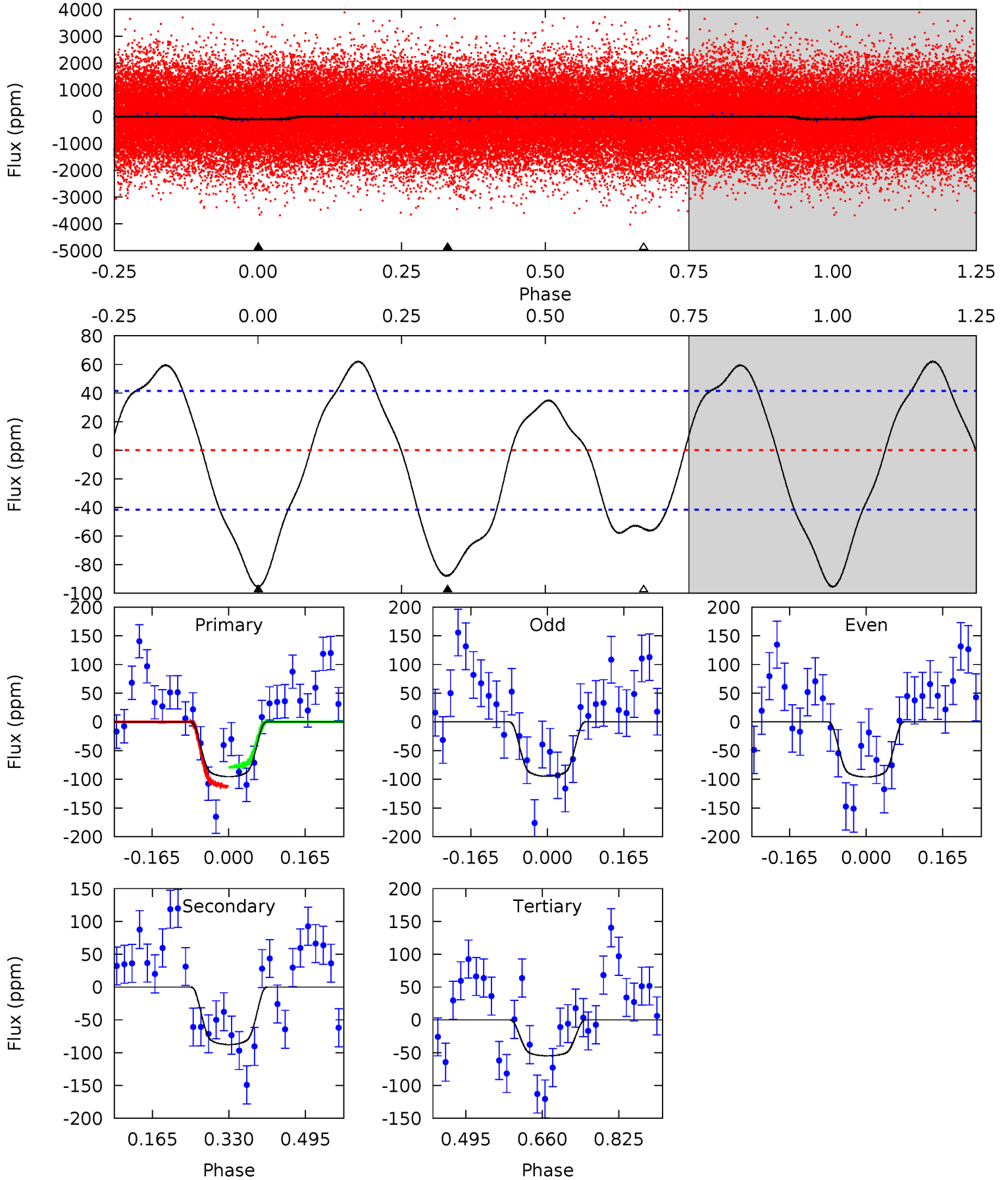
TCE 009716947-01 P= 1.641486 Days $T_0=132.182555$ (BKJD)



DV Model-Shift Uniqueness Test

009716947-01, P = 1.641488 Days, E = 130.557186 Days

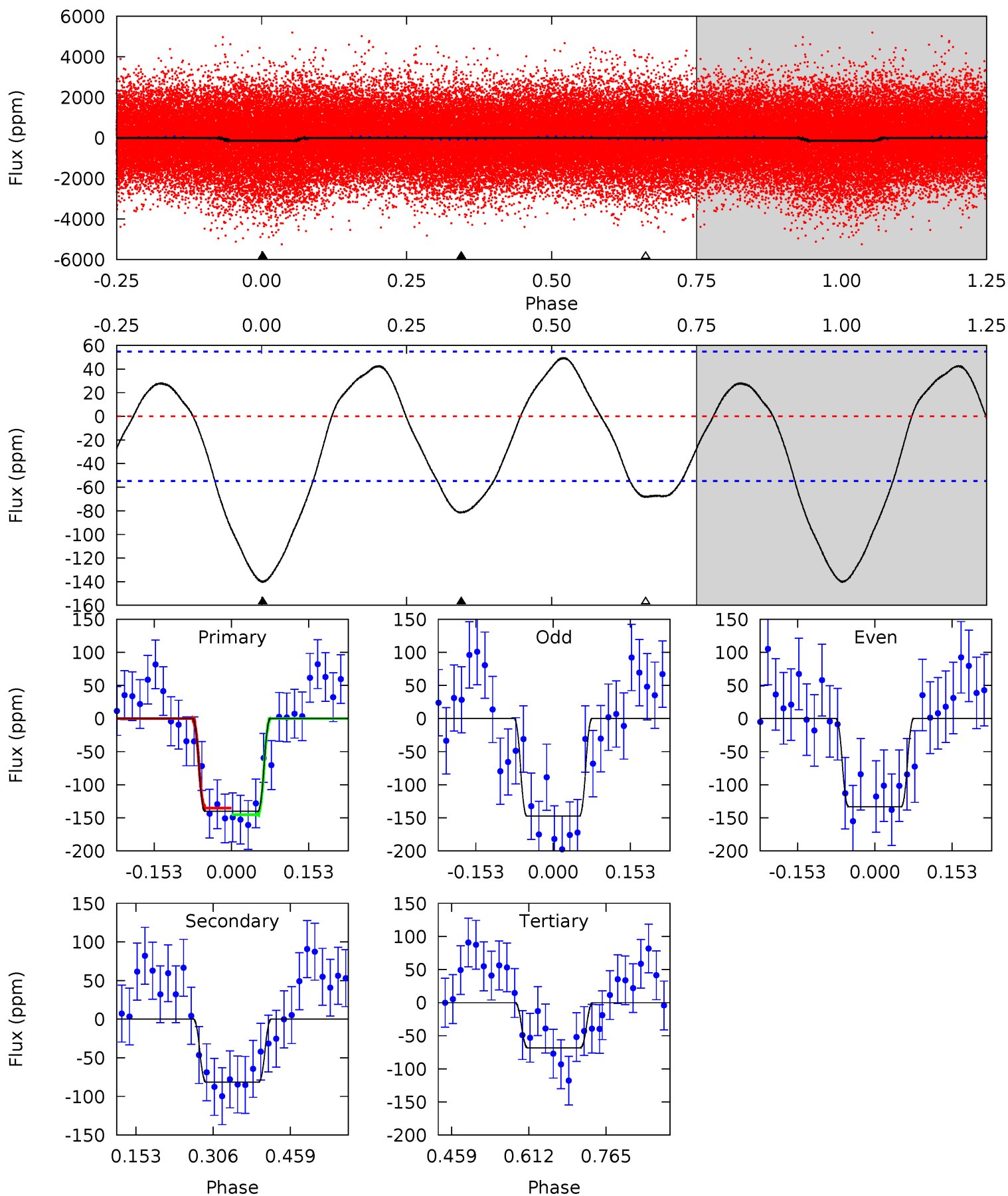
| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|-----|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 10.3 | 9.42 | 5.89 | 0 | 4.46 | 1.39 | 4.25 | 4.36 | 10.3 | 3.53 | 9.42 | 0.06 | 1.15 | 0.39 | 1.81 |



Alt Model-Shift Uniqueness Test

009716947-01, P = 1.641486 Days, E = 130.541069 Days

| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|-----|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 11.4 | 6.65 | 5.56 | 0 | 4.47 | 1.43 | 3.32 | 5.87 | 11.4 | 1.09 | 6.65 | 0.58 | 1.35 | 0.26 | 0.41 |



Stellar Parameters For KIC 009716947

| | $T_{\text{eff}}(K)$ | $\log(g)$ | [Fe/H] | R (R_{\odot}) | M (M_{\odot}) | p_{\star} ($\text{g}\cdot\text{cm}^{-3}$) |
|--------|----------------------|---------------------------|---------------------------|---------------------------|---------------------------|---|
| | 7517^{+208}_{-357} | $4.029^{+0.135}_{-0.165}$ | $0.360^{+0.100}_{-0.350}$ | $2.207^{+0.566}_{-0.412}$ | $1.897^{+0.171}_{-0.277}$ | $0.248^{+0.184}_{-0.112}$ |
| | +3%/-5% | +3%/-4% | +28%/-97% | +26%/-19% | +9%/-15% | +74%/-45% |
| 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 009716947-01 / KOI

| Detrend | Depth (ppm) | R_p (R_{\oplus}) | T_{max} (K) | T_{obs} (K) | A_{obs} |
|---------|--------------|------------------------|----------------------|----------------------|---------------------------|
| DV | -88 ± 9 | $3.43^{+0.51}_{-0.41}$ | 3754^{+252}_{-253} | 5879^{+295}_{-307} | $4.555^{+1.447}_{-1.076}$ |
| Alt. | -81 ± 12 | $2.96^{+0.42}_{-0.37}$ | 3754^{+261}_{-255} | 6226^{+412}_{-372} | $5.763^{+1.892}_{-1.633}$ |

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 $A_{\text{obs}} \gg 1.0$

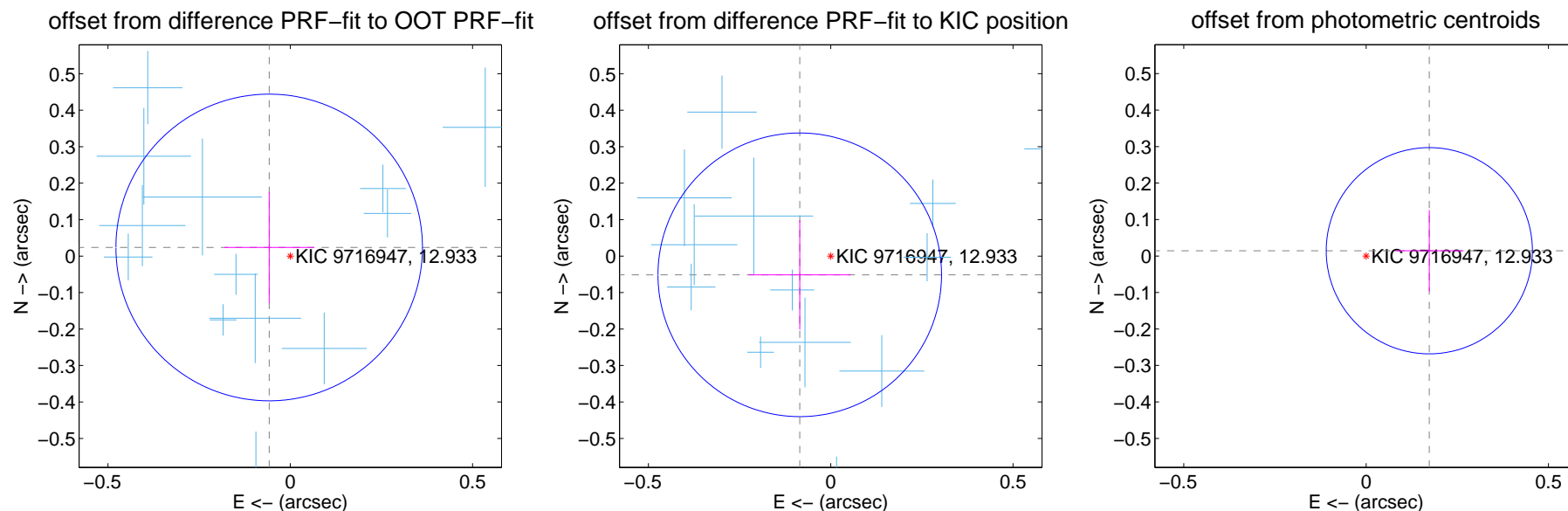
DV Centroid Data

Supplemental centroid analysis for 009716947-01. Kepler magnitude: 12.93. Transit SNR 10.36

There are 17 quarters with good PRF difference image offsets

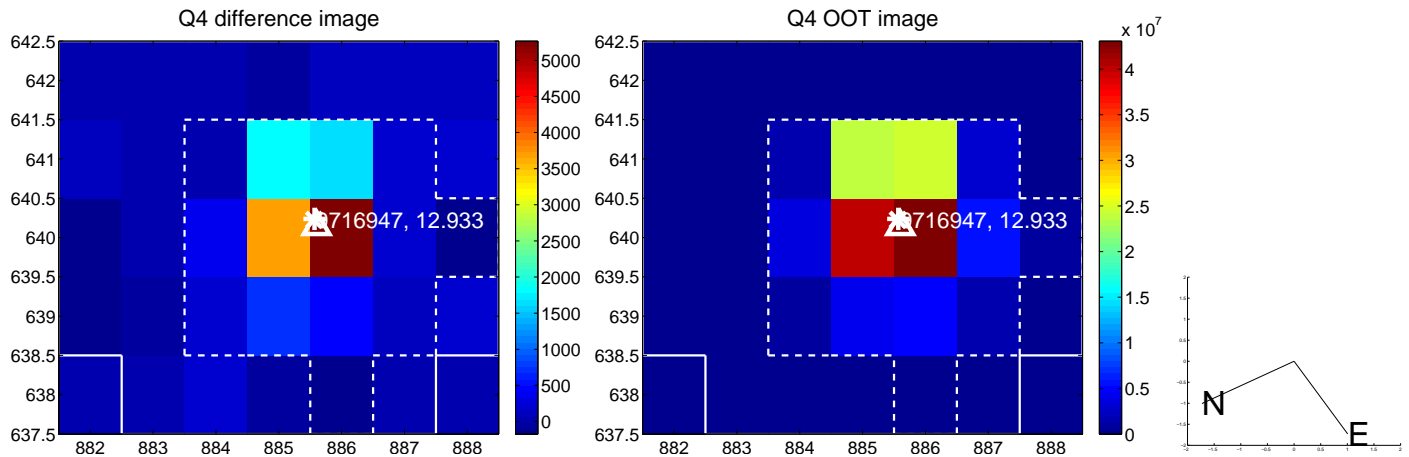
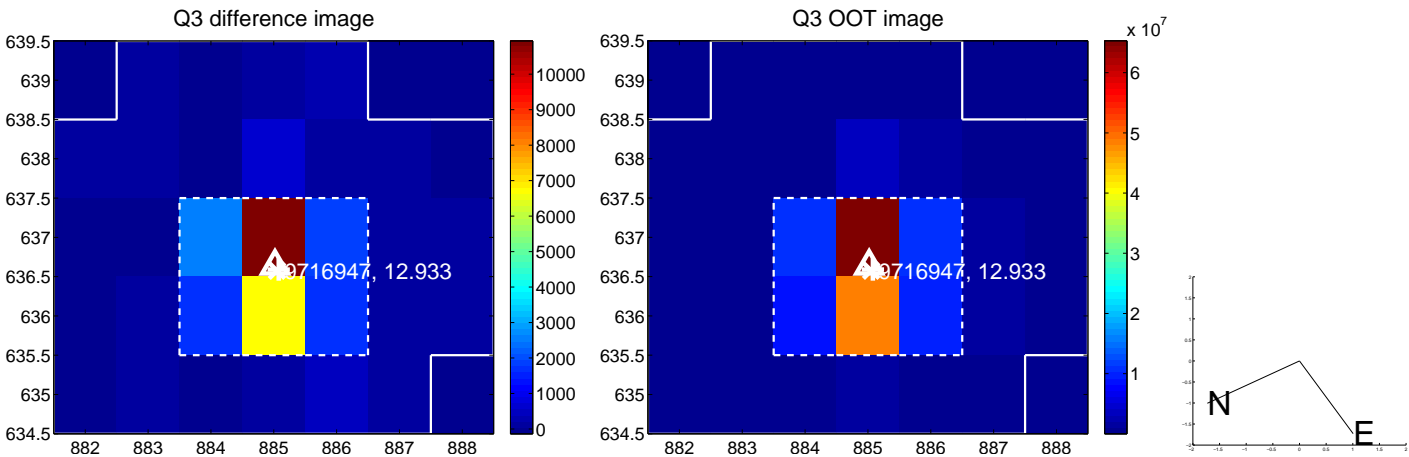
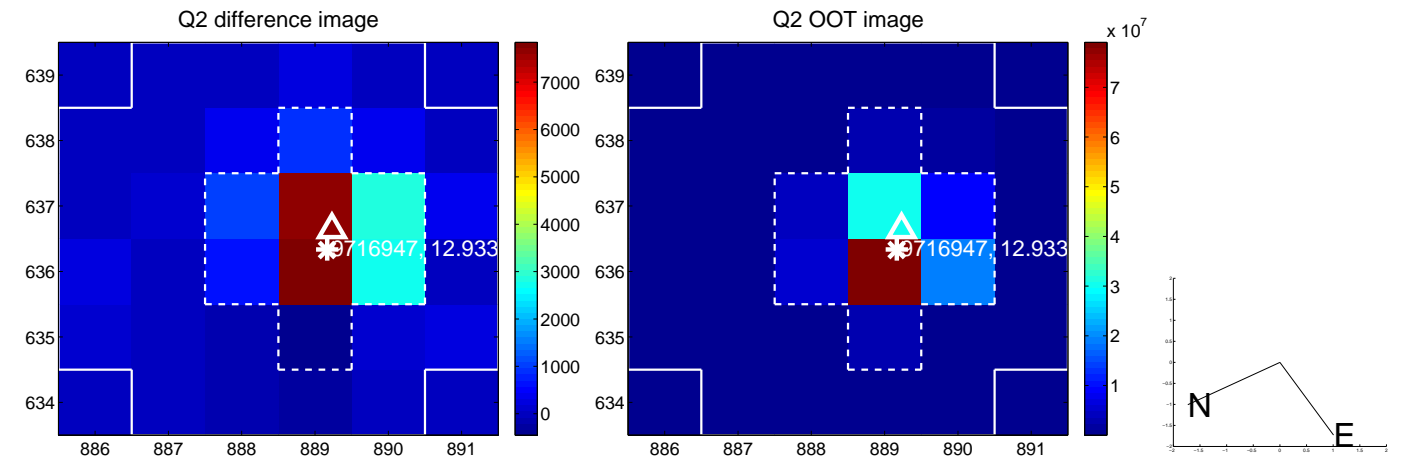
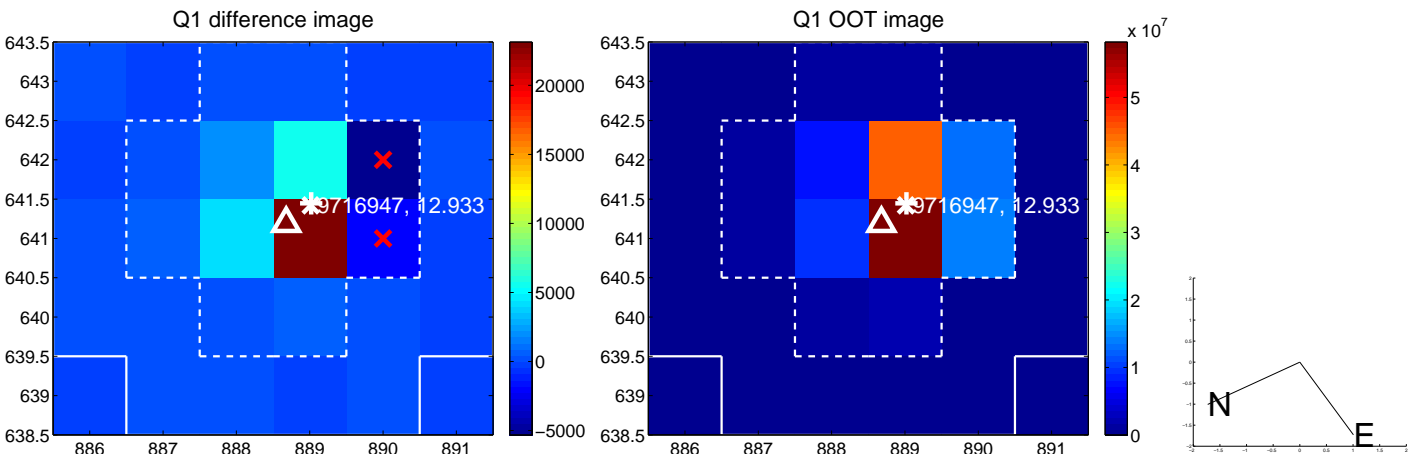
The direct PRF centroid is offset from the target star catalog position by about 0.13 arcsec

| | Distance in arcsec | Distance / σ | Δ RA | Δ Dec |
|---|--------------------|---------------------|-------------------|--------------------|
| PRF-fit source offset from OOT | 0.062 ± 0.140 | 0.45 | 0.058 ± 0.123 | 0.024 ± 0.152 |
| PRF-fit source offset from KIC position | 0.099 ± 0.130 | 0.77 | 0.085 ± 0.140 | -0.051 ± 0.150 |
| photometric centroid source offset | 0.17 ± 0.09 | 1.85 | -0.17 ± 0.09 | 0.01 ± 0.11 |

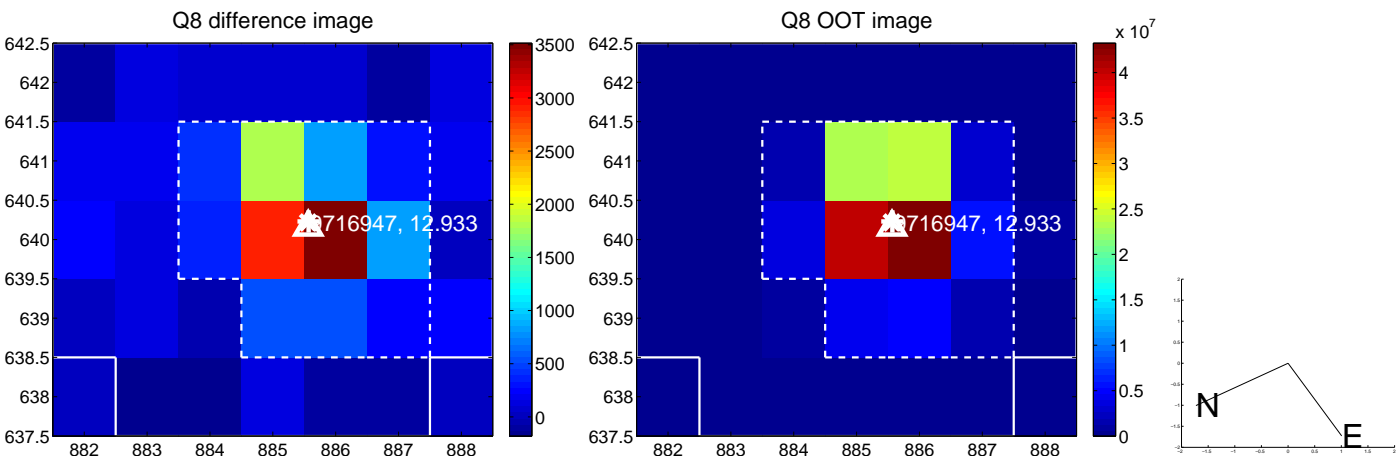
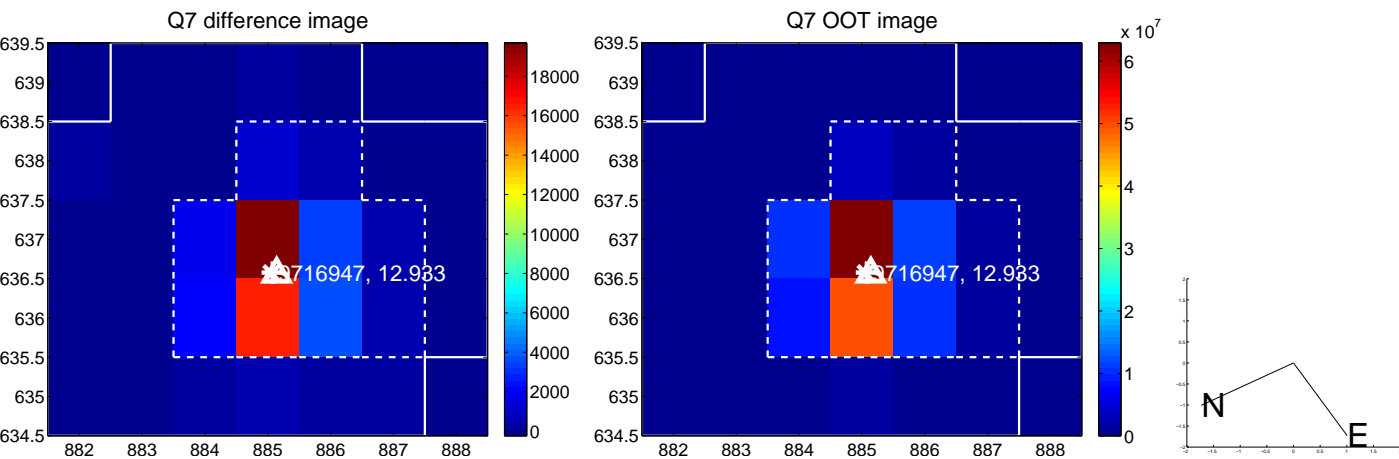
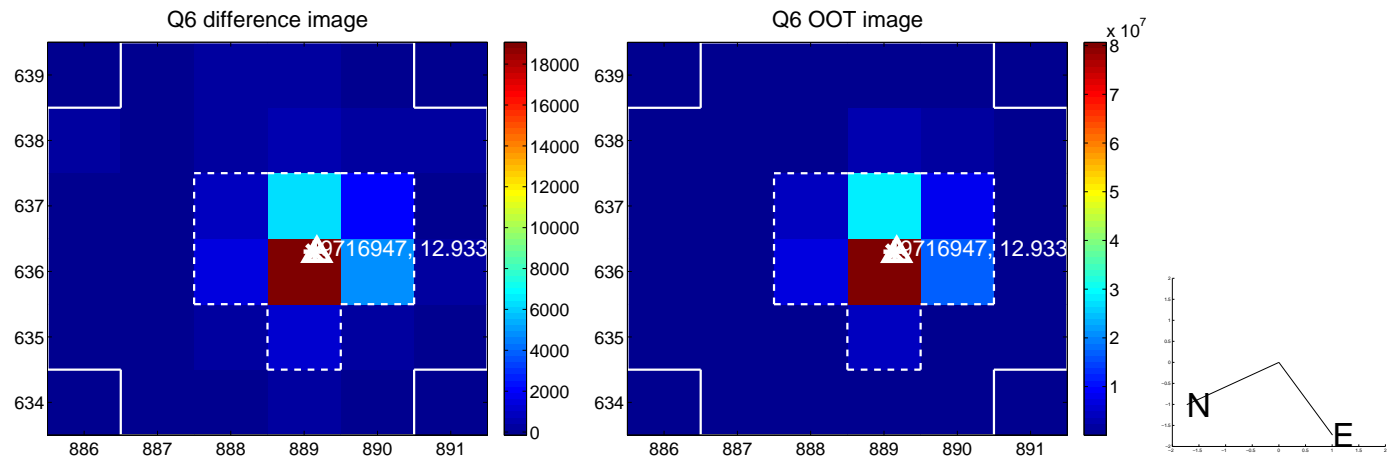
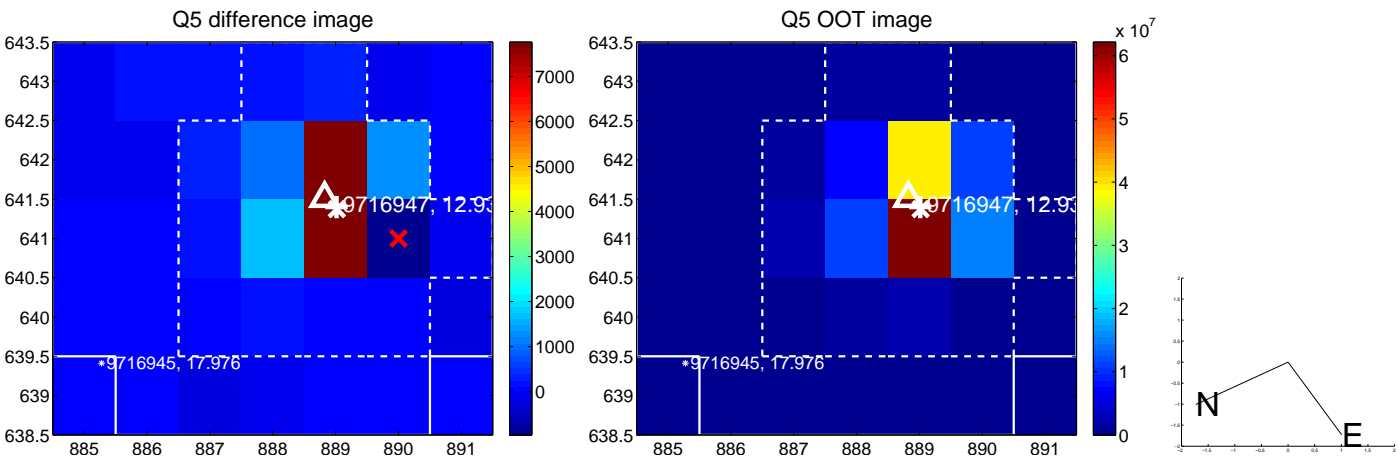


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- σ uncertainty. Blue circle: three-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

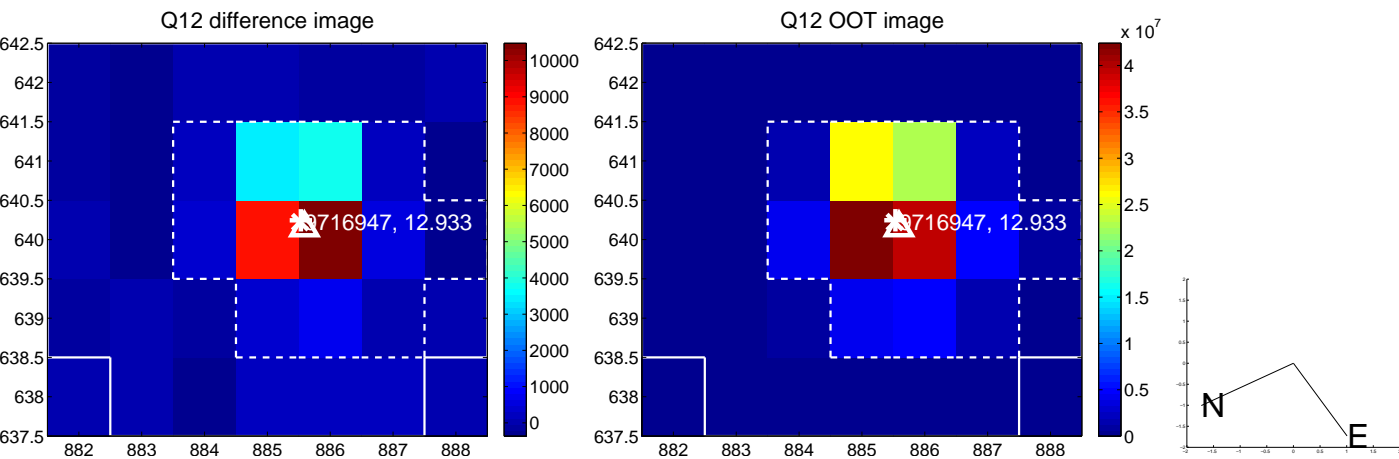
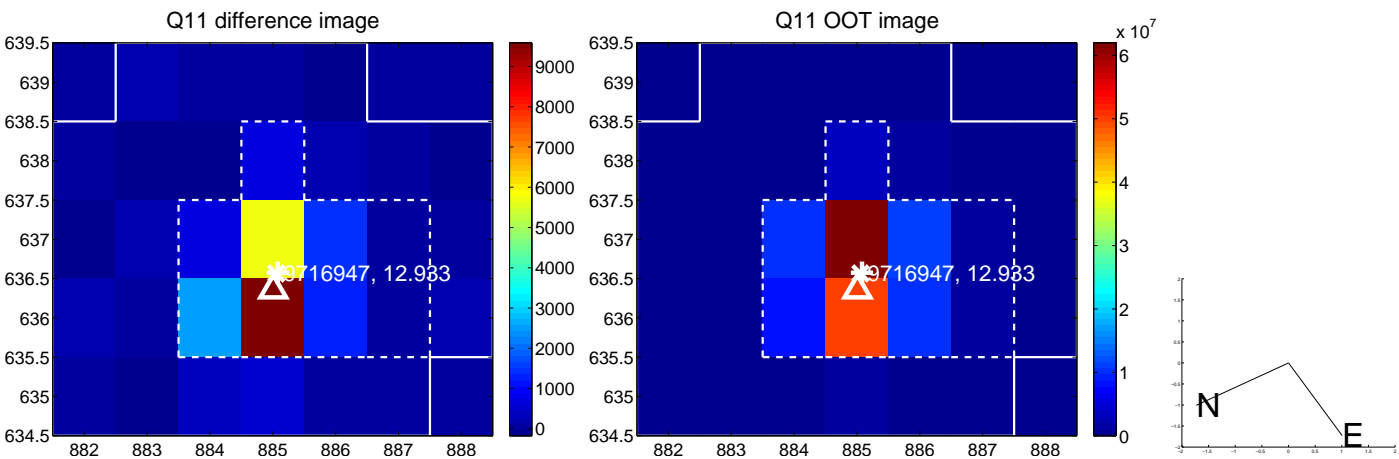
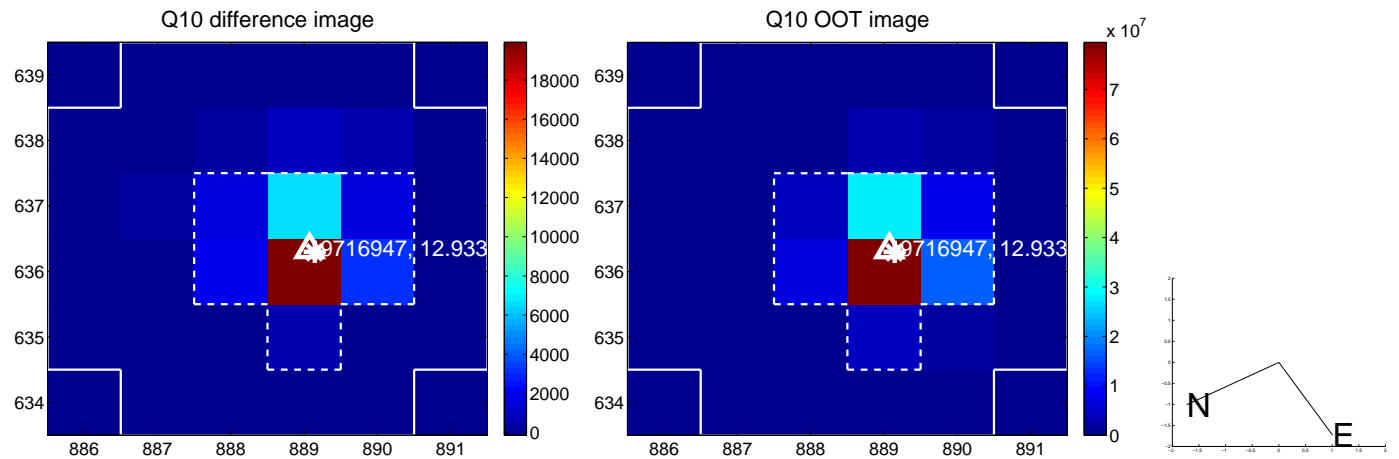
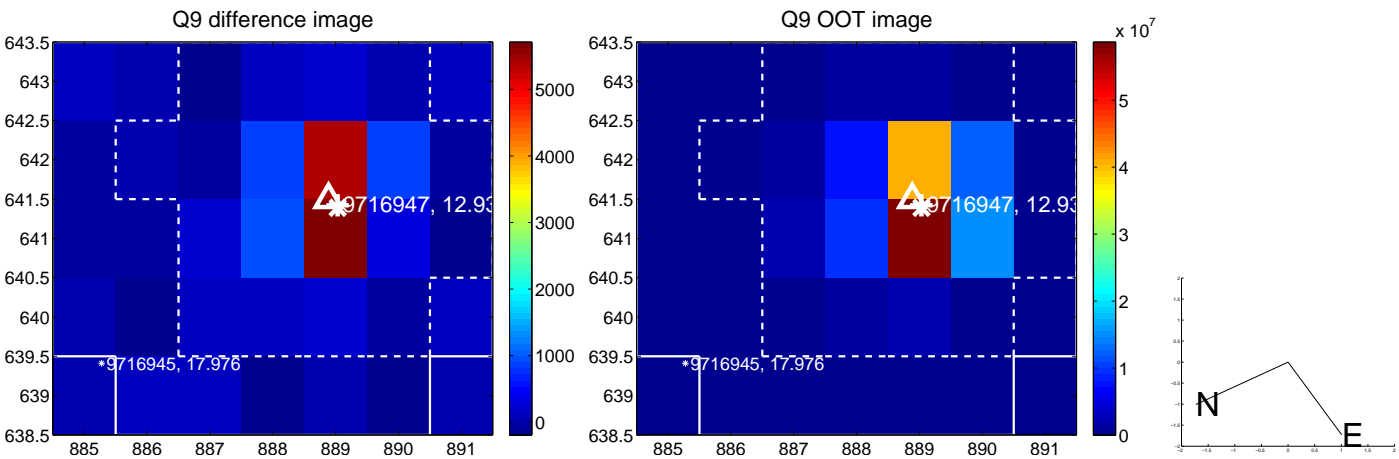
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



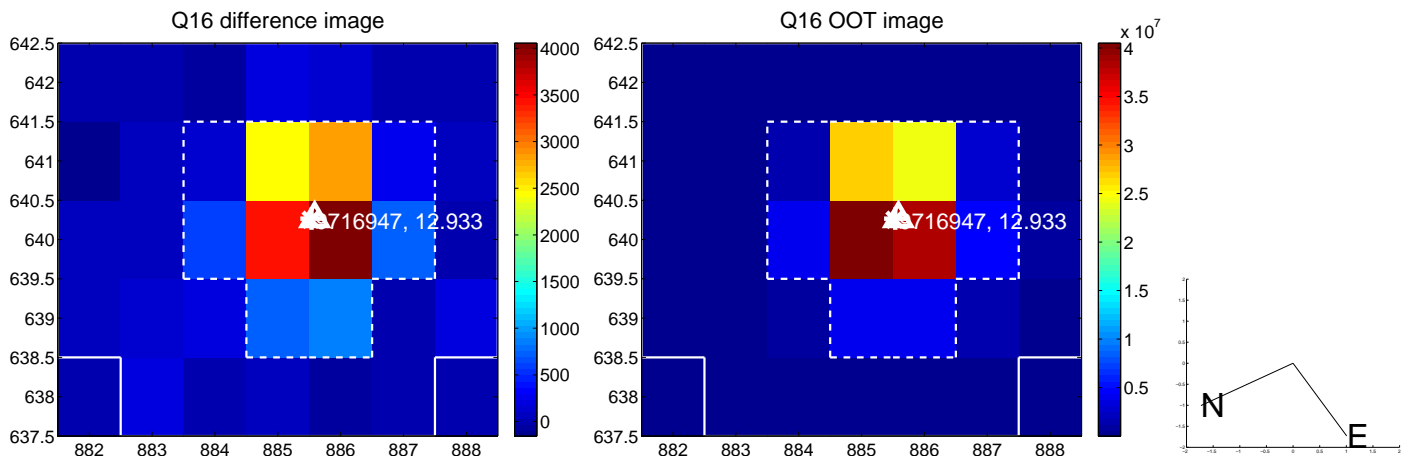
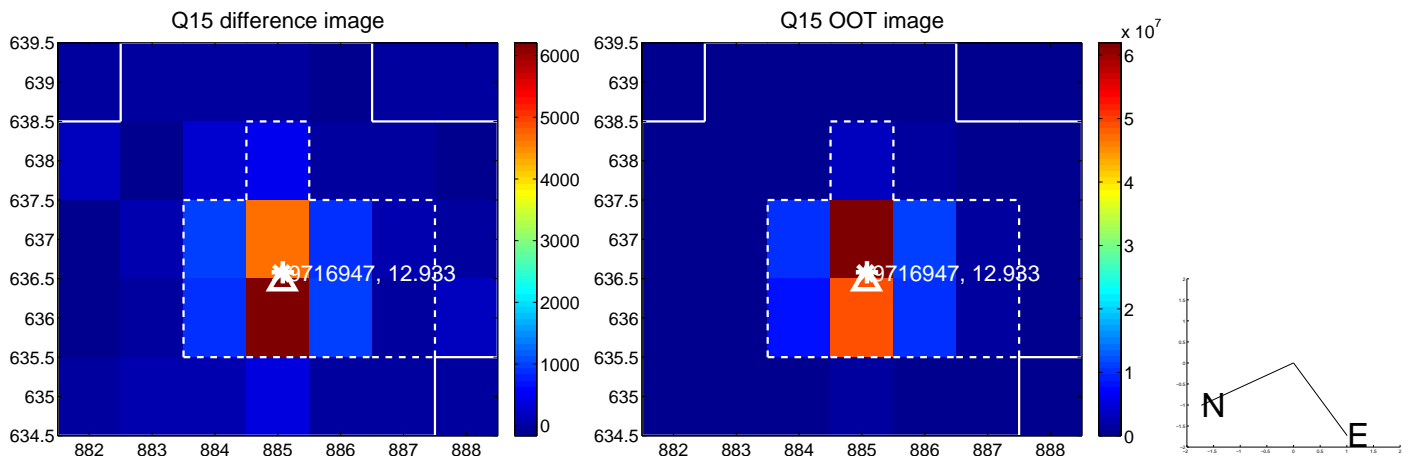
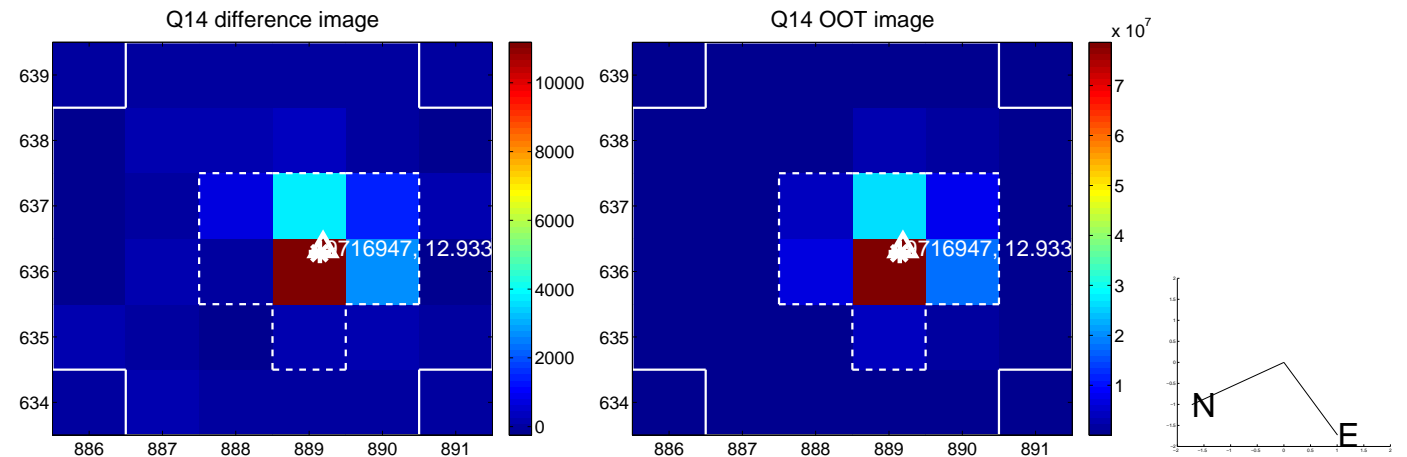
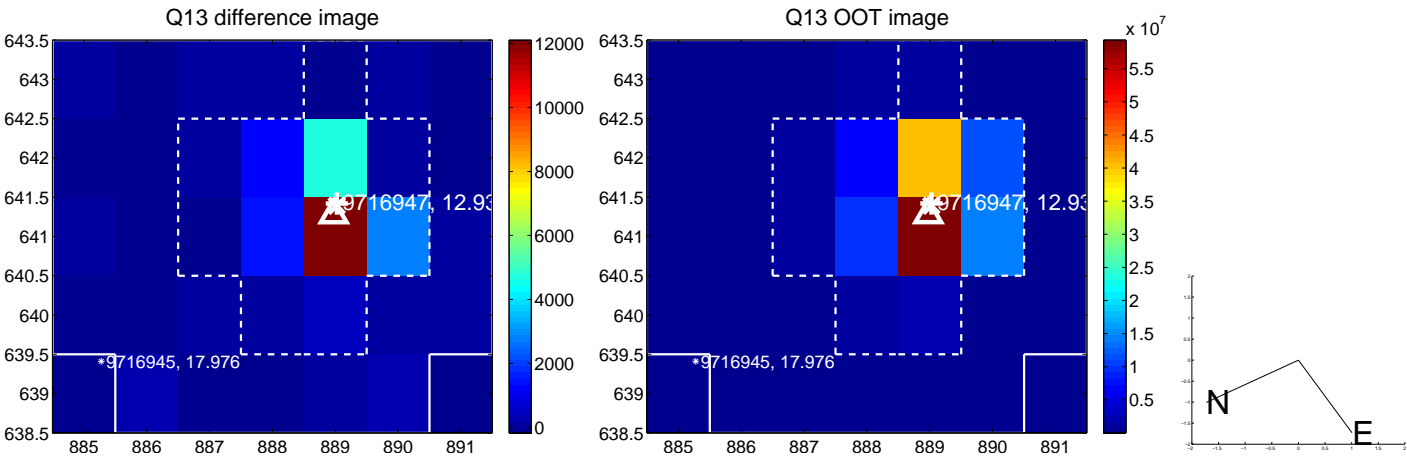
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



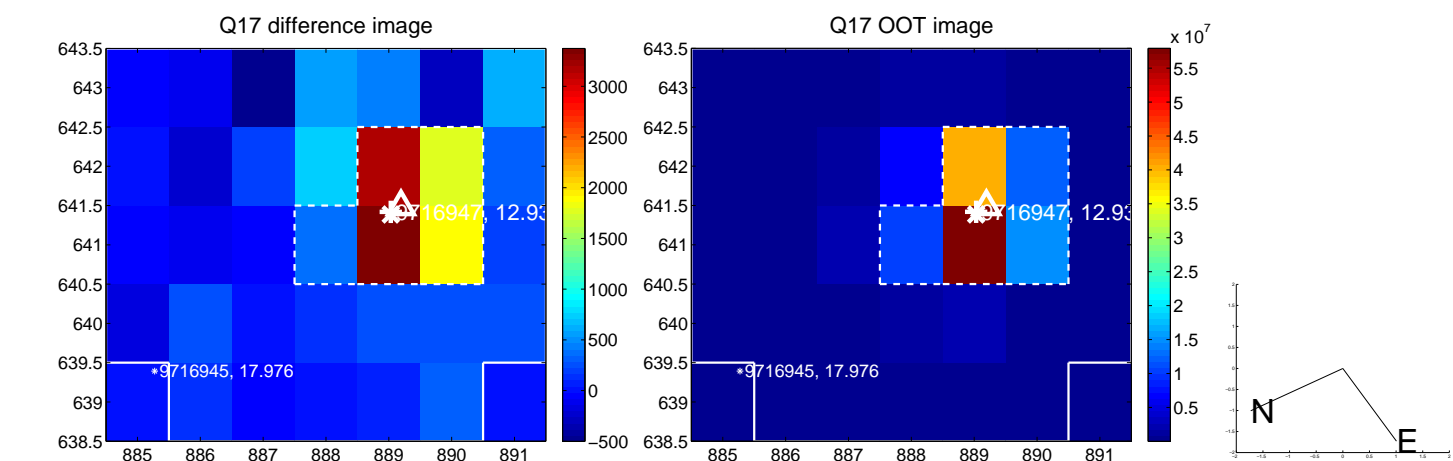
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



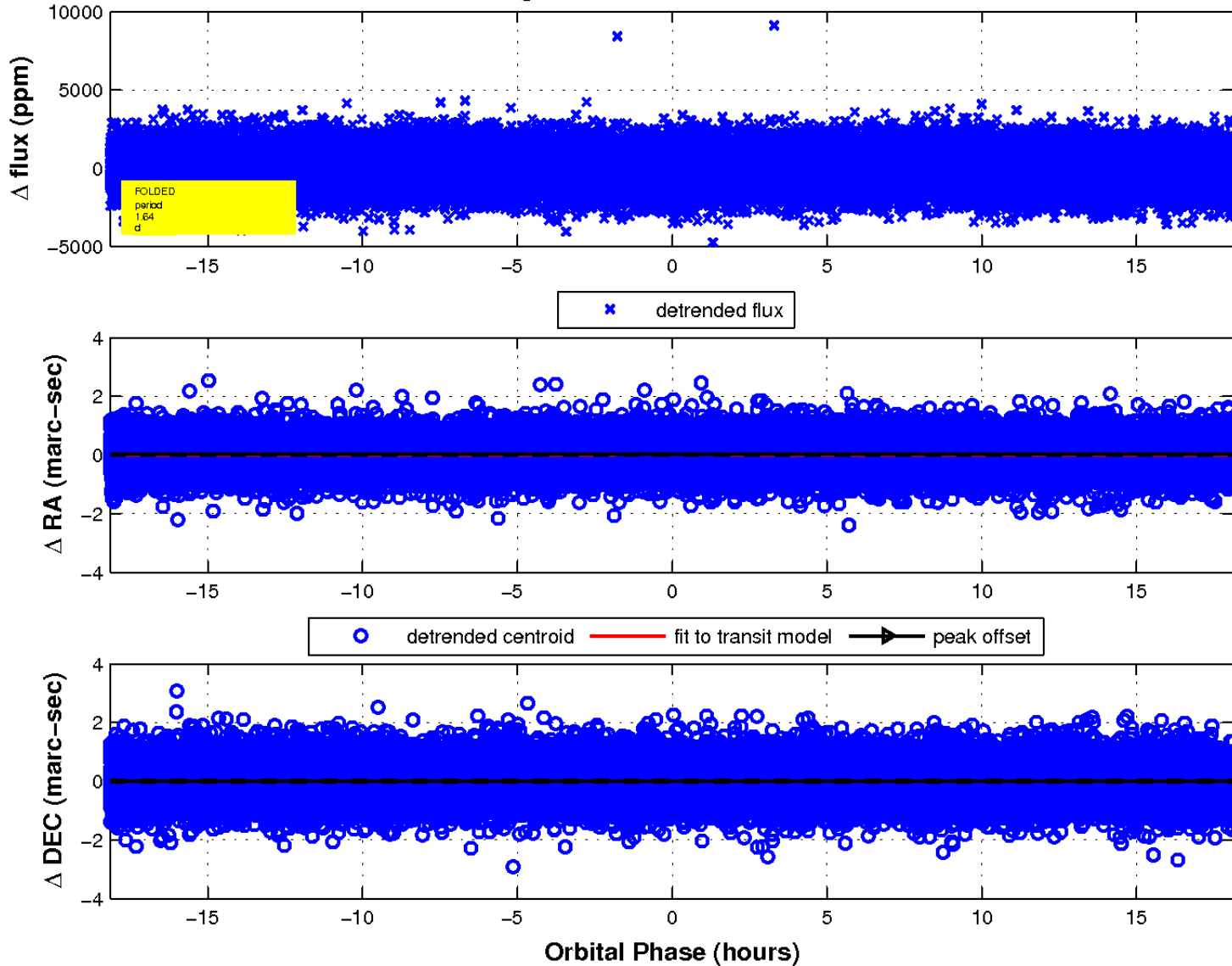
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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

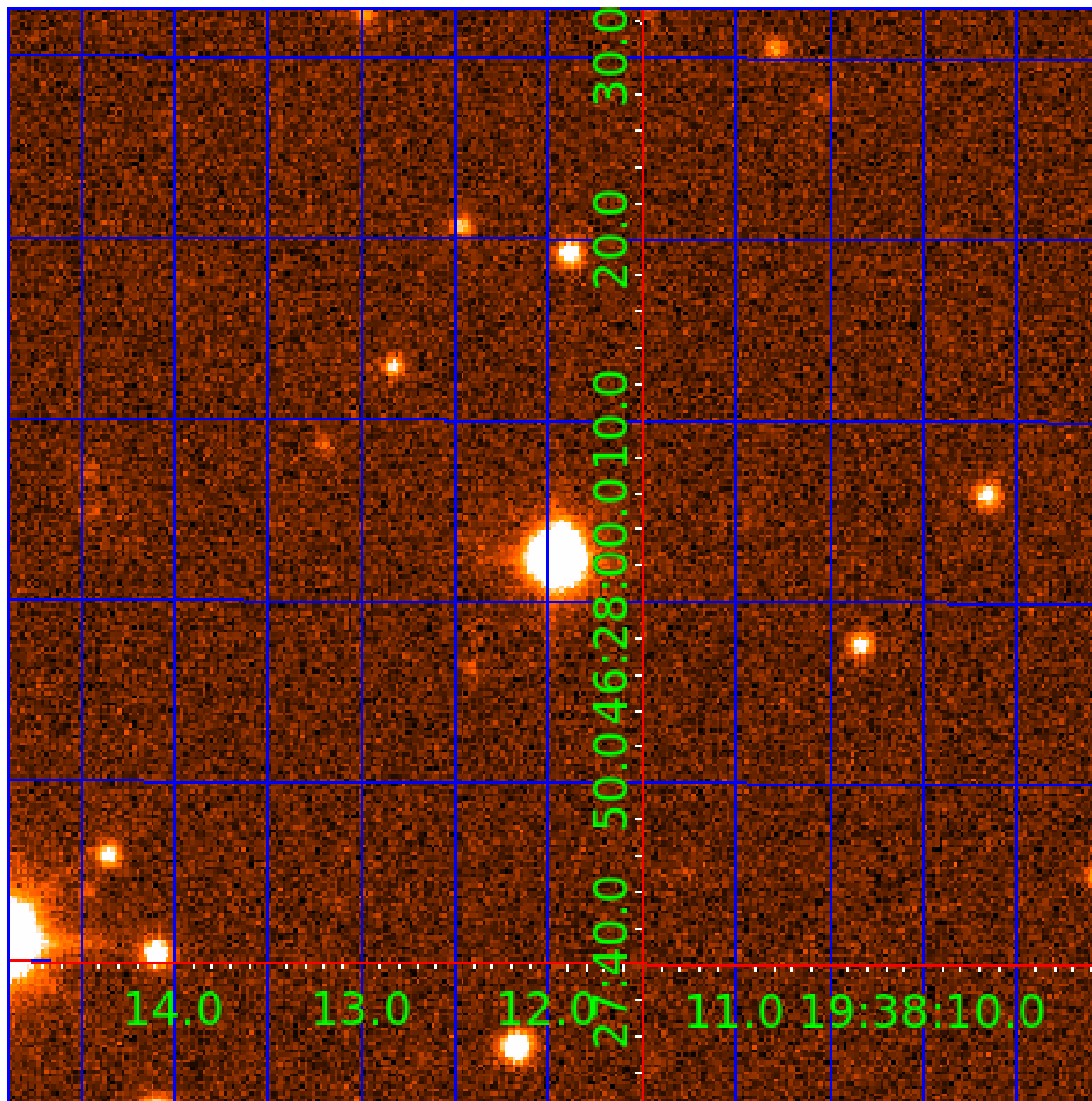


fluxWeightedCentroids, Planet 1 of 2



UKIRT Image

Declination



KIC 009716947

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}) |
|--------------|----------|------|---------------|--------------|-------------|------------------|-----|------|-----------------------------|-----------------|------------------------|------------------------|
| 009716947-01 | OBS | No | 1.641488 | 132.198674 | 150.5 | 6.051 | 9.3 | 10.4 | 2.21 | 7517 | 3.43 | 12244.95 |
| 009716947-02 | OBS | No | 0.612950 | 131.654342 | 143.7 | 1.205 | 9.3 | 8.9 | 2.21 | 7517 | 2.76 | 45537.98 |

Robovetter Results

| TCE | Run Type | Disp | Score | N | S | C | E | Comments |
|--------------|----------|------|-------|---|---|---|---|---|
| 009716947-01 | OBS | FP | 0.00 | 1 | 0 | 0 | 0 | LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT |
| 009716947-02 | OBS | FP | 0.00 | 1 | 0 | 1 | 0 | TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—HALO_GHOST |

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

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

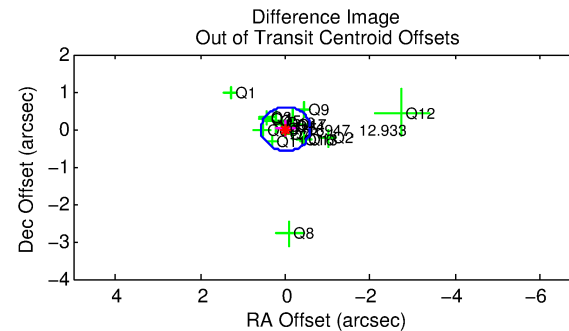
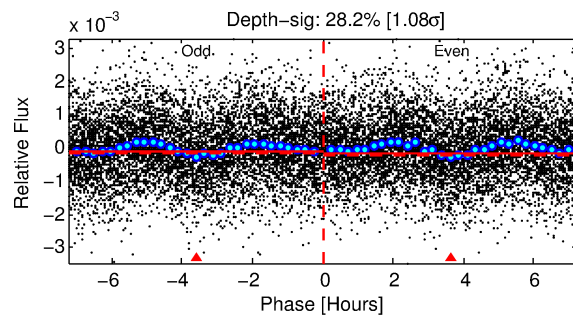
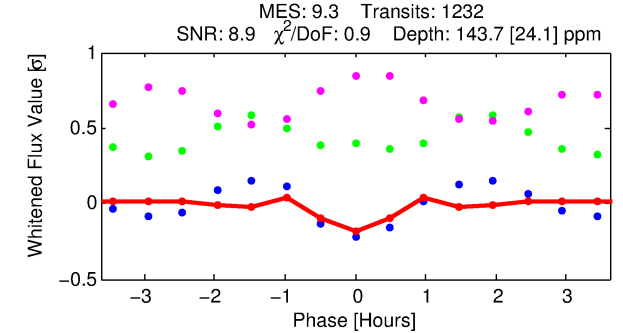
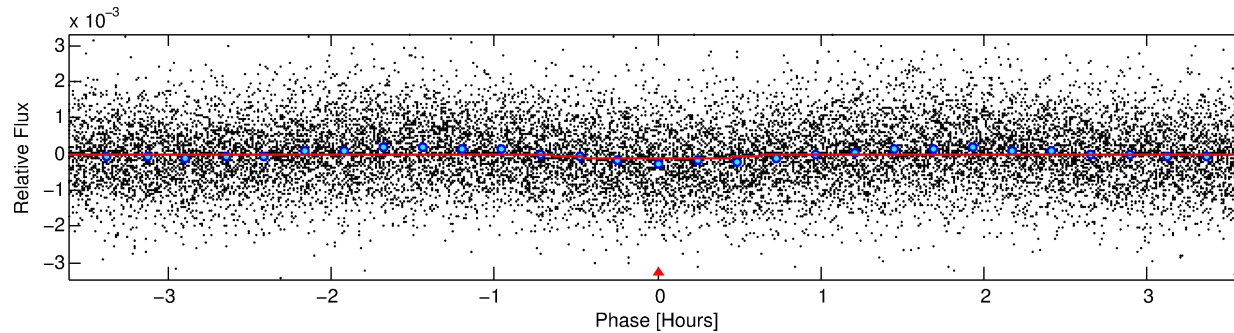
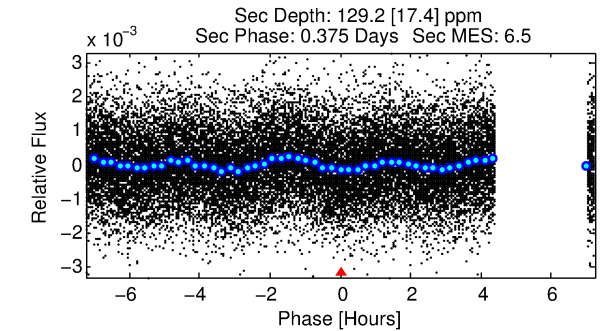
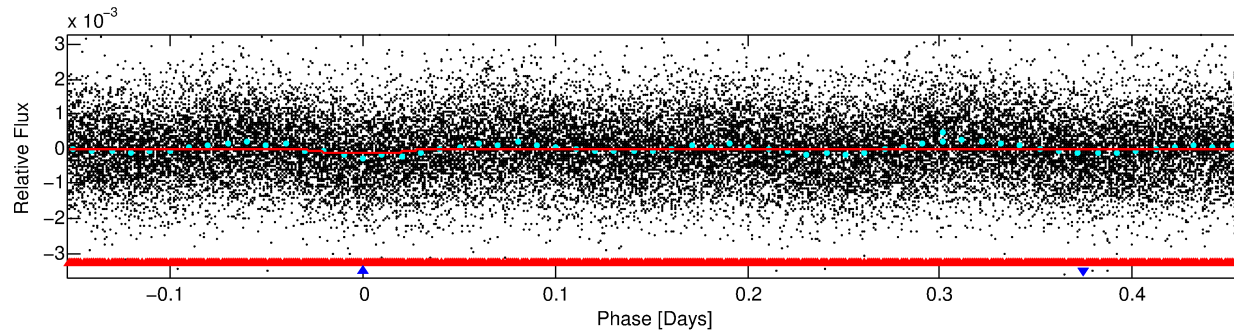
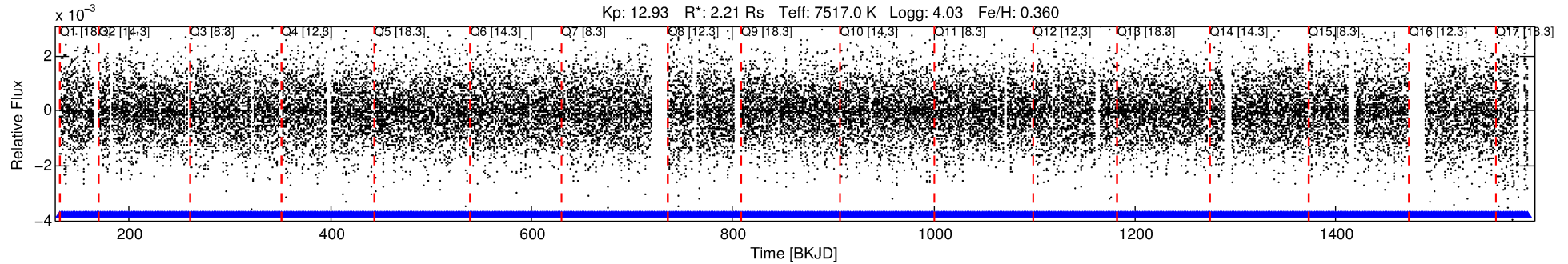
See http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col for comment definitions.

Ephemeris Match Information For 009716947-02

No Significant Match Found

DV One-Page Summary

KIC: 9716947 Candidate: 2 of 2 Period: 0.613 d



DV Fit Results:

Period = 0.61295 [0.00001] d
Epoch = 131.6543 [0.0015] BKJD
Rp/R* = 0.0115 [0.0040]
a/R* = 3.50 [6.63]
b = 0.50 [3.14]
Seff = 45537.98 [16385.60]
Teq = 3725 [335] K
Rp = 2.76 [1.19] Re
a = 0.0175 [0.0037] AU
Ag = 2.86 [2.21] [0.84σ]
Teffp = 7487 [1374] K [2.66σ]

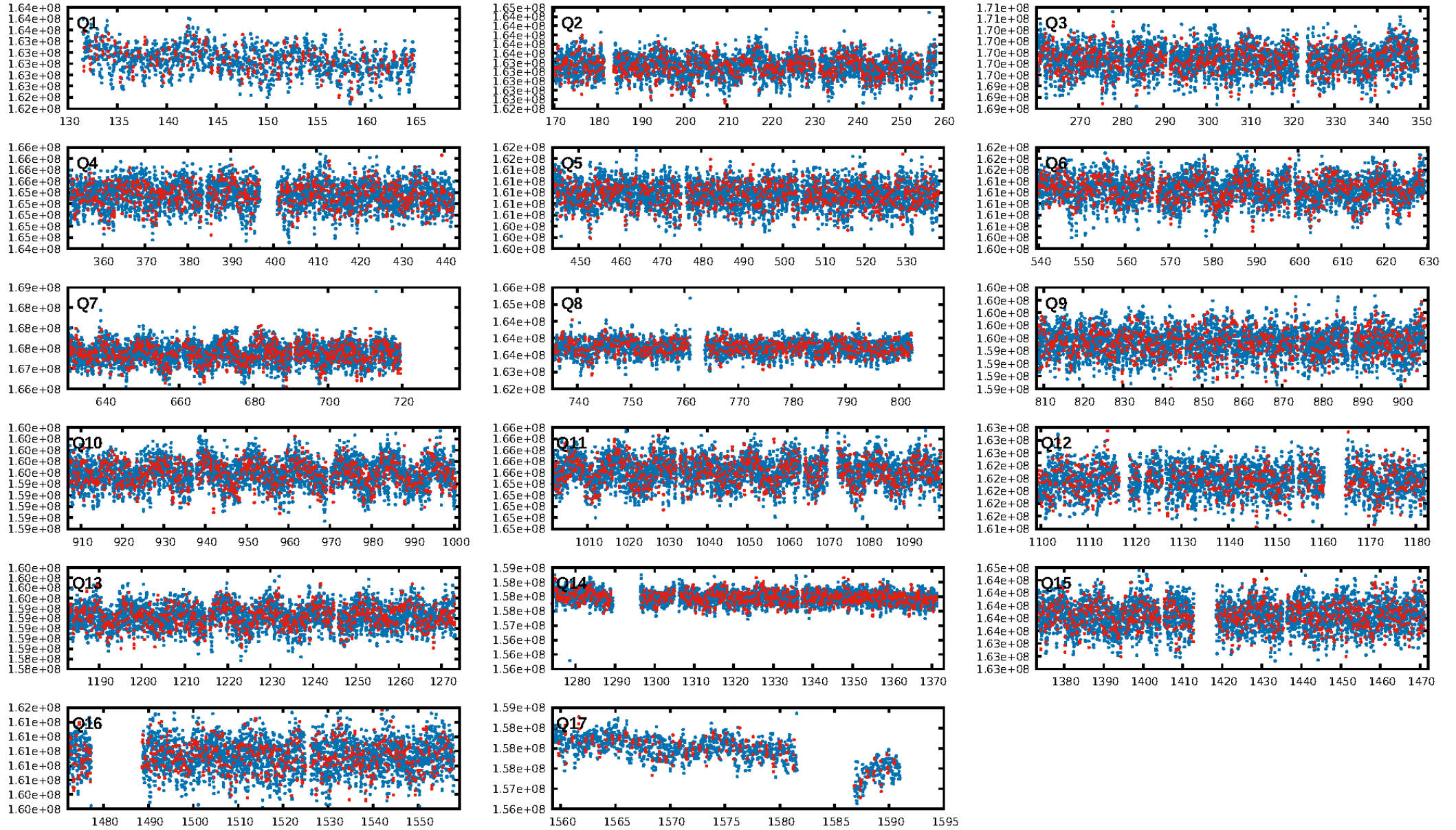
DV Diagnostic Results:

ShortPeriod-sig: N/A
LongPeriod-sig: 100.0% [4.00σ]
ModelChiSquare2-sig: N/A
ModelChiSquareGof-sig: N/A
Bootstrap-pfa: 4.31e-17
RollingBand-fgt: 1.00 [1177/1177]
GhostDiagnostic-chr: -0.03645
Centroid-sig: 12.6%
Centroid-so: 0.199 arcsec [1.59σ]
OotOffset-rm: 0.013 arcsec [0.07σ]
OotOffset-st: 4/4/4/5 [17]
KicOffset-rm: 0.076 arcsec [0.36σ]
KicOffset-st: 4/4/4/5 [17]
DiffImageQuality-fgm: 0.82 [14/17]
DiffImageOverlap-fno: 1.00 [17/17]

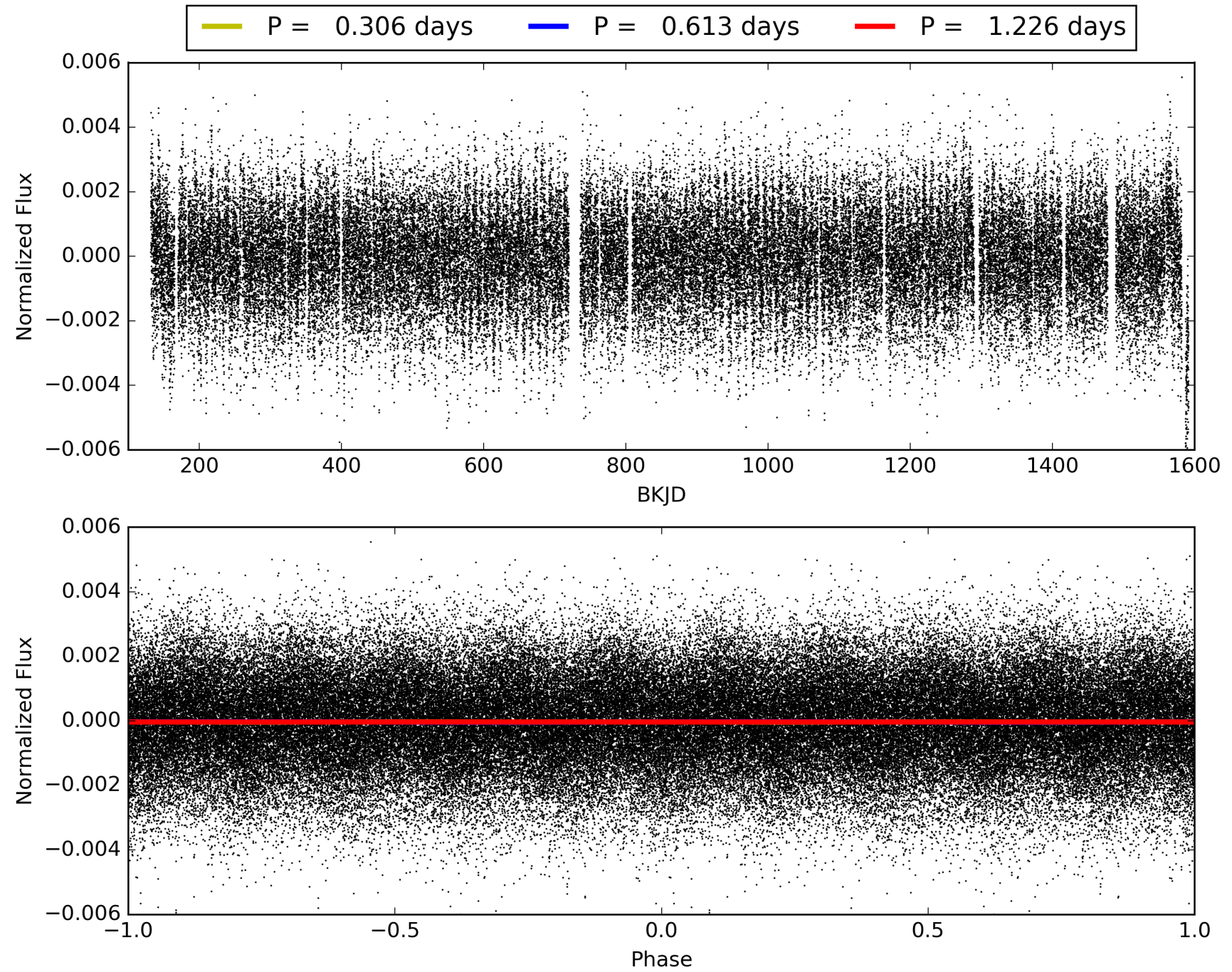
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 18:42:29 Z

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

TCE 009716947-02, PDC Light Curves

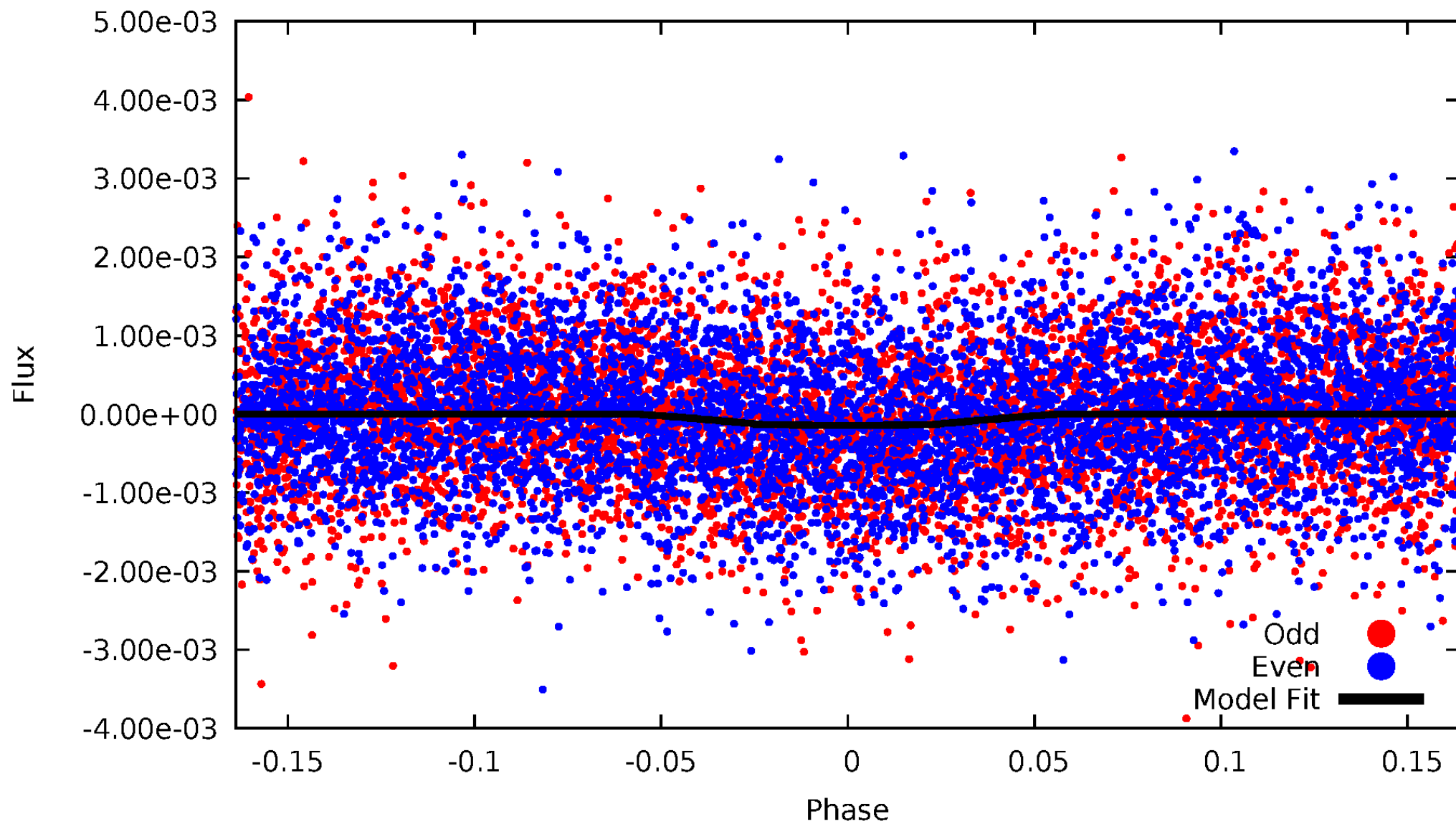


TCE 009716947-02



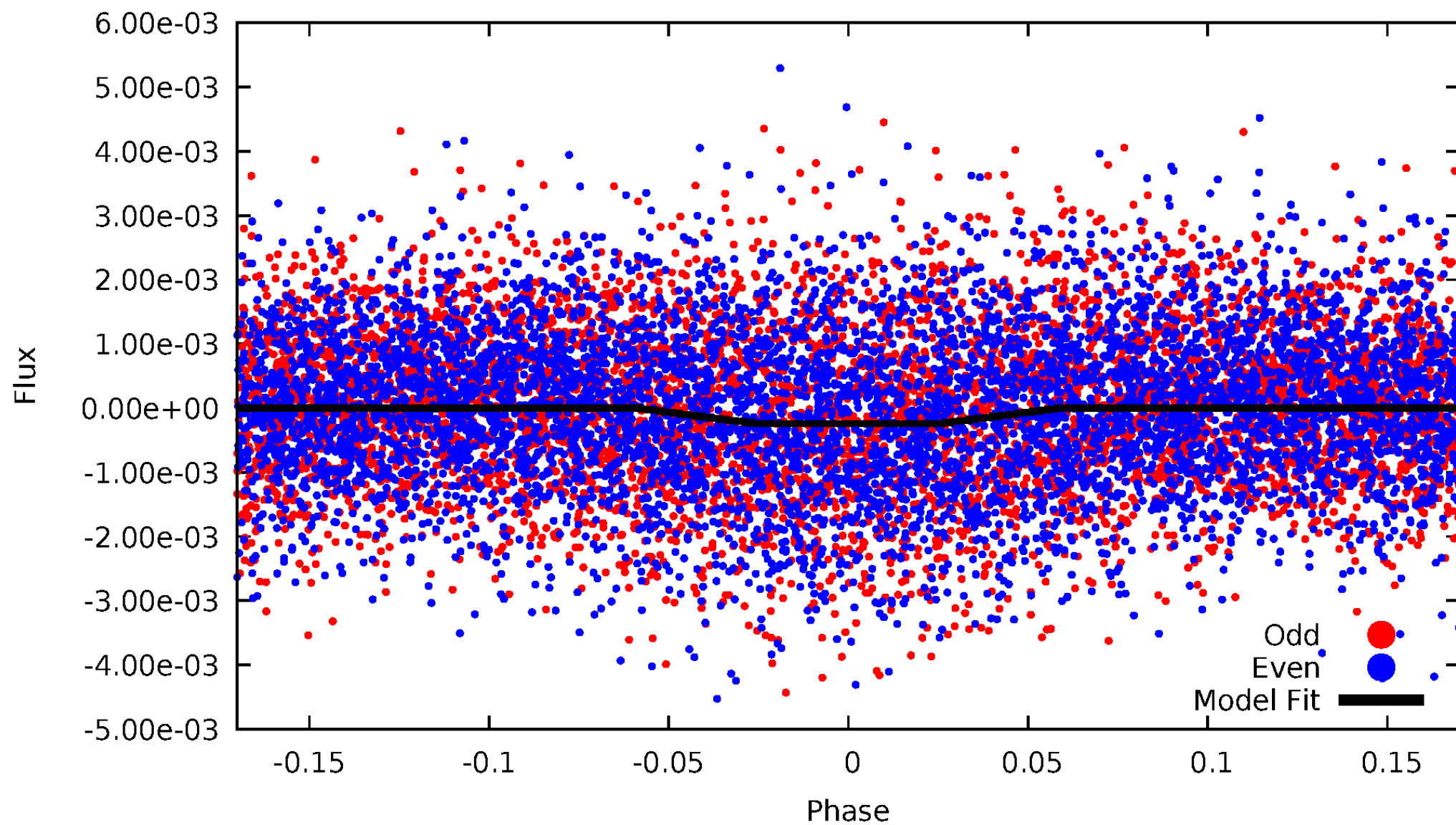
DV Odd/Even

TCE 009716947-02



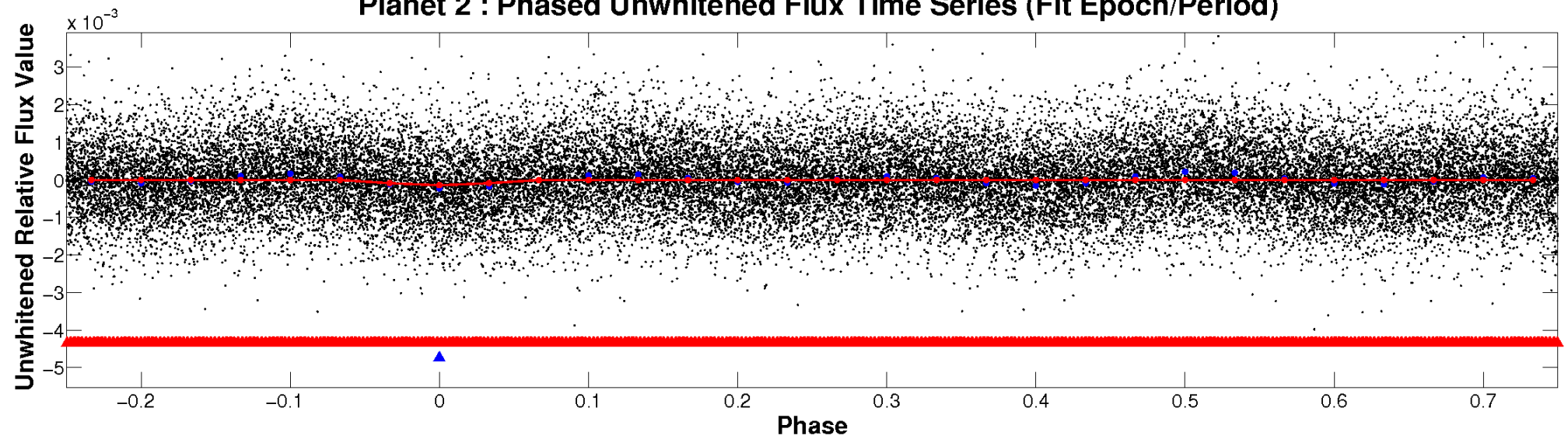
ALT Odd/Even

TCE 009716947-02

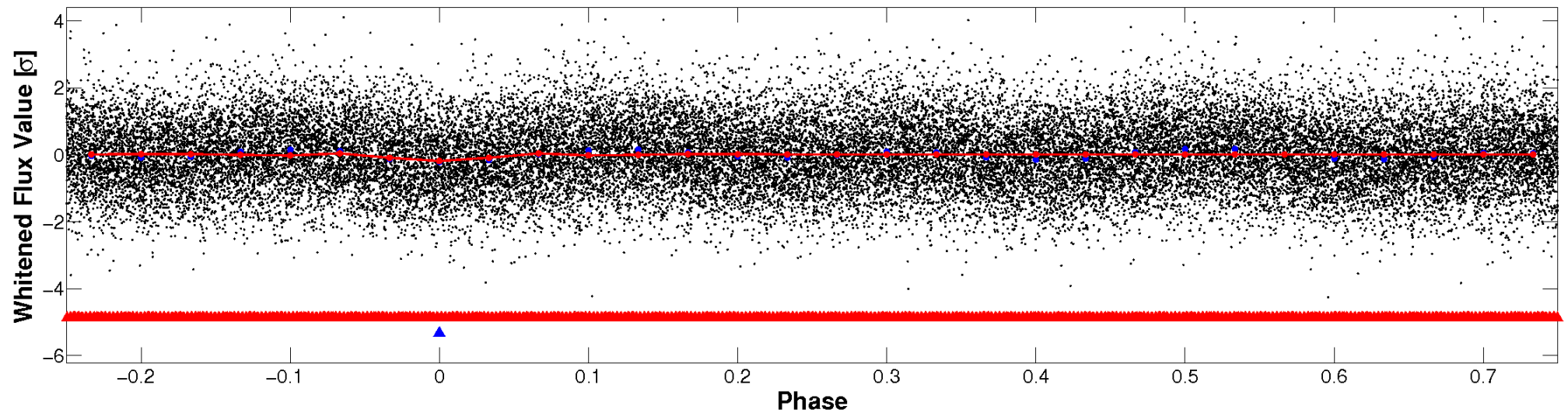


Non-Whitened Vs. Whitened Light Curve

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

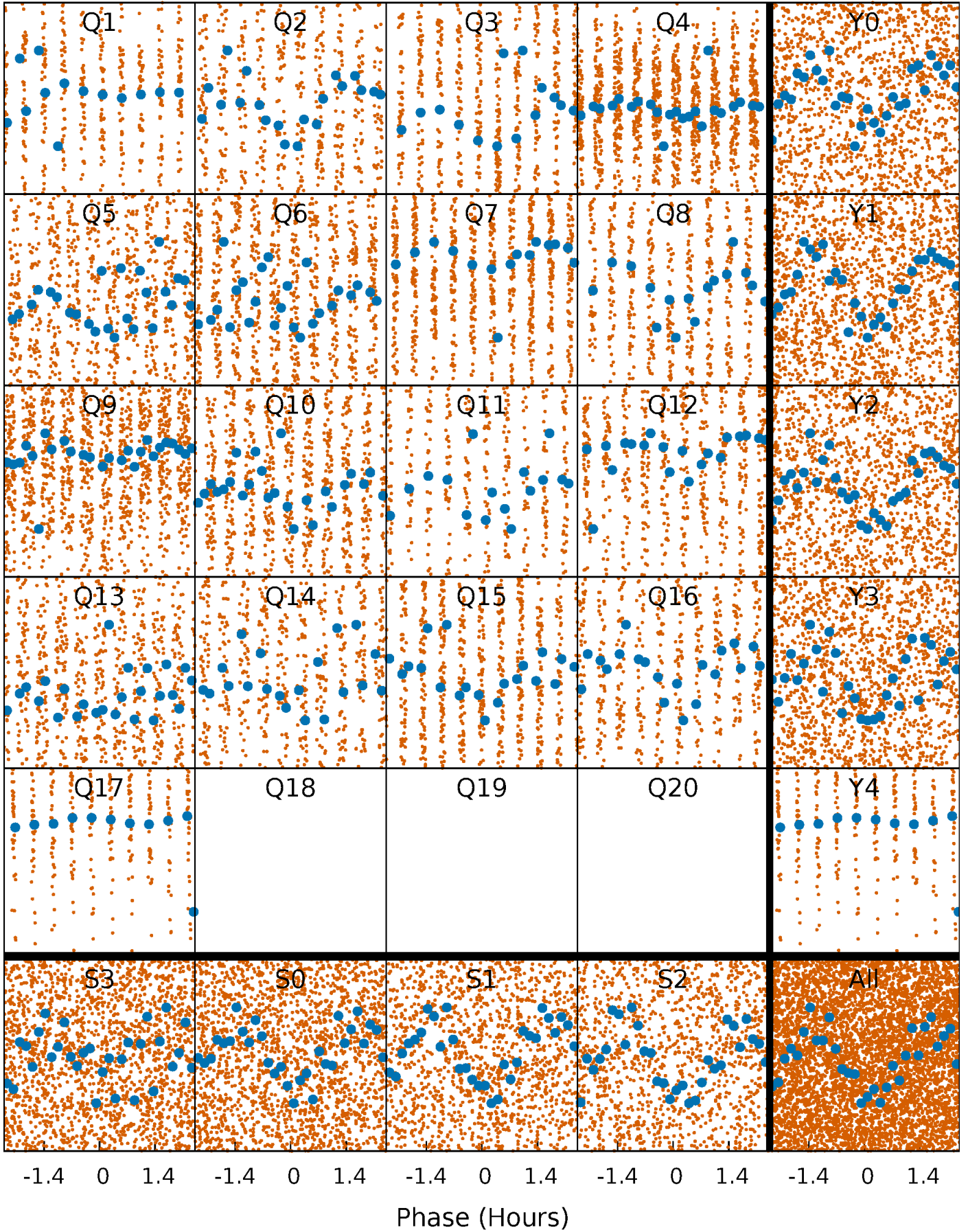


Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



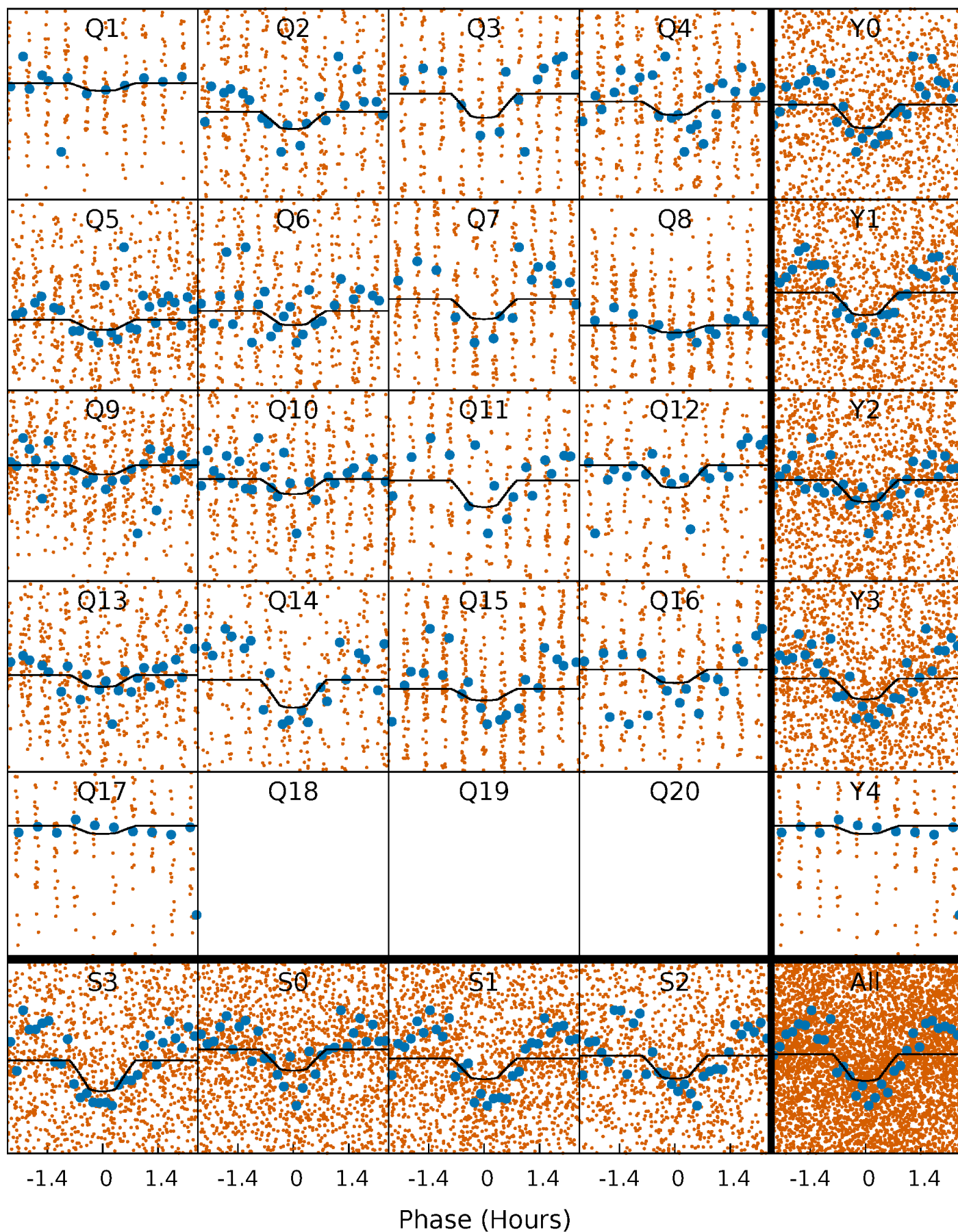
PDC Quarter-Phased Transit Curves

TCE 009716947-02 P= 0.612950 Days $T_0=131.654342$ (BKJD)



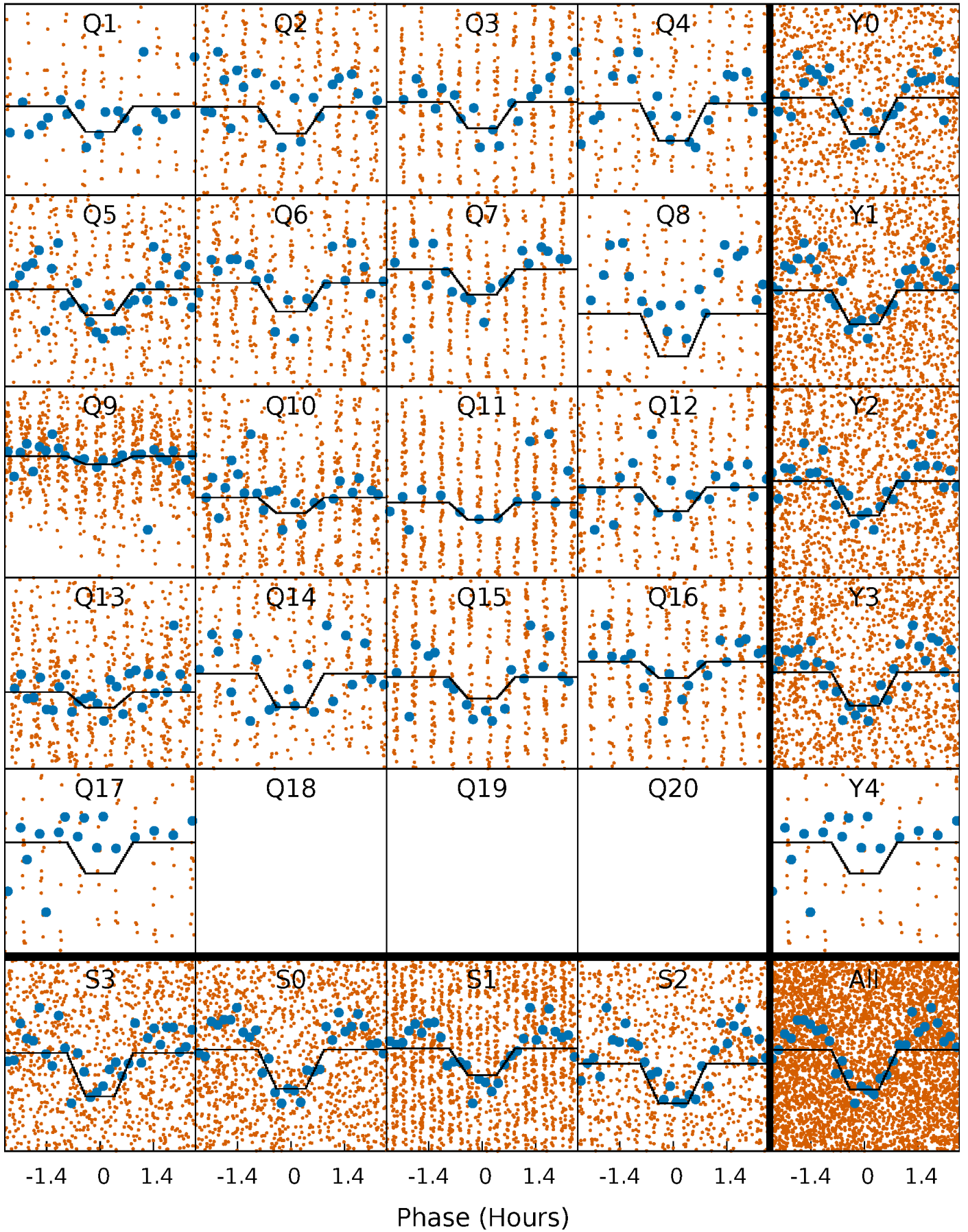
DV Quarter-Phased Transit Curves

TCE 009716947-02 P= 0.612950 Days $T_0=131.654342$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

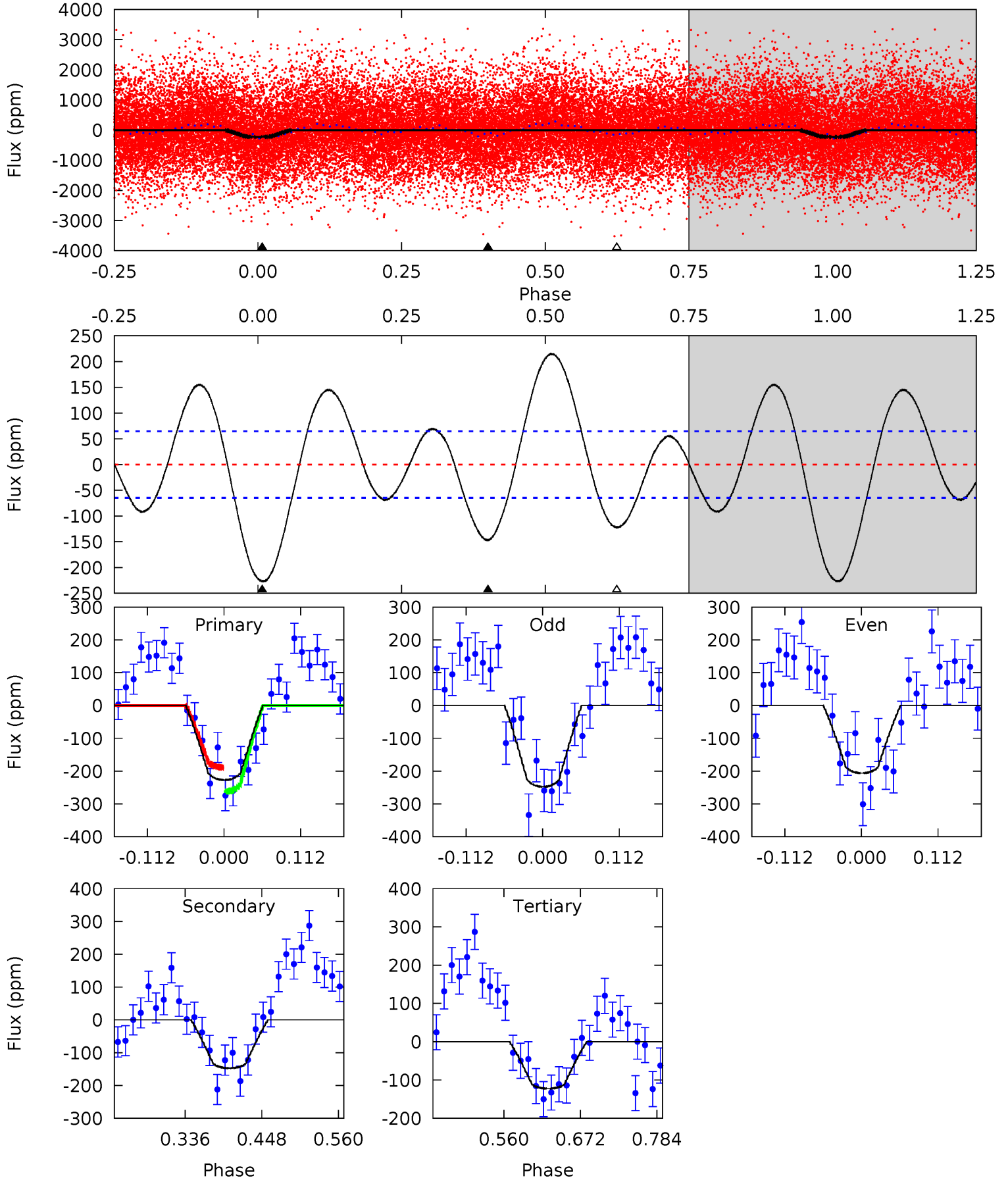
TCE 009716947-02 P= 0.612956 Days $T_0=131.654720$ (BKJD)



DV Model-Shift Uniqueness Test

009716947-02, P = 0.612950 Days, E = 131.041392 Days

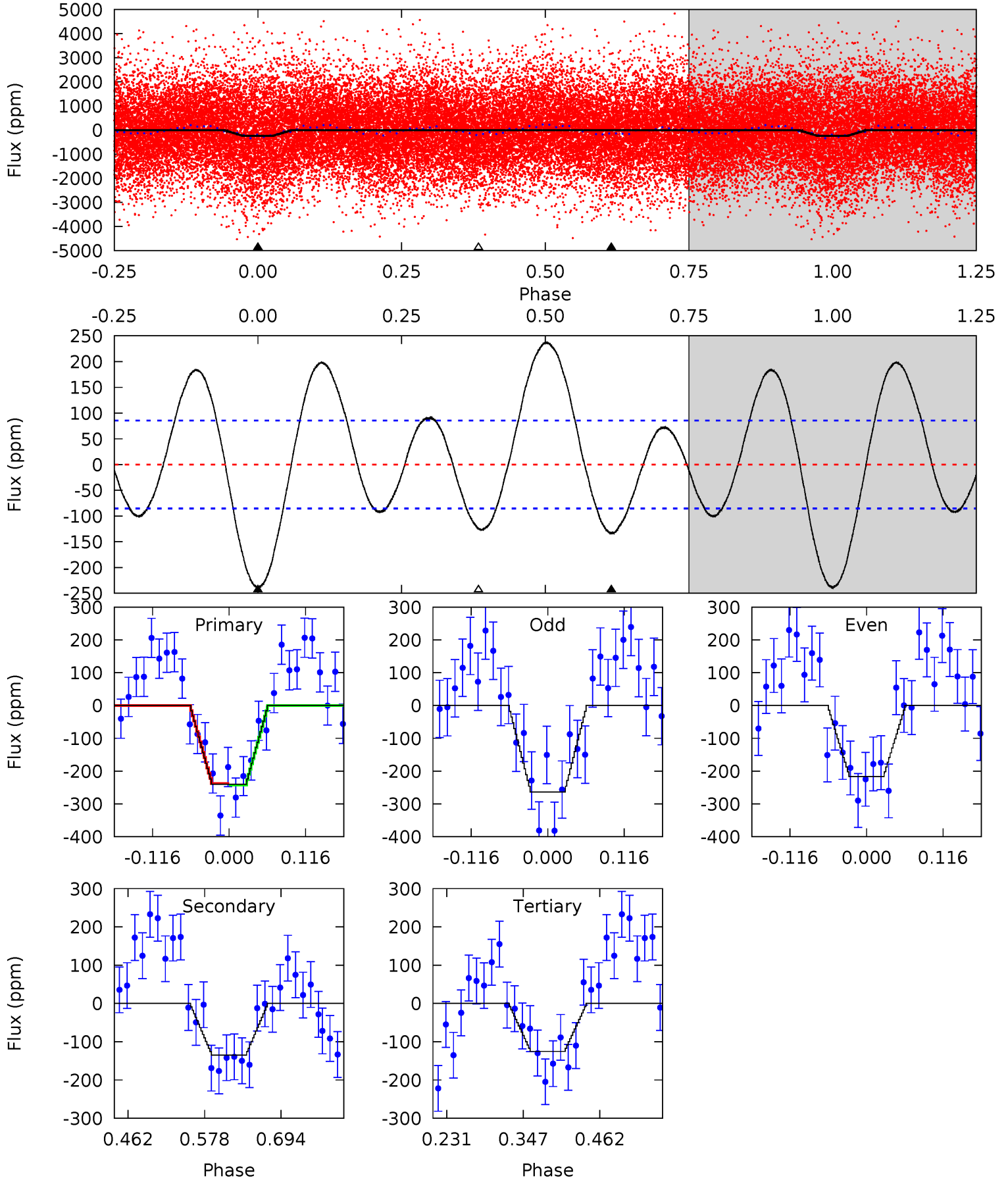
| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|-----|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 15.9 | 10.3 | 8.61 | 0 | 4.54 | 1.59 | 6.03 | 7.34 | 15.9 | 1.74 | 10.3 | 1.46 | 1.02 | 0.49 | 2.57 |



Alt Model-Shift Uniqueness Test

009716947-02, P = 0.612956 Days, E = 131.041764 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 | 7.17 | 6.65 | 0 | 4.53 | 1.57 | 5.18 | 6.10 | 12.8 | 0.52 | 7.17 | 1.25 | 1.00 | 0.50 | 0.11 |



Stellar Parameters For KIC 009716947

| | $T_{\text{eff}}(K)$ | $\log(g)$ | [Fe/H] | R (R_{\odot}) | $M(M_{\odot})$ | p_{\star} ($\text{g}\cdot\text{cm}^{-3}$) |
|--------|----------------------|---------------------------|---------------------------|---------------------------|---------------------------|---|
| | 7517^{+208}_{-357} | $4.029^{+0.135}_{-0.165}$ | $0.360^{+0.100}_{-0.350}$ | $2.207^{+0.566}_{-0.412}$ | $1.897^{+0.171}_{-0.277}$ | $0.248^{+0.184}_{-0.112}$ |
| | +3%/-5% | +3%/-4% | +28%/-97% | +26%/-19% | +9%/-15% | +74%/-45% |
| 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 009716947-02 / KOI

| Detrend | Depth (ppm) | R_p (R_{\oplus}) | T_{max} (K) | T_{obs} (K) | A_{obs} |
|---------|---------------|------------------------|----------------------|------------------------|---------------------------|
| DV | -147 ± 14 | $2.72^{+1.10}_{-0.98}$ | 5201^{+354}_{-325} | 7452^{+2889}_{-1260} | $3.278^{+4.642}_{-1.581}$ |
| Alt. | -135 ± 19 | $3.71^{+1.19}_{-1.10}$ | 5196^{+376}_{-343} | 6030^{+1412}_{-892} | $1.608^{+1.636}_{-0.692}$ |

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 $A_{obs} \gg 1.0$

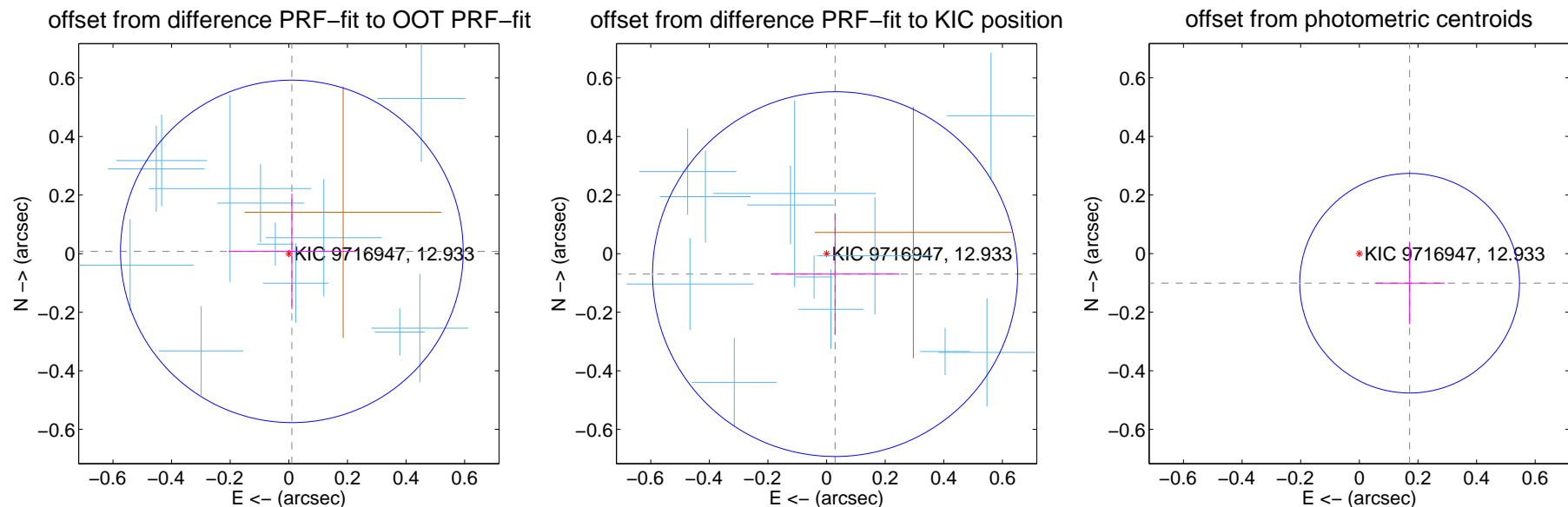
DV Centroid Data

Supplemental centroid analysis for 009716947-02. Kepler magnitude: 12.93. Transit SNR 8.91

There are 14 quarters with good PRF difference image offsets

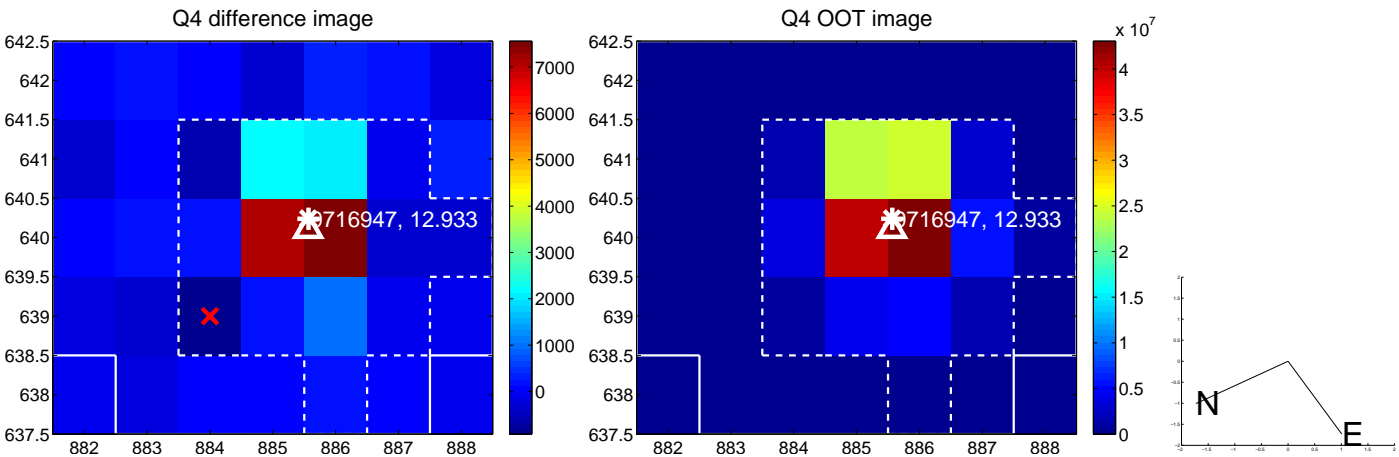
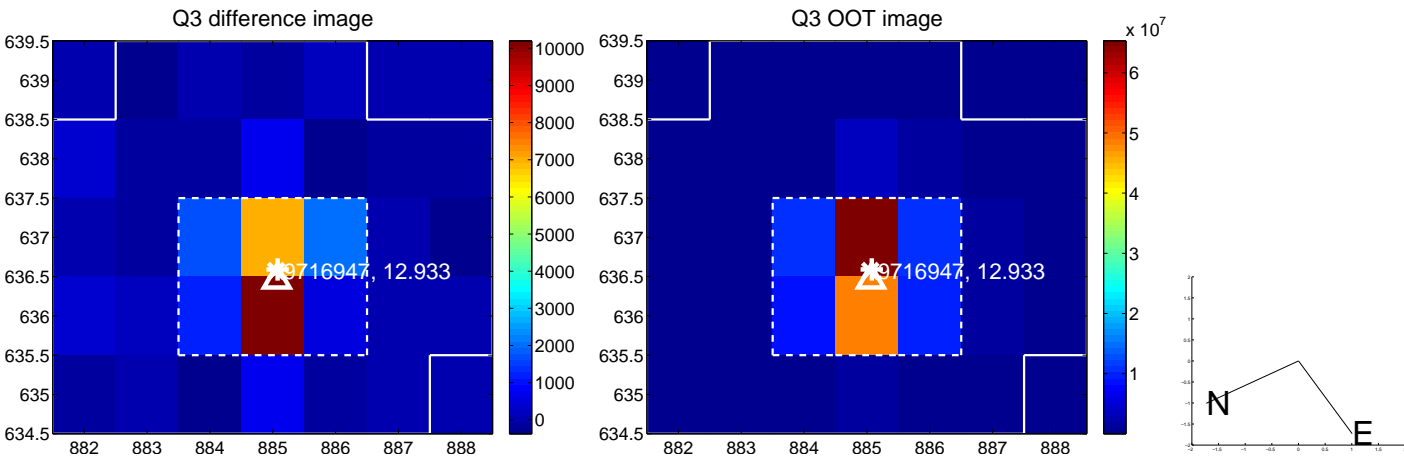
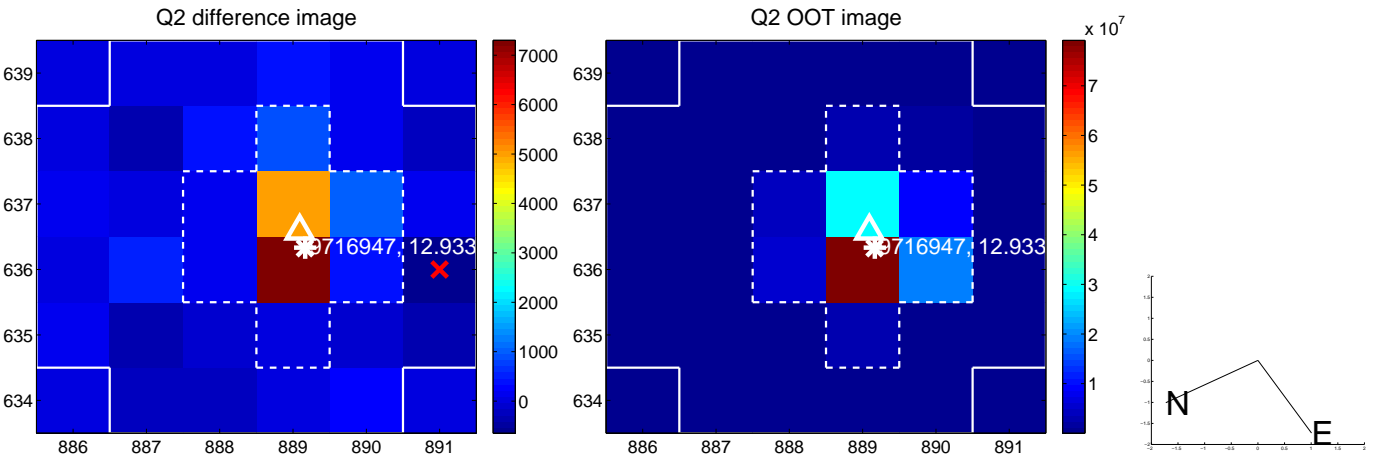
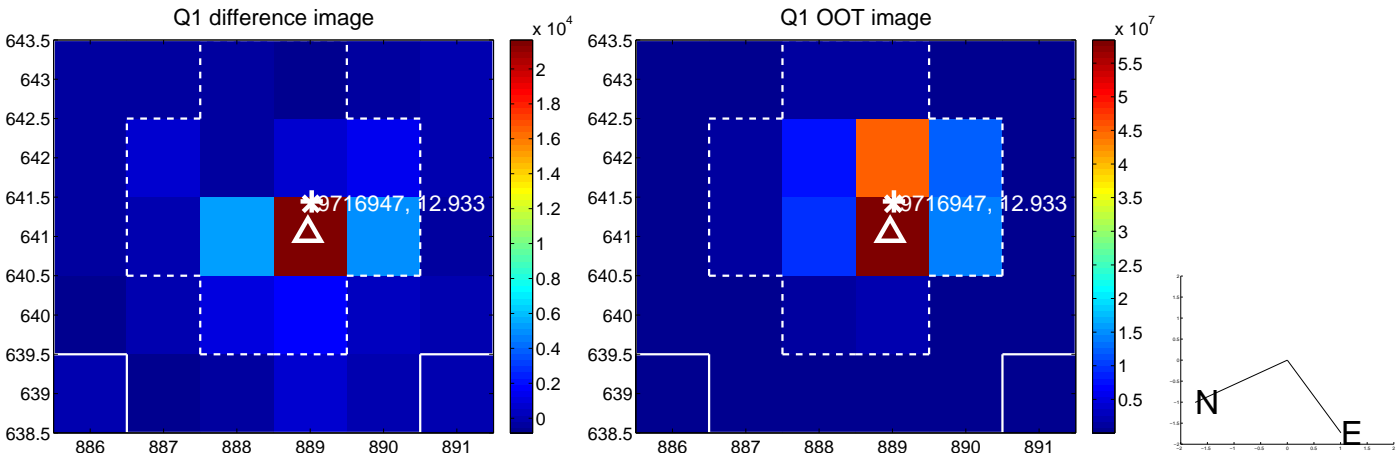
The direct PRF centroid is offset from the target star catalog position by about 0.13 arcsec

| | Distance in arcsec | Distance / σ | Δ RA | Δ Dec |
|---|--------------------|---------------------|--------------------|--------------------|
| PRF-fit source offset from OOT | 0.013 ± 0.195 | 0.07 | -0.010 ± 0.216 | 0.008 ± 0.197 |
| PRF-fit source offset from KIC position | 0.076 ± 0.208 | 0.36 | -0.029 ± 0.220 | -0.070 ± 0.206 |
| photometric centroid source offset | 0.20 ± 0.12 | 1.59 | -0.17 ± 0.12 | -0.10 ± 0.14 |

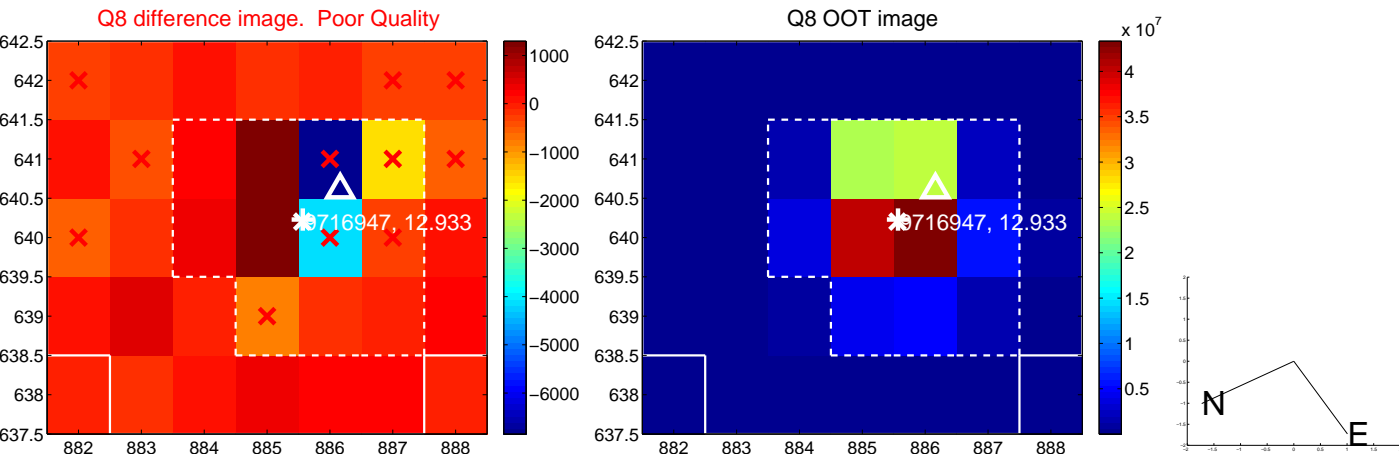
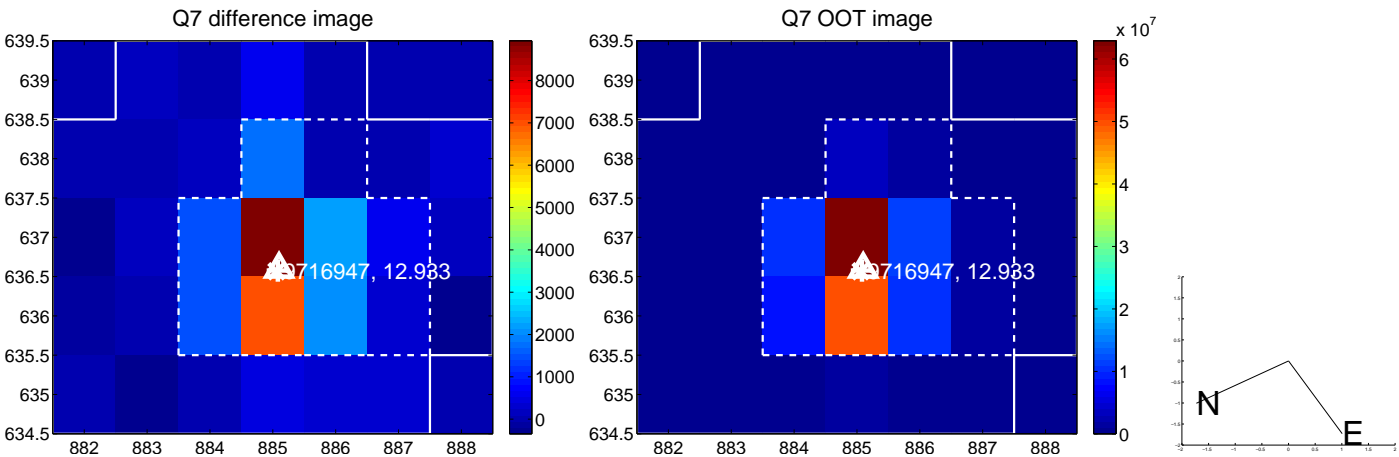
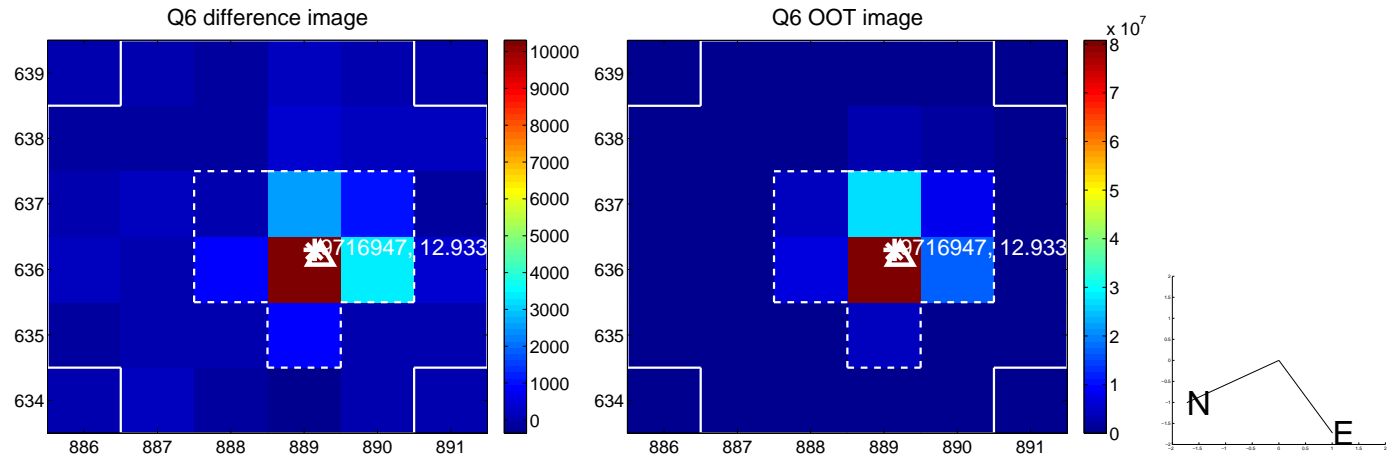
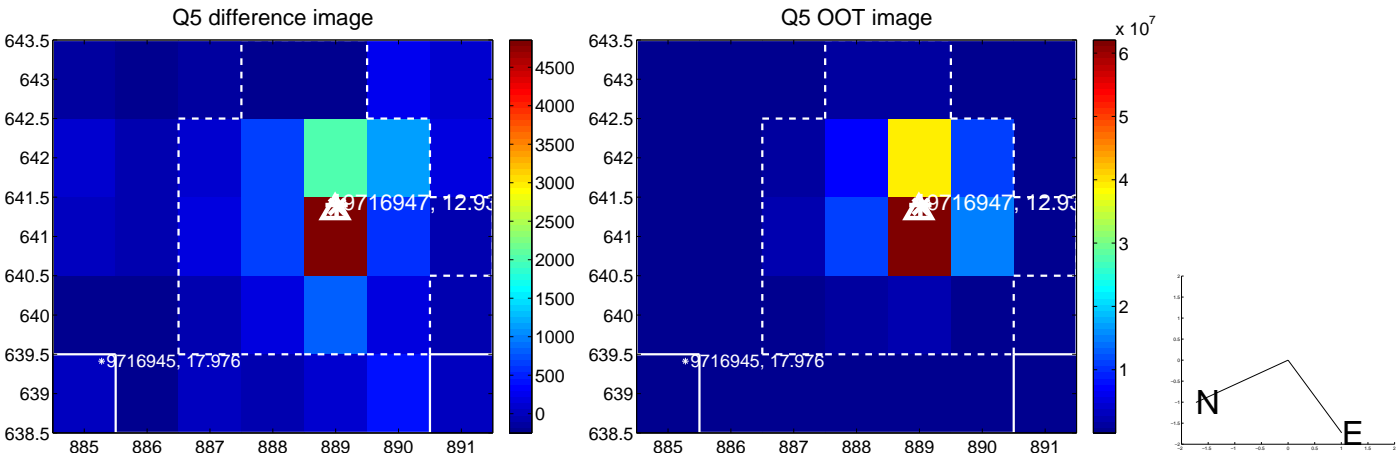


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets**; **Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- σ uncertainty. Blue circle: three-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

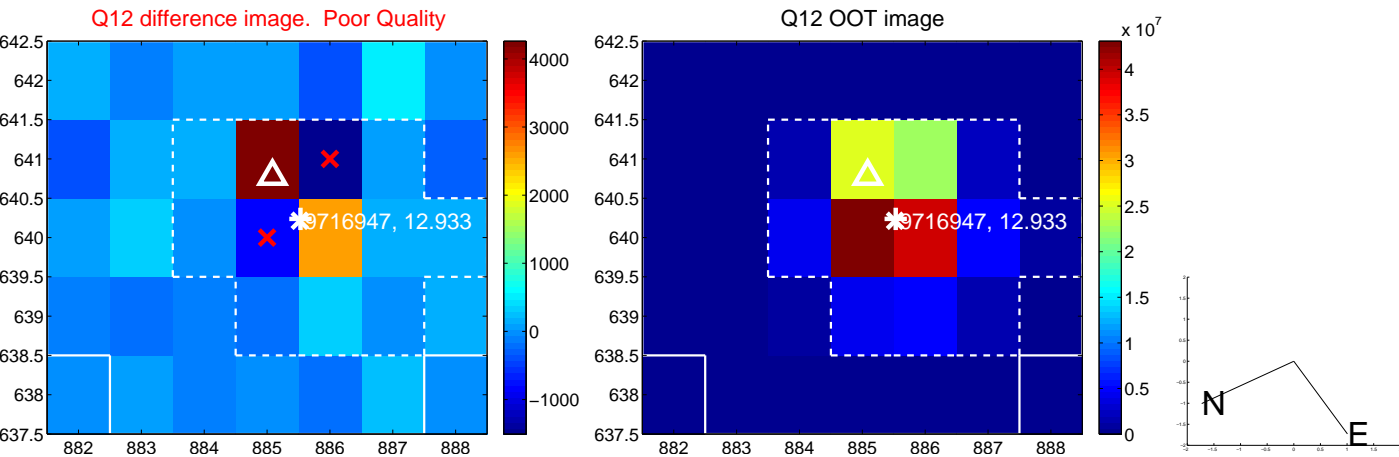
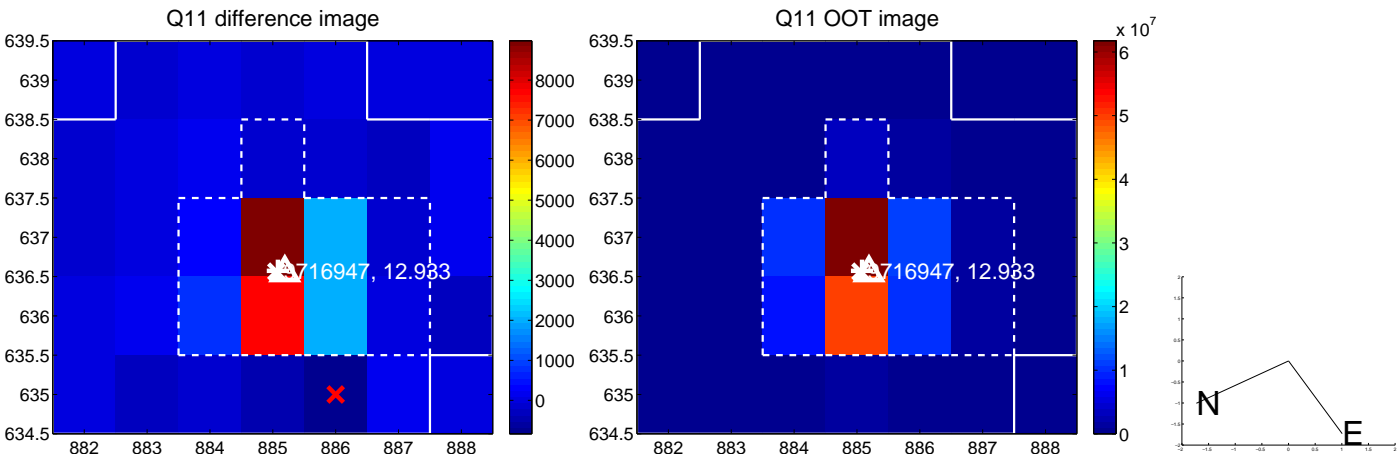
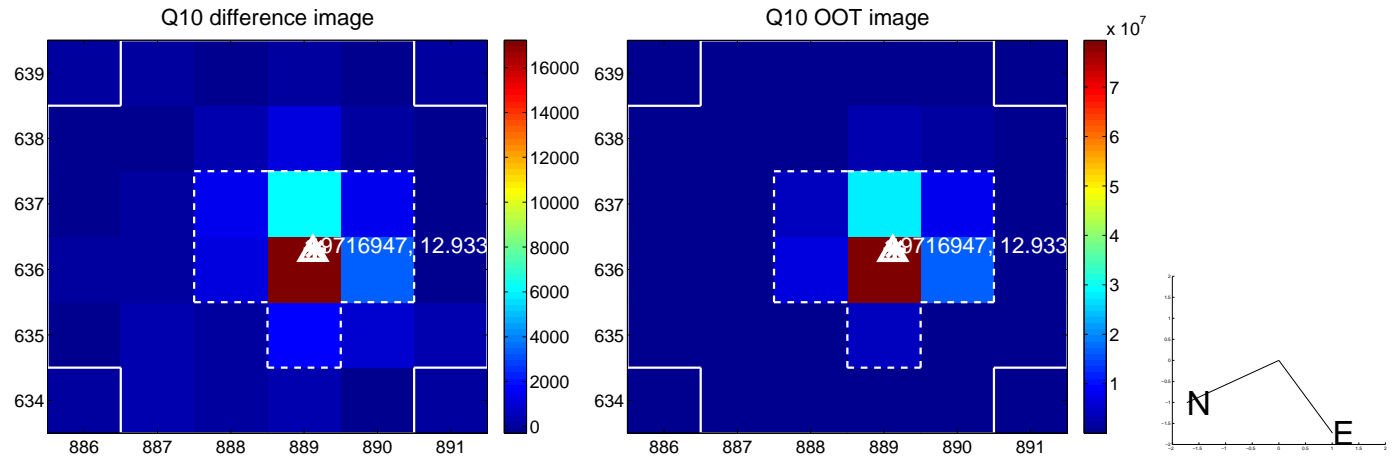
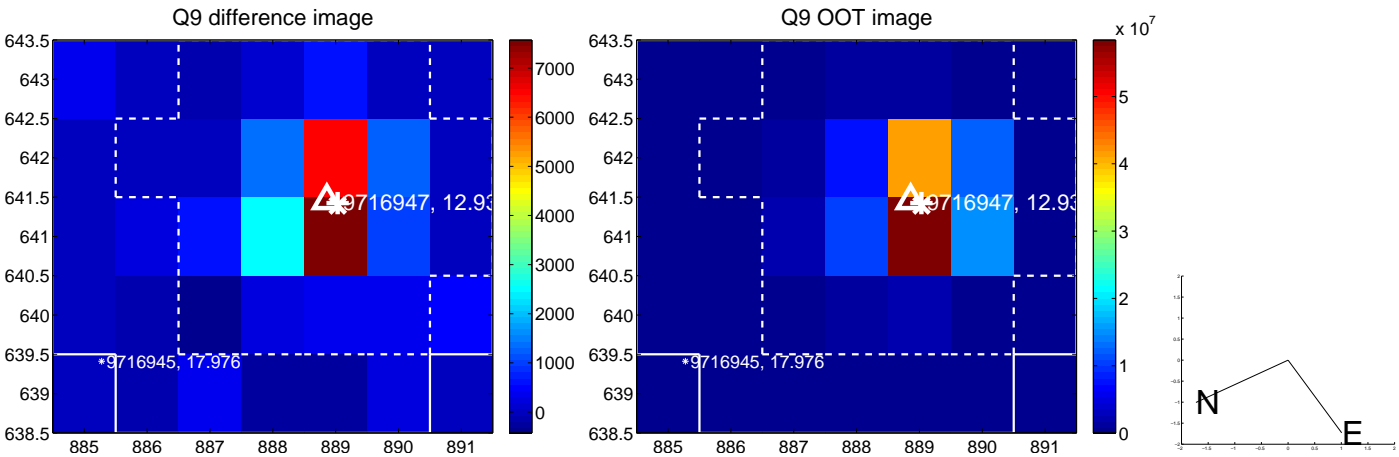
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



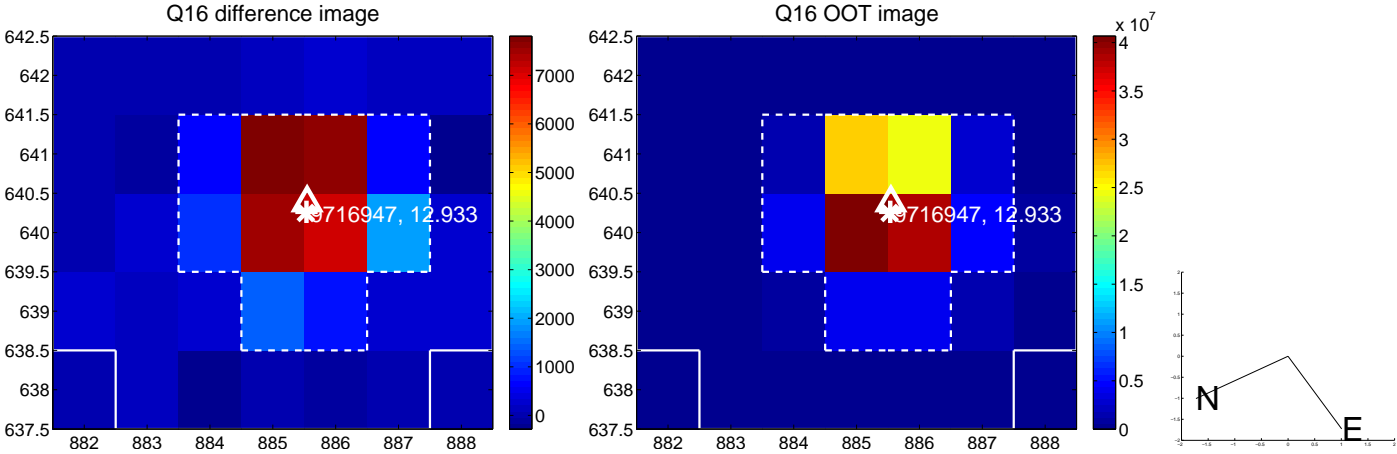
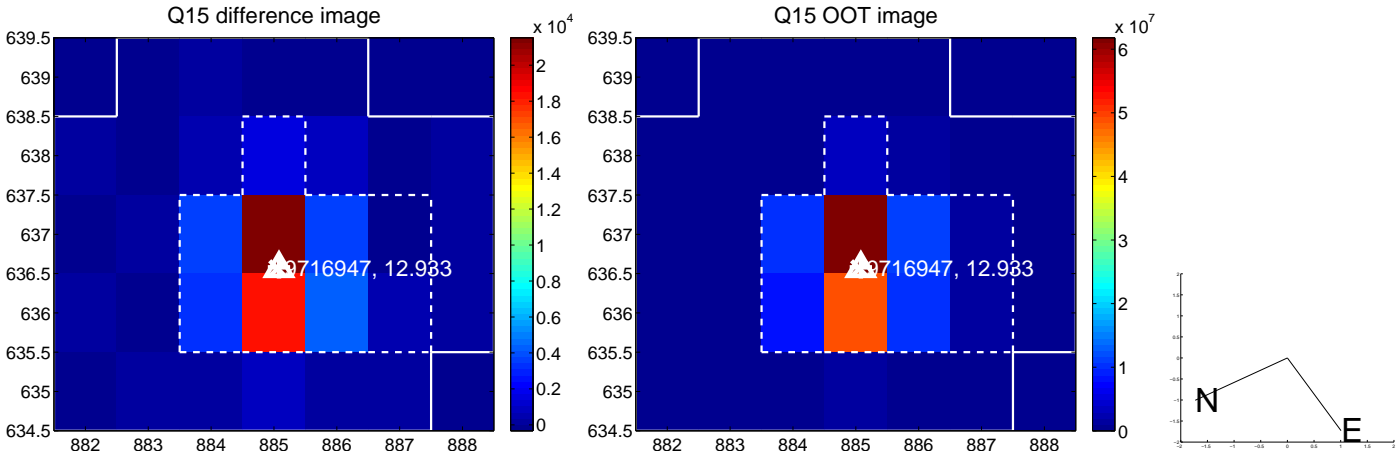
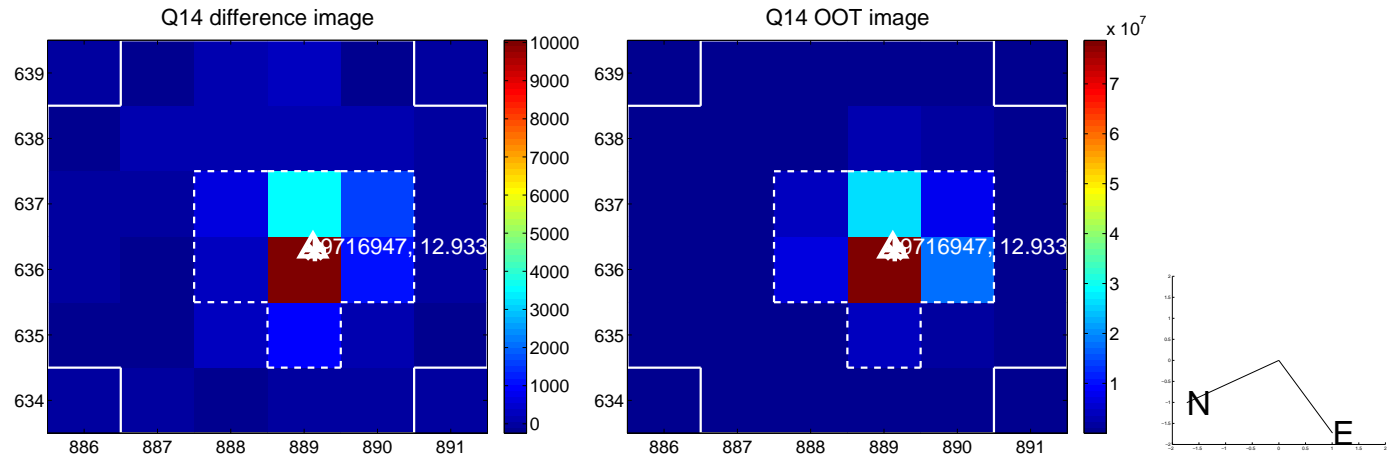
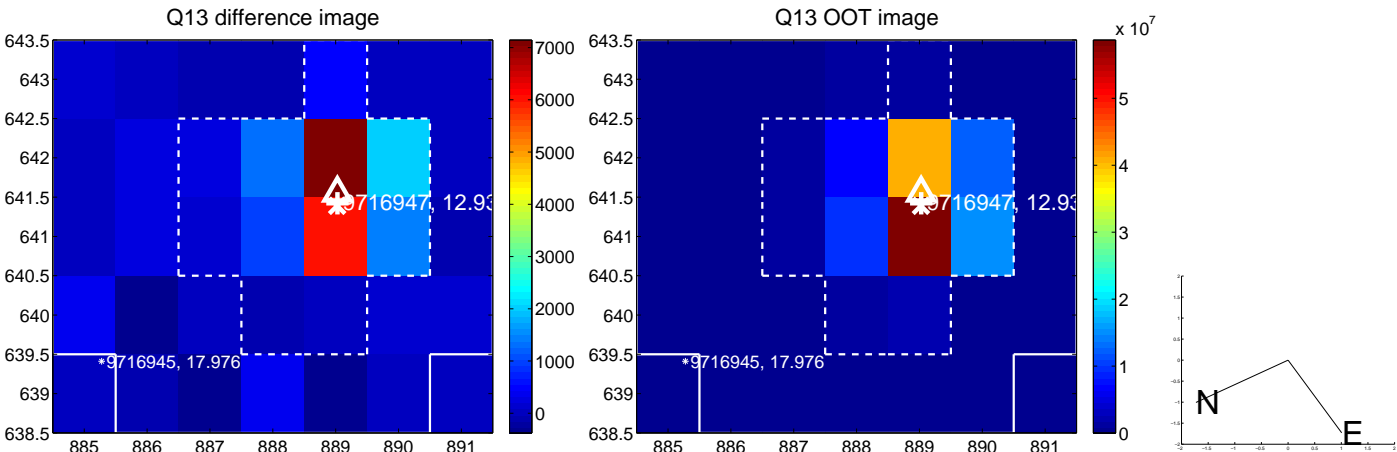
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



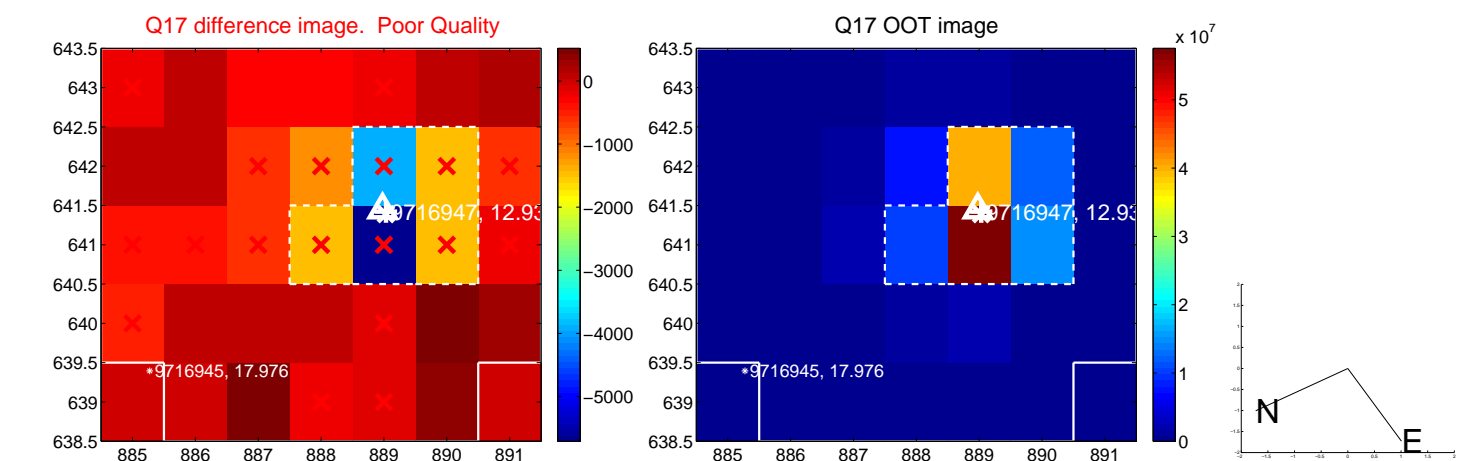
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



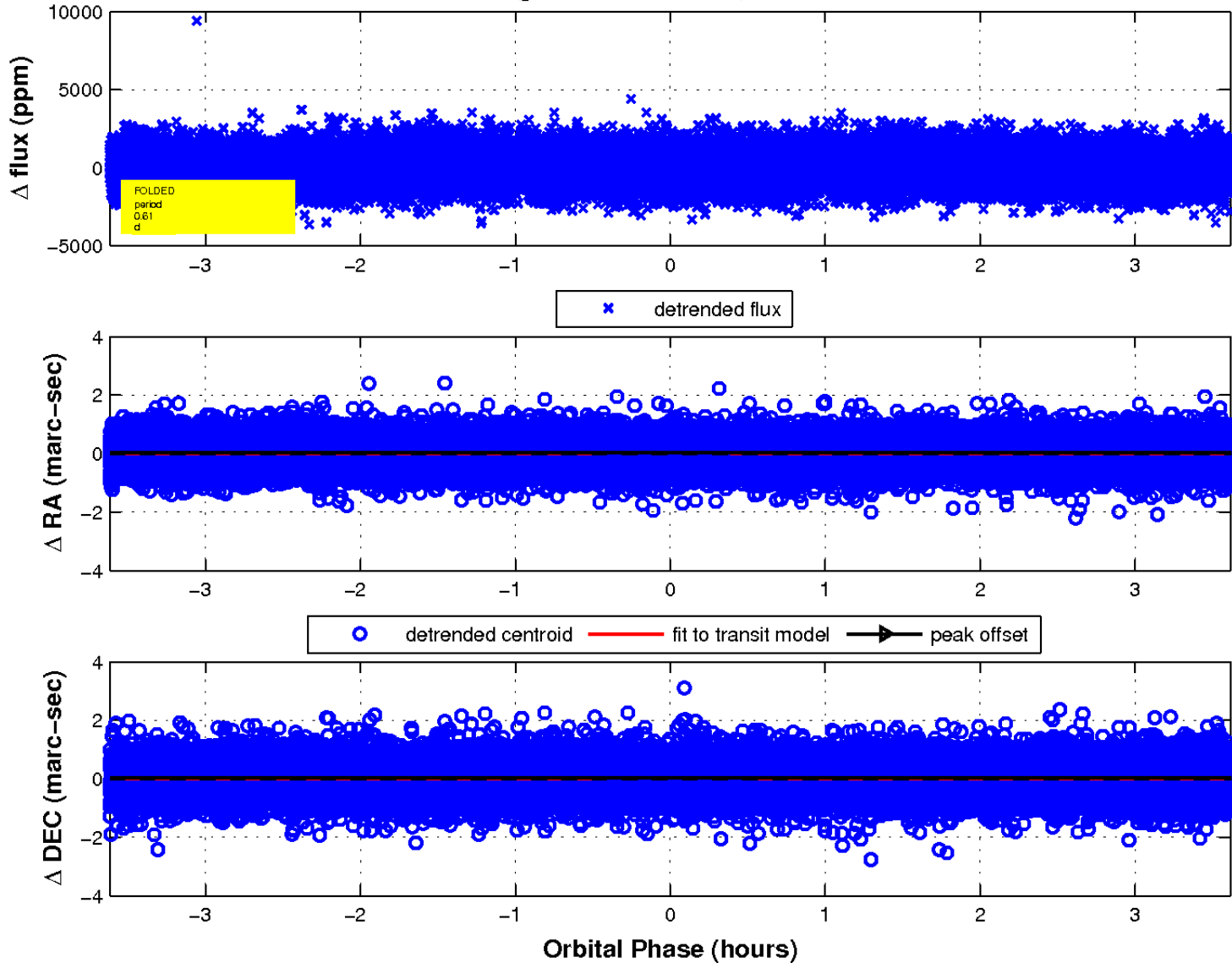
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

