

KIC 009549471

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}) |
|--------------|----------|---------|---------------|--------------|-------------|------------------|-------|-------|-----------------------------|-----------------|------------------------|------------------------|
| 009549471-01 | OBS | 6070.01 | 15.713770 | 132.099089 | 3639.6 | 10.800 | 313.6 | 183.6 | 0.96 | 5812 | 10.76 | 66.38 |
| 009549471-02 | OBS | No | 15.713754 | 137.331889 | 379.7 | 5.988 | 35.4 | 29.8 | 0.96 | 5812 | 2.30 | 66.38 |

Robovetter Results

| TCE | Run Type | Disp | Score | N | S | C | E | Comments |
|--------------|----------|------|-------|---|---|---|---|---|
| 009549471-01 | OBS | FP | 0.00 | 0 | 1 | 1 | 1 | MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE—SEASONAL_DEPTH_DV—SEASONAL_DEPTH_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH |
| 009549471-02 | OBS | FP | 0.00 | 1 | 1 | 1 | 1 | IS_SEC_TCE—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH |

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

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

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

Ephemeris Match Information For 009549471-01

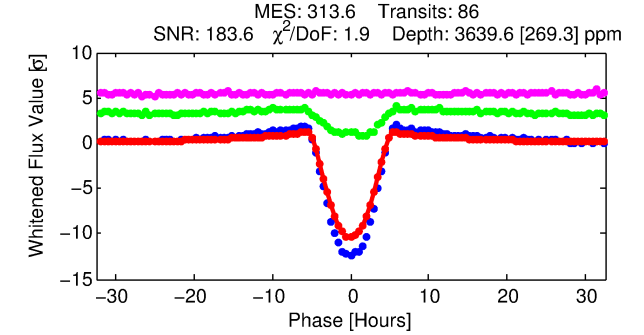
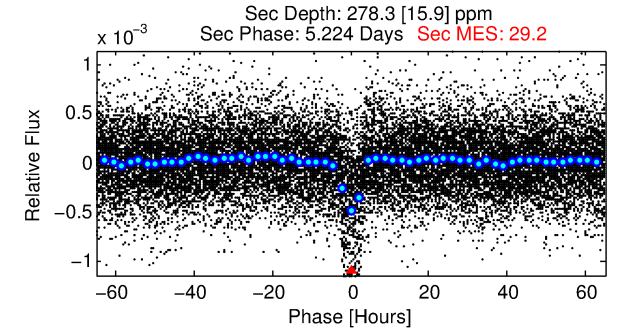
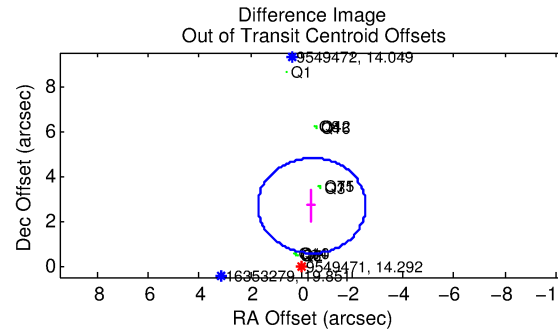
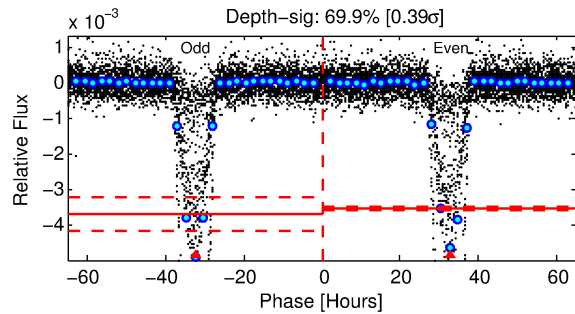
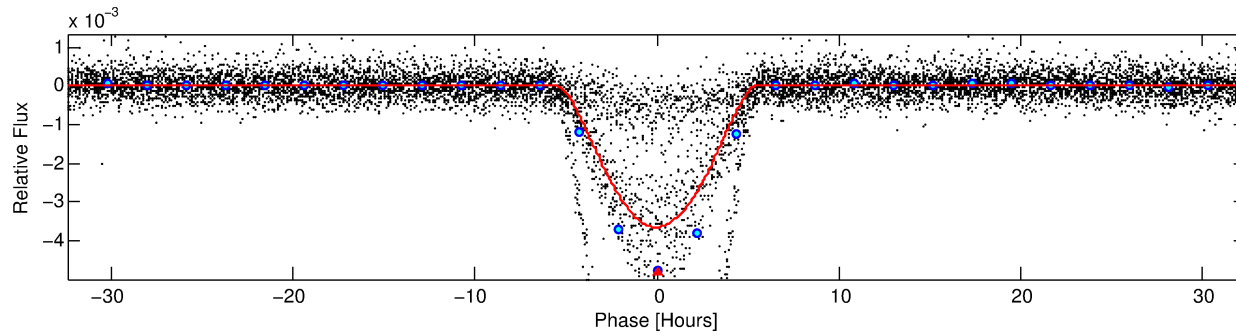
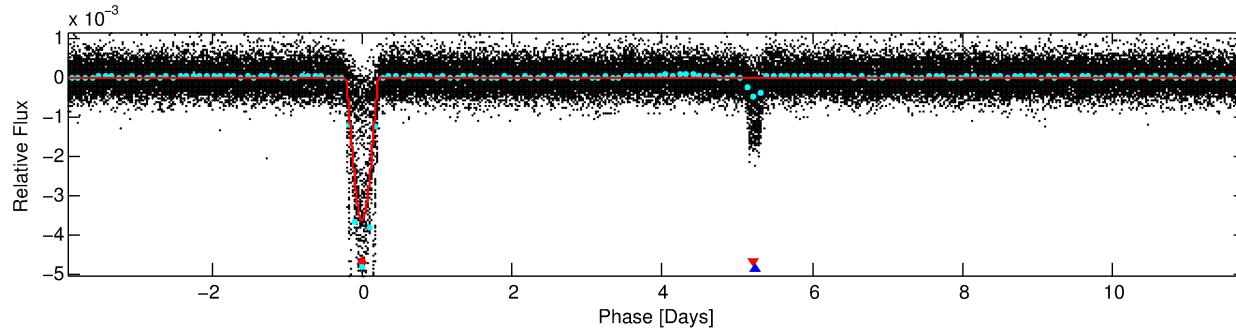
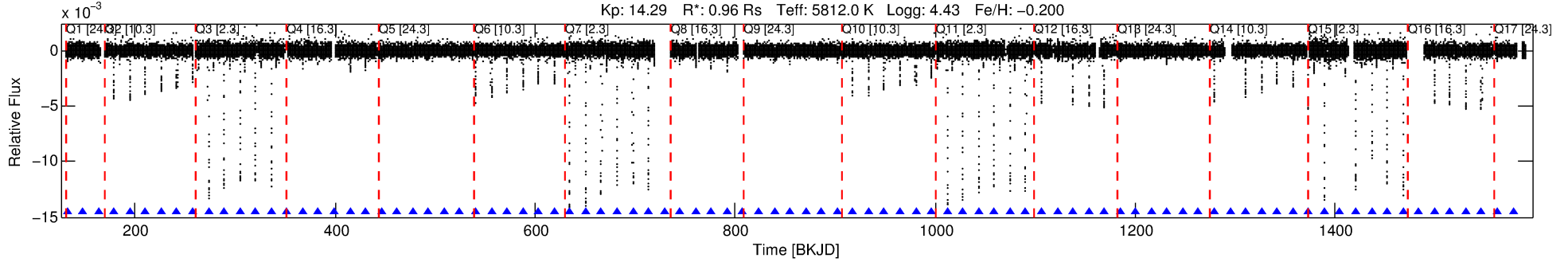
| TCE (1) | KIC | Parent (2) | Parent KIC | $P_1:P_2$ | Dist ($''$) | Δ Row | Δ Col | m_2 | m_1 | D_2/D_1 | Mechanism | Flag | σ_P | σ_T |
|--------------|---------|------------|------------|-----------|---------------|--------------|--------------|-------|-------|-----------|------------|------|------------|------------|
| 009549471-01 | 9549471 | 6206.01 | 9549472 | 1:1 | 9.3 | 1 | 2 | 14.05 | 14.29 | 17.28 | Direct-PRF | 0 | 0.06 | 0.05 |

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

DV One-Page Summary

KIC: 9549471 Candidate: 1 of 2 Period: 15.714 d
KOI: K06070.01 Corr: 0.988

Kp: 14.29 R*: 0.96 Rs Teff: 5812.0 K Logg: 4.43 Fe/H: -0.200



DV Fit Results:

Period = 15.71377 [0.00003] d
Epoch = 132.0991 [0.0013] BKJD
Rp/R* = 0.1027 [0.0224]
a/R* = 5.27 [0.21]
b = 1.00 [0.04]
Seff = 66.37 [24.00]
Teq = 728 [66] K
Rp = 10.76 [3.76] Re
a = 0.1191 [0.0277] AU
Ag = 18.76 [10.46] [1.70σ]
Teffp = 2342 [267] K [5.86σ]

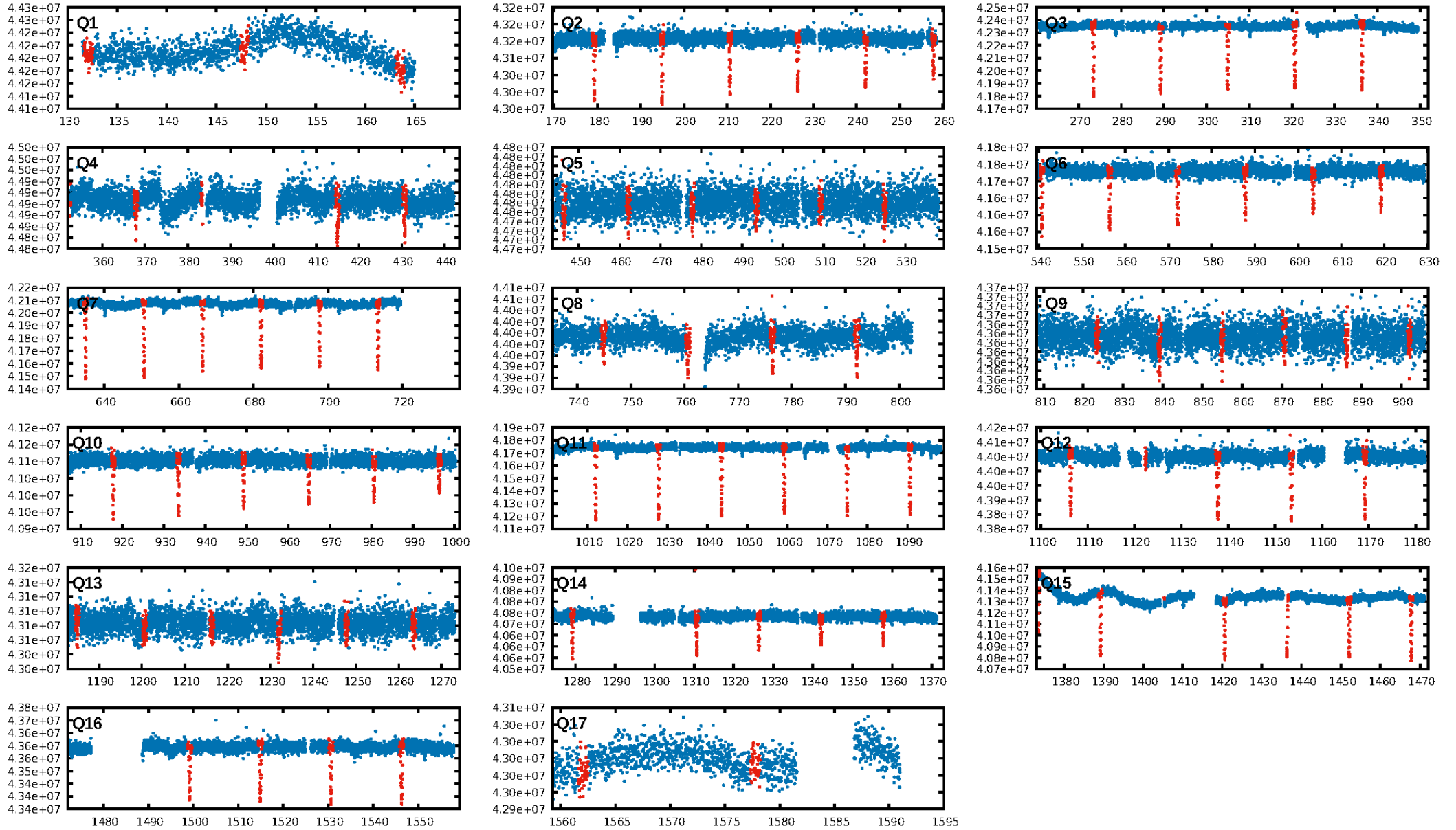
DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]
LongPeriod-sig: N/A
ModelChiSquare2-sig: 0.0%
ModelChiSquareGof-sig: 0.0%
Bootstrap-pfa: 0.00e+00
RollingBand-fgt: 1.00 [81/81]
GhostDiagnostic-chr: -0.2388
Centroid-sig: 0.0%
Centroid-so: 27.256 arcsec [631.36σ]
OotOffset-rm: 2.707 arcsec [3.83σ]
KicOffset-rm: 9.315 arcsec [128.86σ]
OotOffset-st: 4/4/4/1 [13]
KicOffset-st: 4/4/4/1 [13]
DiffImageQuality-fgm: 1.00 [13/13]
DiffImageOverlap-fno: 1.00 [17/17]

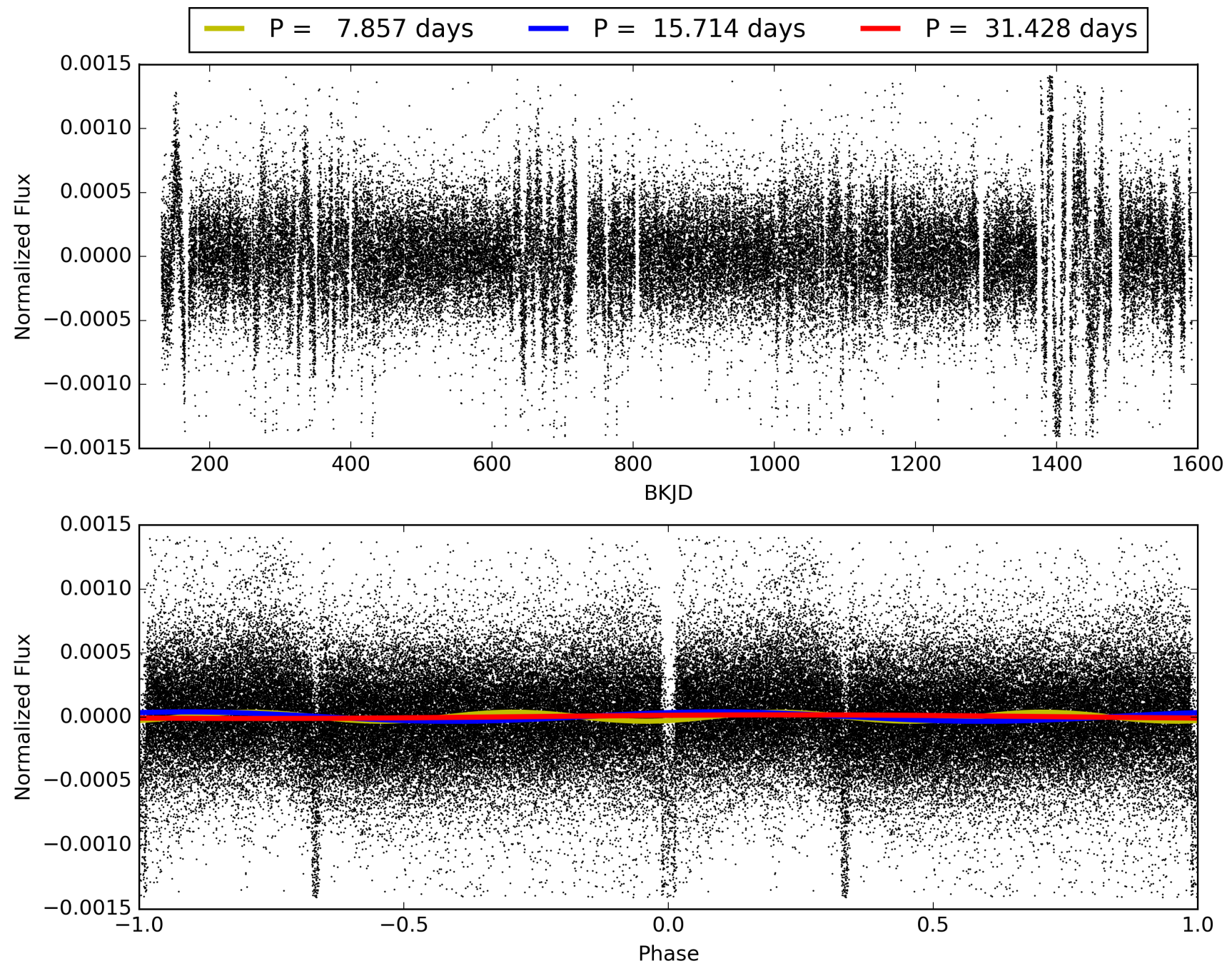
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 14:09:51 Z

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

TCE 009549471-01, PDC Light Curves

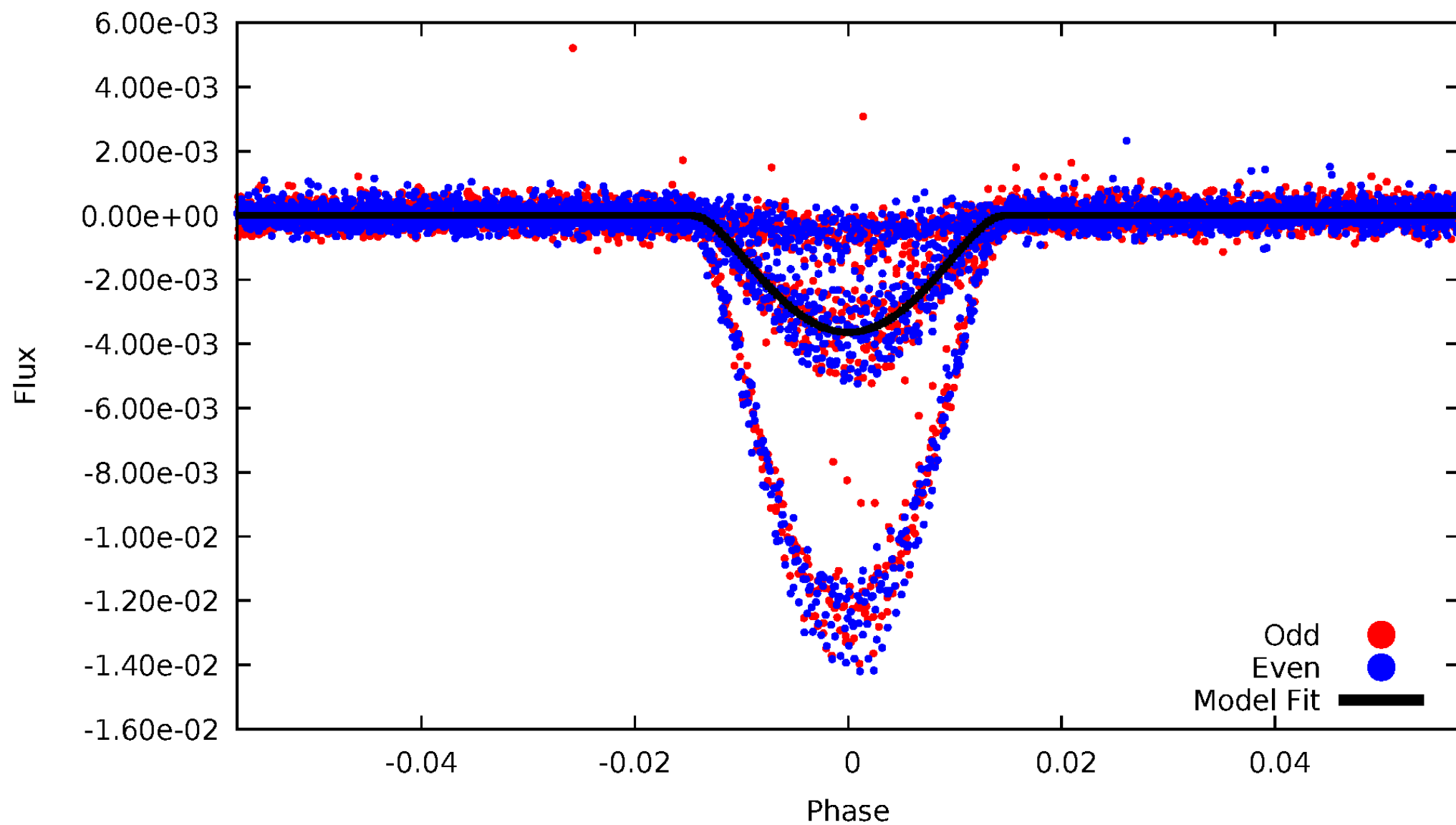


TCE 009549471-01



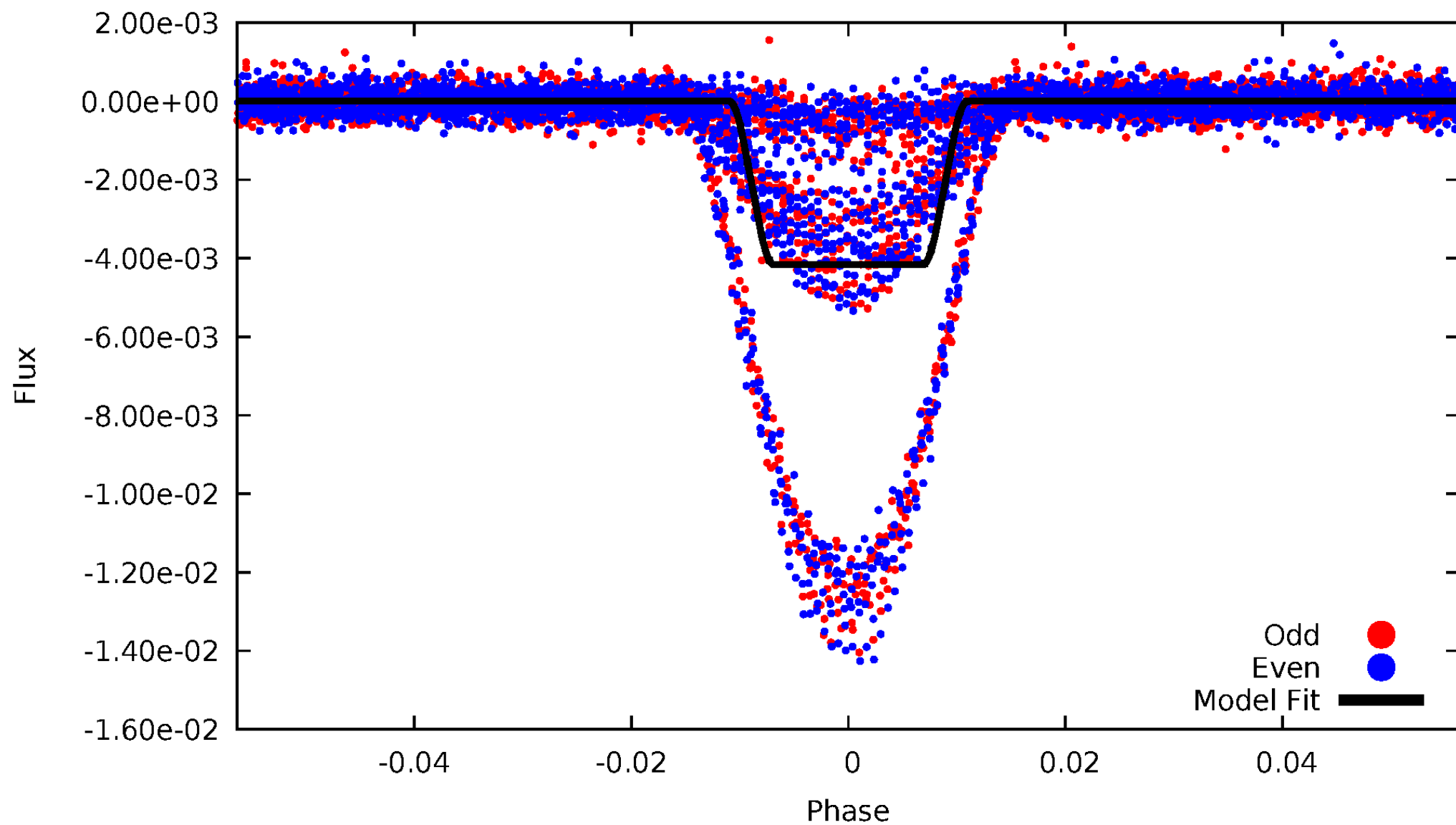
DV Odd/Even

TCE 009549471-01



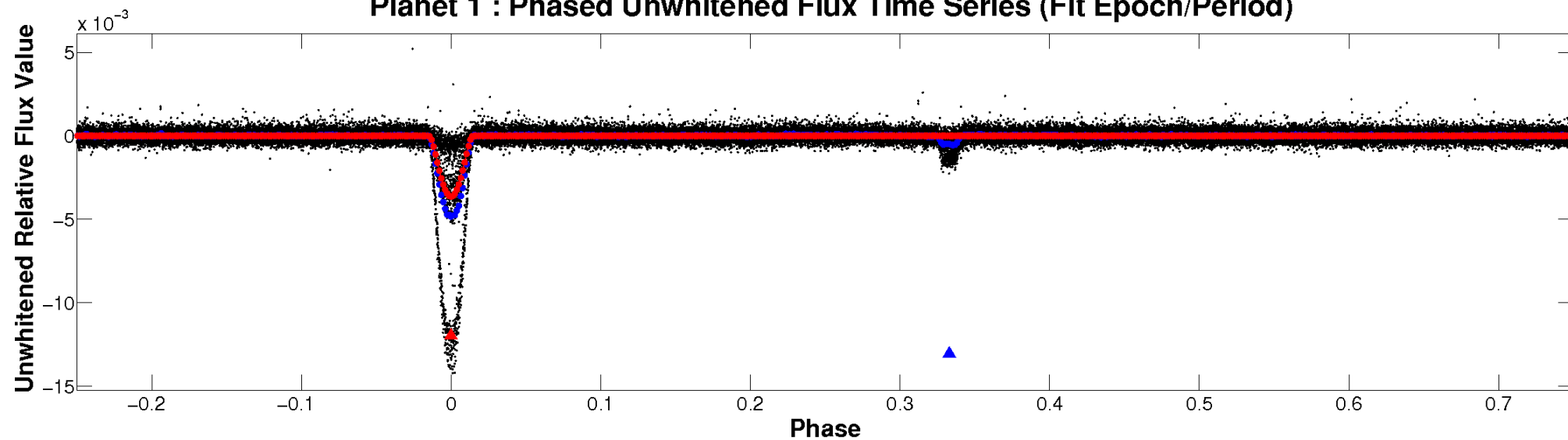
ALT Odd/Even

TCE 009549471-01

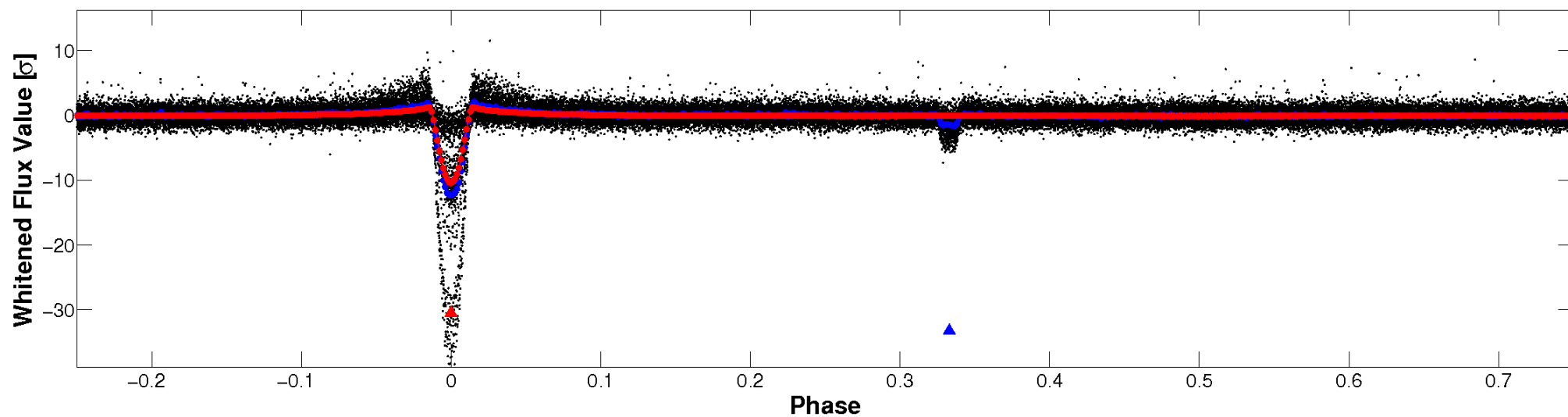


Non-Whitened Vs. Whitened Light Curve

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

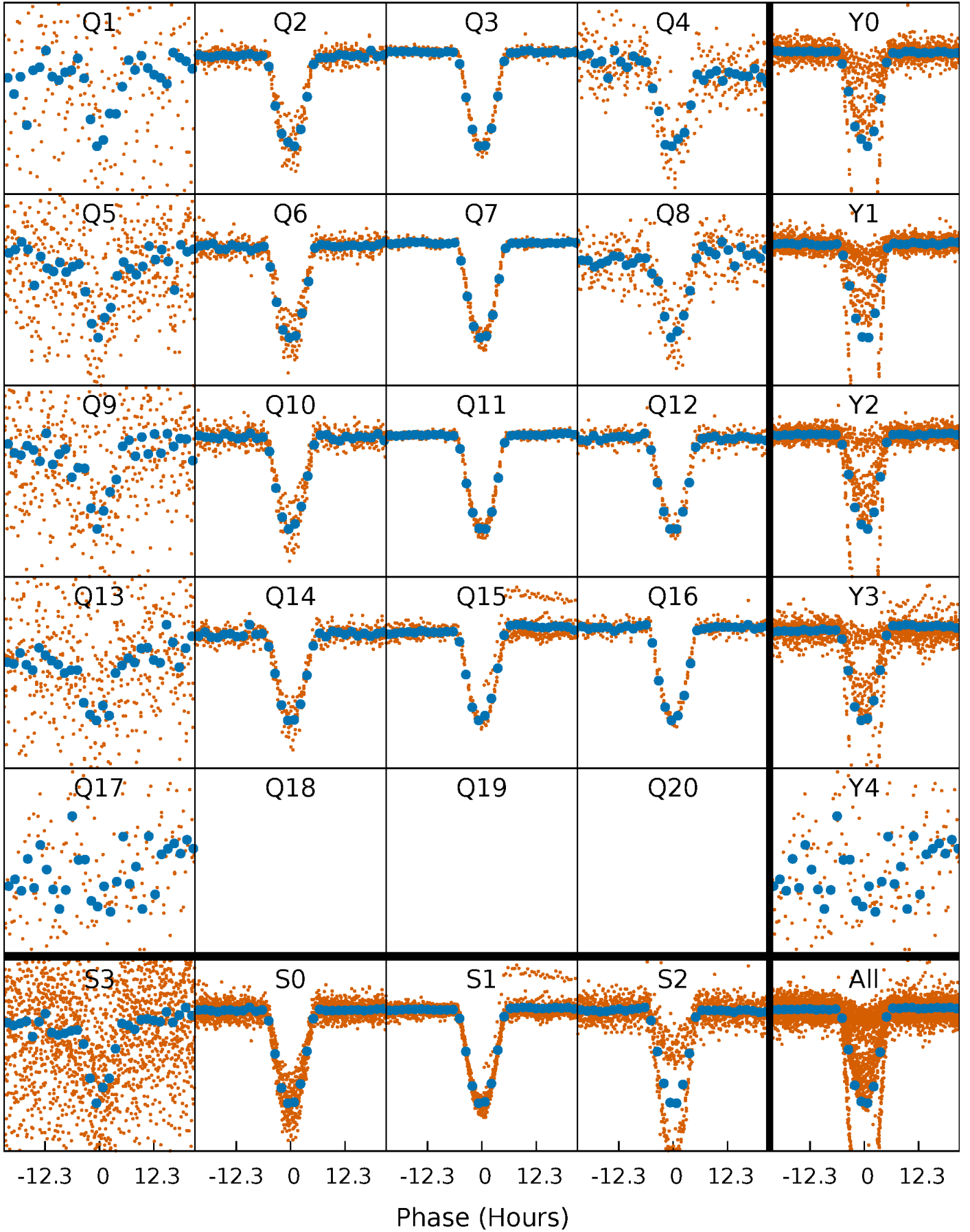


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



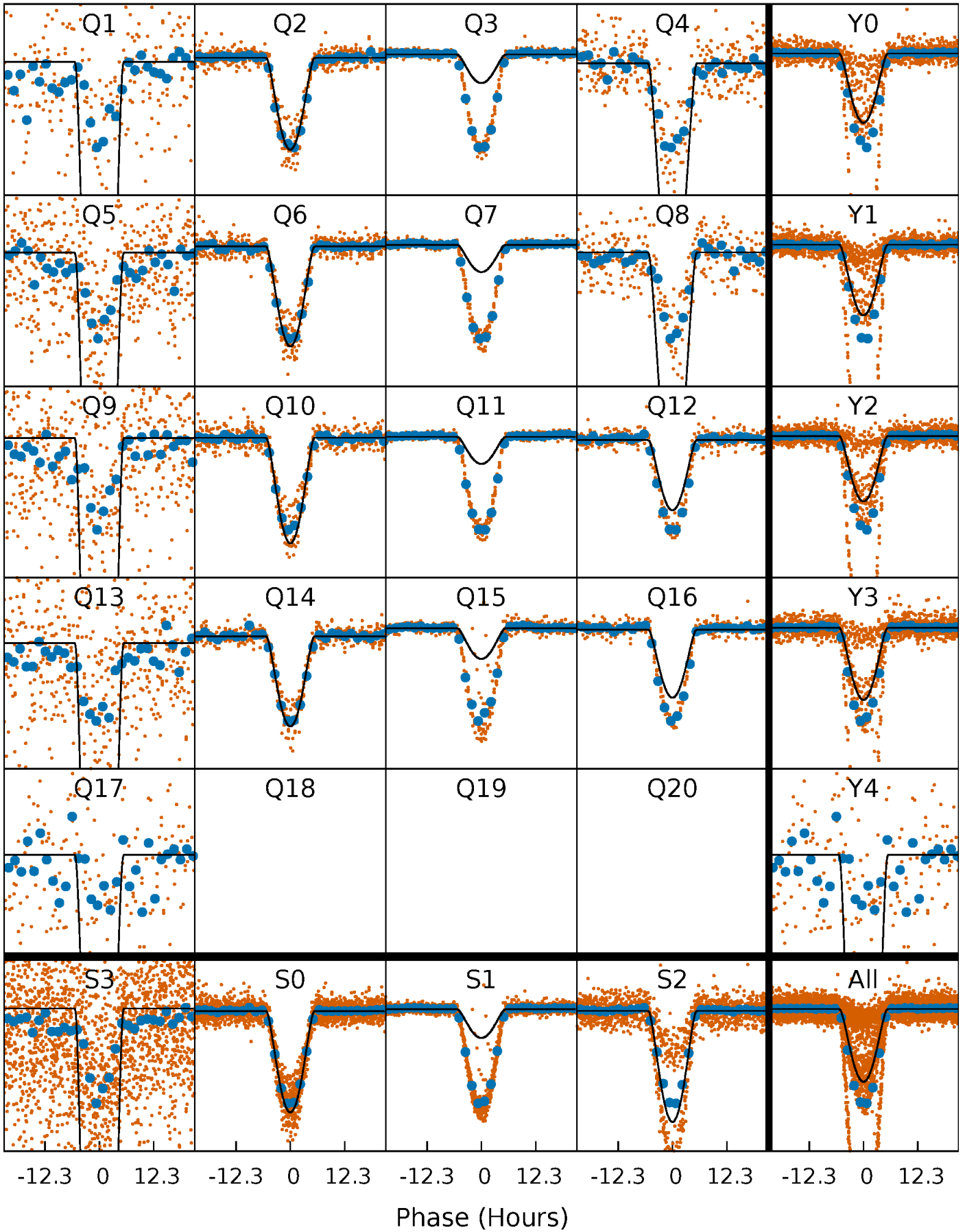
PDC Quarter-Phased Transit Curves

TCE 009549471-01 P= 15.713770 Days $T_0=132.099089$ (BKJD)



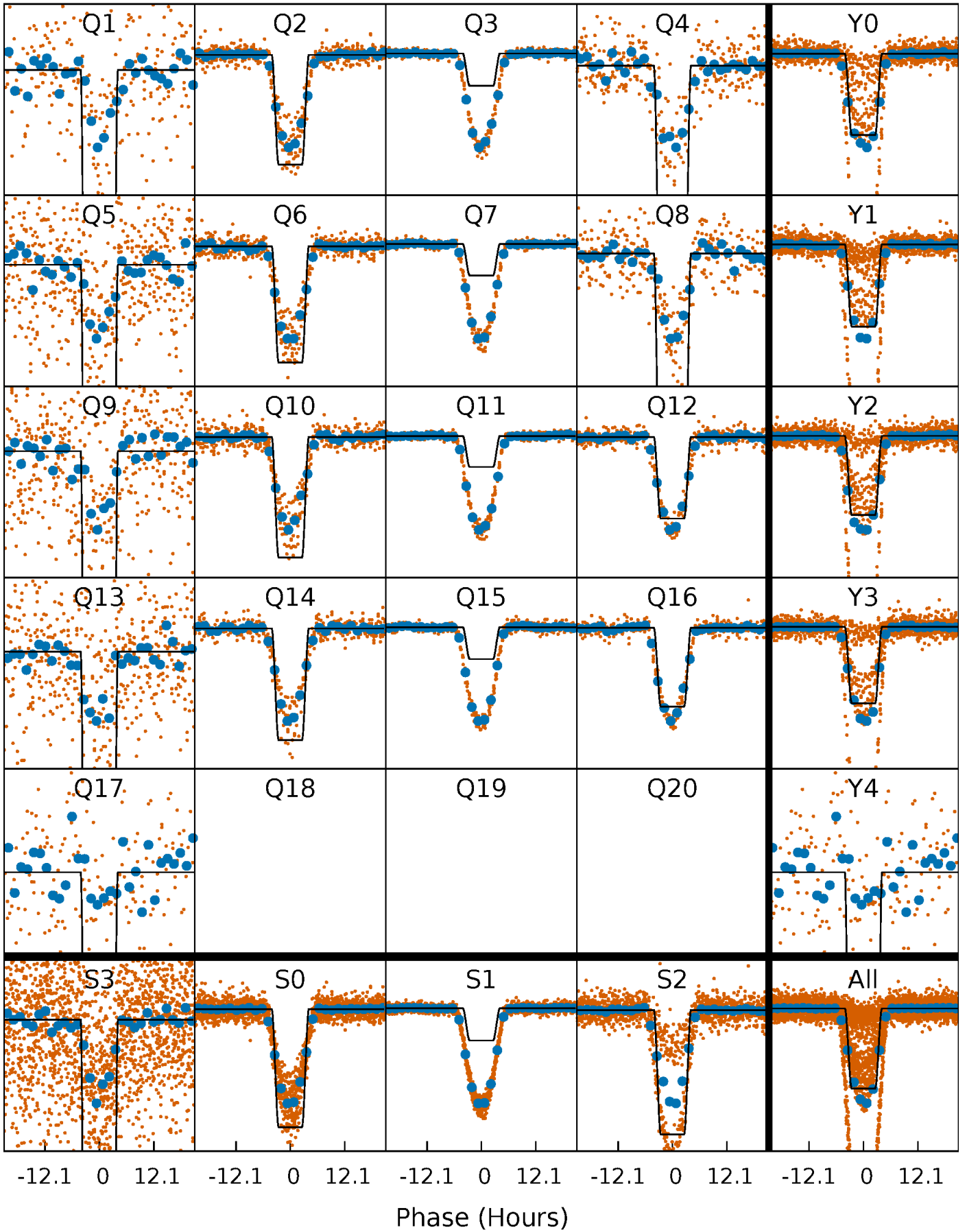
DV Quarter-Phased Transit Curves

TCE 009549471-01 P= 15.713770 Days $T_0=132.099089$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

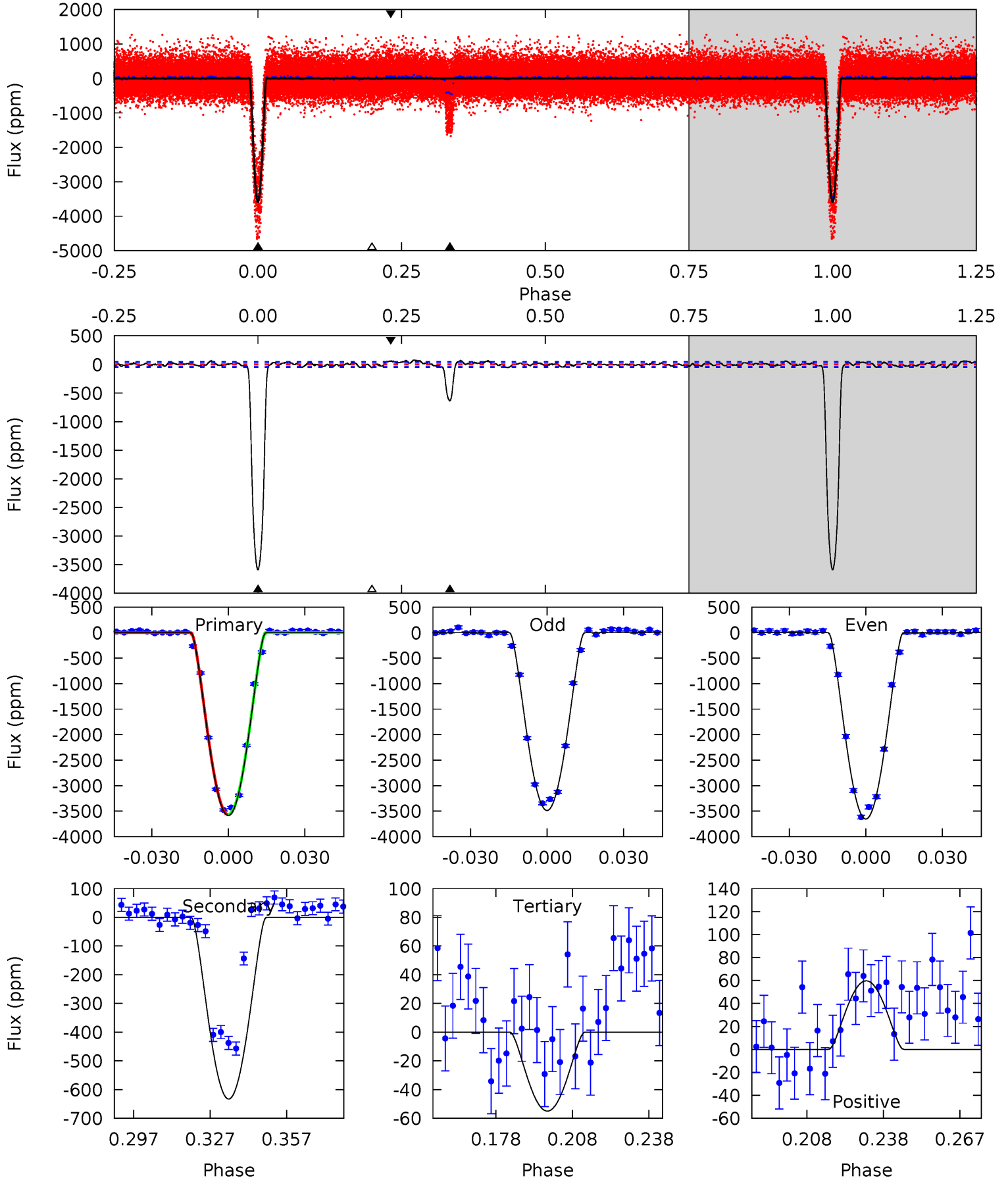
TCE 009549471-01 P= 15.713879 Days $T_0=132.095971$ (BKJD)



DV Model-Shift Uniqueness Test

009549471-01, P = 15.713770 Days, E = 116.385319 Days

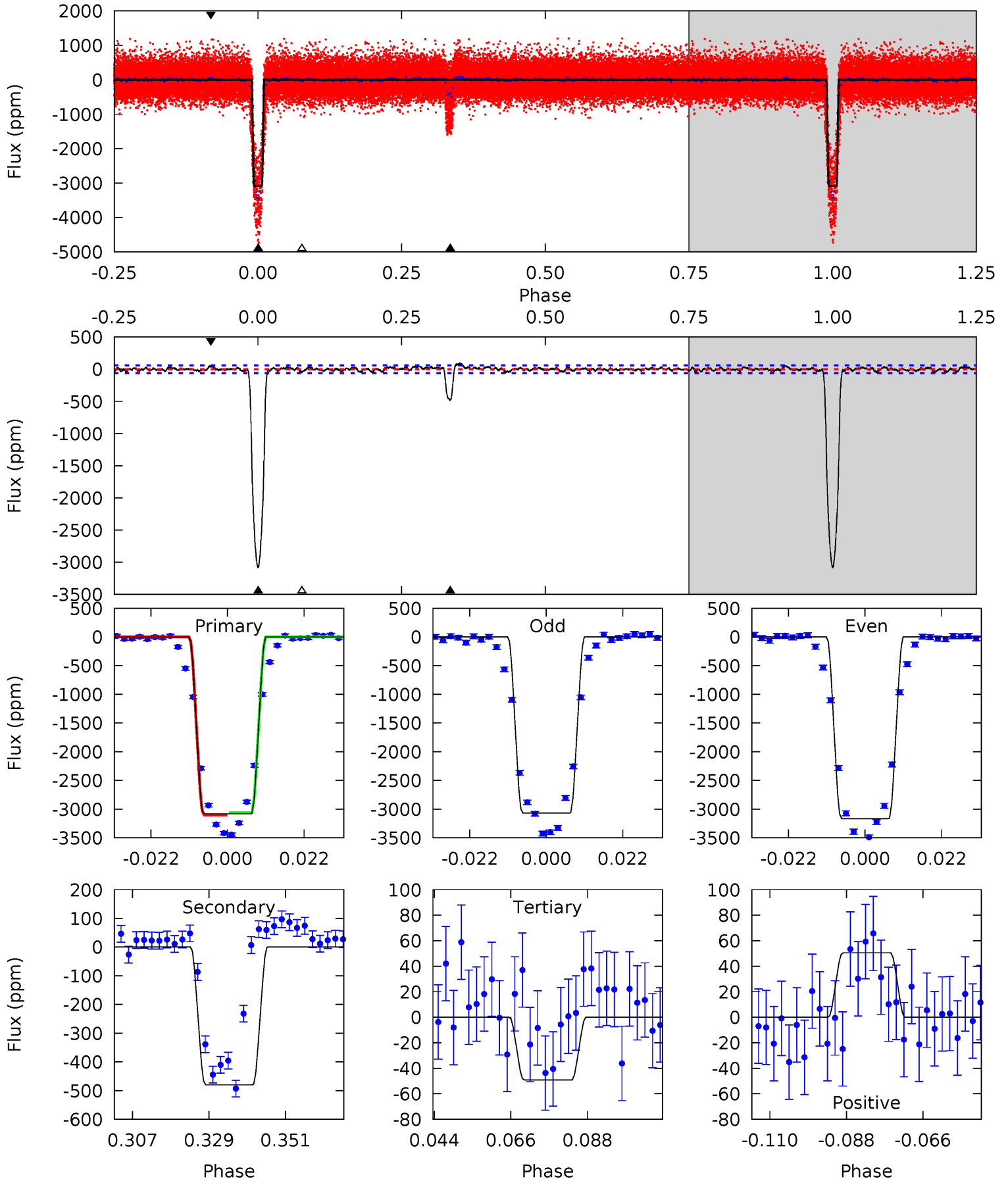
| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|-------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|-----|
| 391.0 | 69.0 | 5.99 | 6.51 | 4.81 | 2.17 | 2.54 | 385.0 | 384.5 | 63.0 | 62.5 | 9.08 | 1.43 | 0.02 | 0 |



Alt Model-Shift Uniqueness Test

009549471-01, P = 15.713879 Days, E = 116.382092 Days

| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|-------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|-----|
| 250.6 | 39.0 | 4.00 | 4.11 | 4.87 | 2.29 | 1.43 | 246.6 | 246.5 | 35.0 | 34.9 | 3.86 | 1.48 | 0.03 | 0 |



Stellar Parameters For KIC 009549471

| | $T_{\text{eff}}(K)$ | $\log(g)$ | [Fe/H] | $R (R_{\odot})$ | $M(M_{\odot})$ | $p_{\star} (\text{g}\cdot\text{cm}^{-3})$ |
|--------|----------------------|---------------------------|----------------------------|---------------------------|---------------------------|---|
| | 5812^{+156}_{-174} | $4.434^{+0.101}_{-0.188}$ | $-0.200^{+0.300}_{-0.300}$ | $0.960^{+0.262}_{-0.121}$ | $0.912^{+0.121}_{-0.091}$ | $1.453^{+0.627}_{-0.703}$ |
| | +3%/-3% | +2%/-4% | +150%/-150% | +27%/-13% | +13%/-10% | +43%/-48% |
| 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 009549471-01 / KOI 6070.01

| Detrend | Depth (ppm) | $R_p (R_{\oplus})$ | $T_{max} (K)$ | $T_{obs} (K)$ | A_{obs} |
|---------|---------------|-------------------------|--------------------|----------------------|-------------------|
| DV | -633 ± 9 | $10.92^{+3.06}_{-2.48}$ | 1028^{+69}_{-58} | 3383^{+300}_{-202} | 41^{+27}_{-16} |
| Alt. | -480 ± 12 | $6.94^{+2.63}_{-2.40}$ | 1029^{+65}_{-54} | 3768^{+637}_{-353} | 78^{+104}_{-37} |

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 $A_{obs} \gg 1.0$

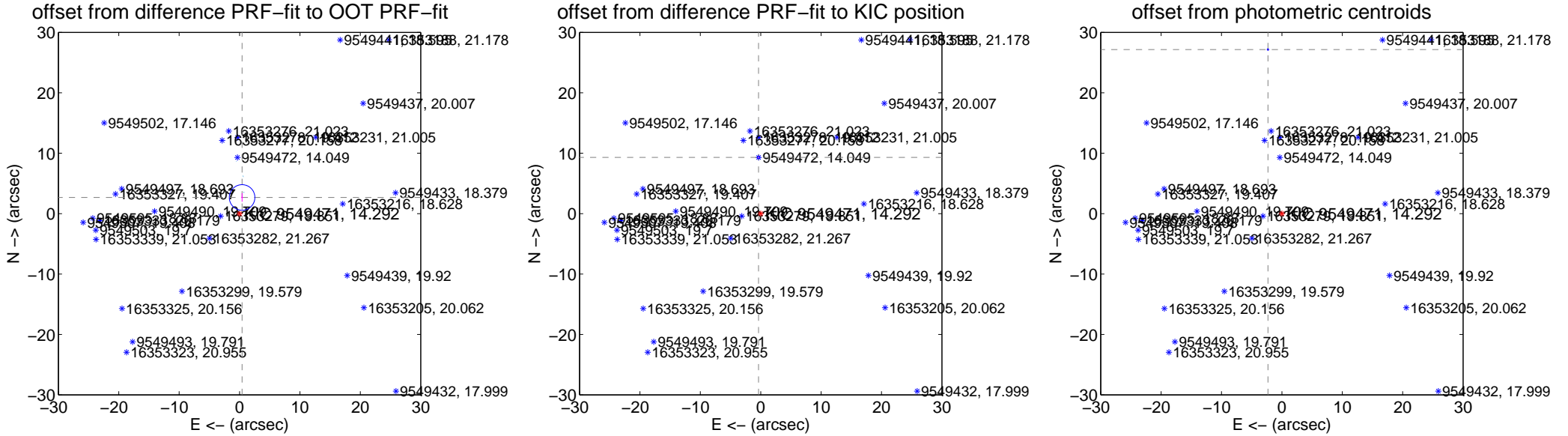
DV Centroid Data

Supplemental centroid analysis for 009549471-01. Kepler magnitude: 14.29. Transit SNR 183.57

There are 13 quarters with good PRF difference image offsets

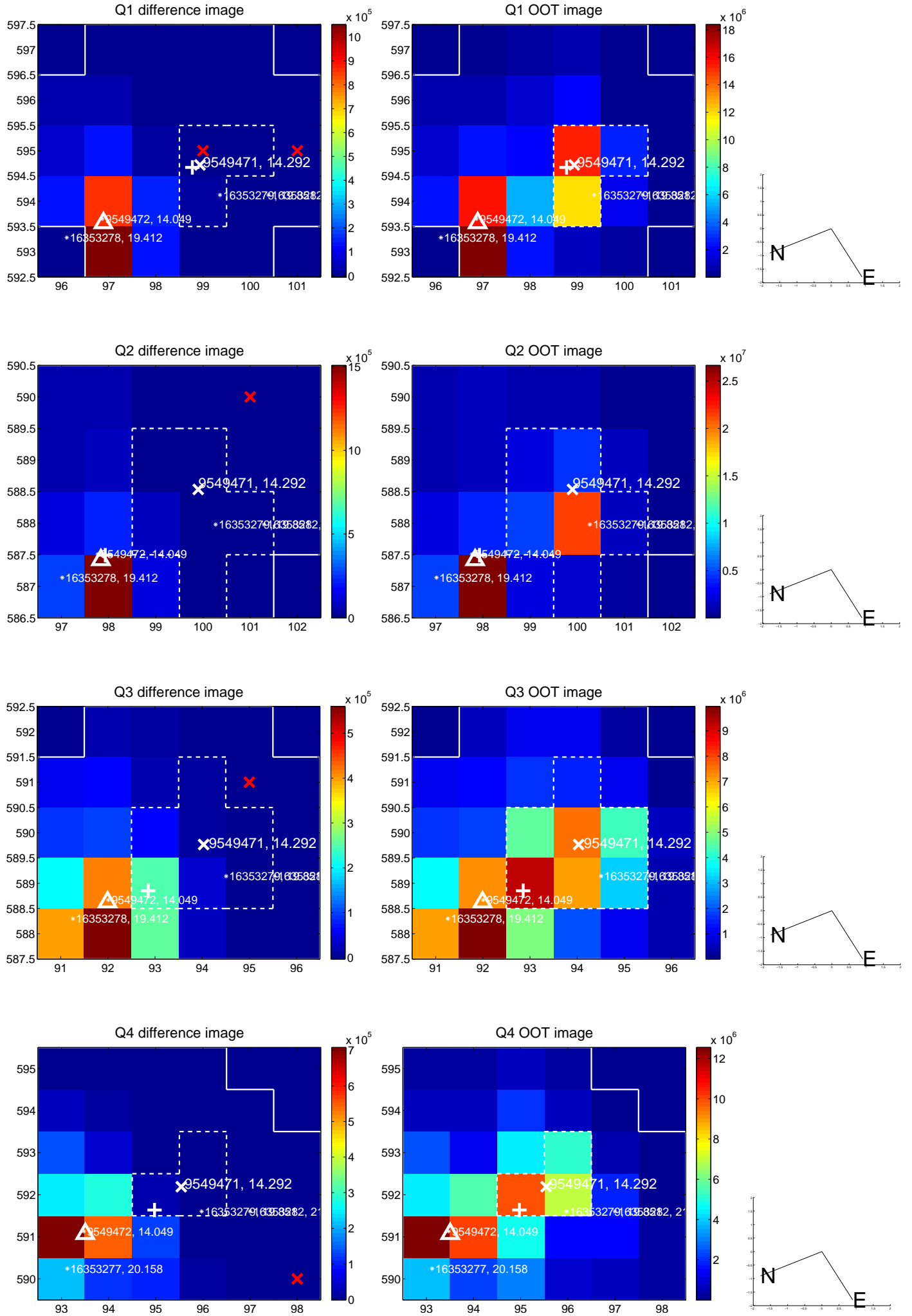
The OOT PRF centroid is offset from the target star catalog position by about 3.17 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

| | Distance in arcsec | Distance / σ | Δ RA | Δ Dec |
|---|--------------------|---------------------|--------------------|-------------------|
| PRF-fit source offset from OOT | 2.707 ± 0.706 | 3.83 | -0.421 ± 0.151 | 2.674 ± 0.715 |
| PRF-fit source offset from KIC position | 9.315 ± 0.072 | 128.86 | 0.363 ± 0.070 | 9.308 ± 0.072 |
| photometric centroid source offset | 27.26 ± 0.04 | 631.36 | 2.31 ± 0.03 | 27.16 ± 0.04 |

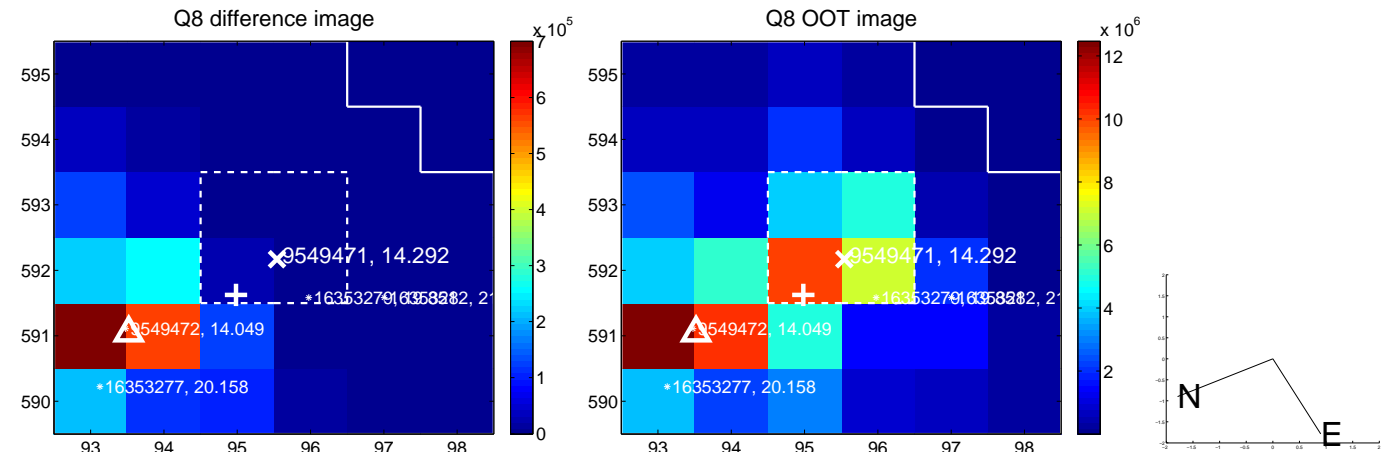
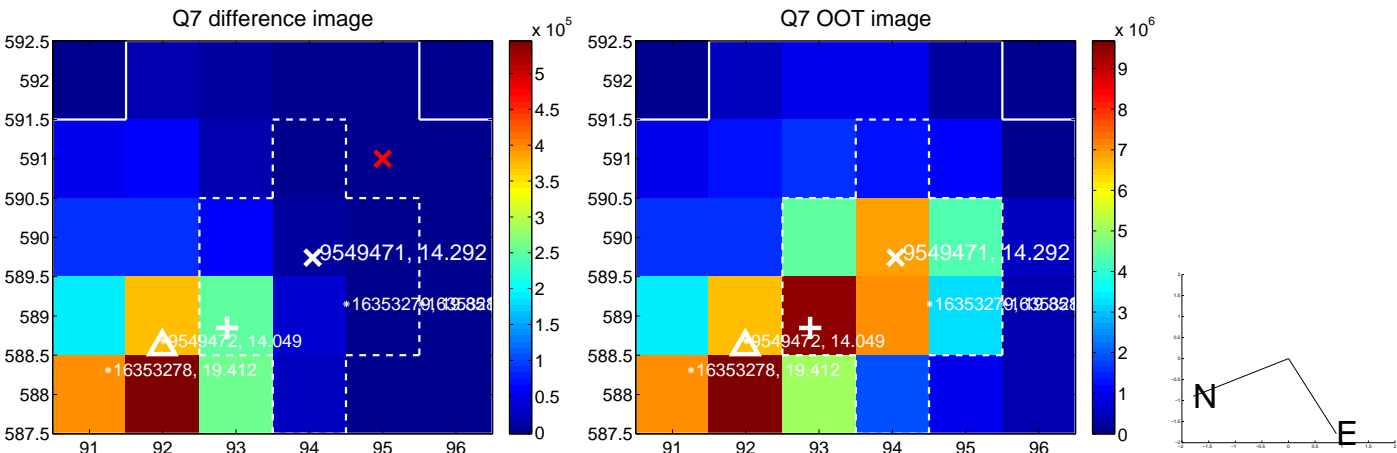
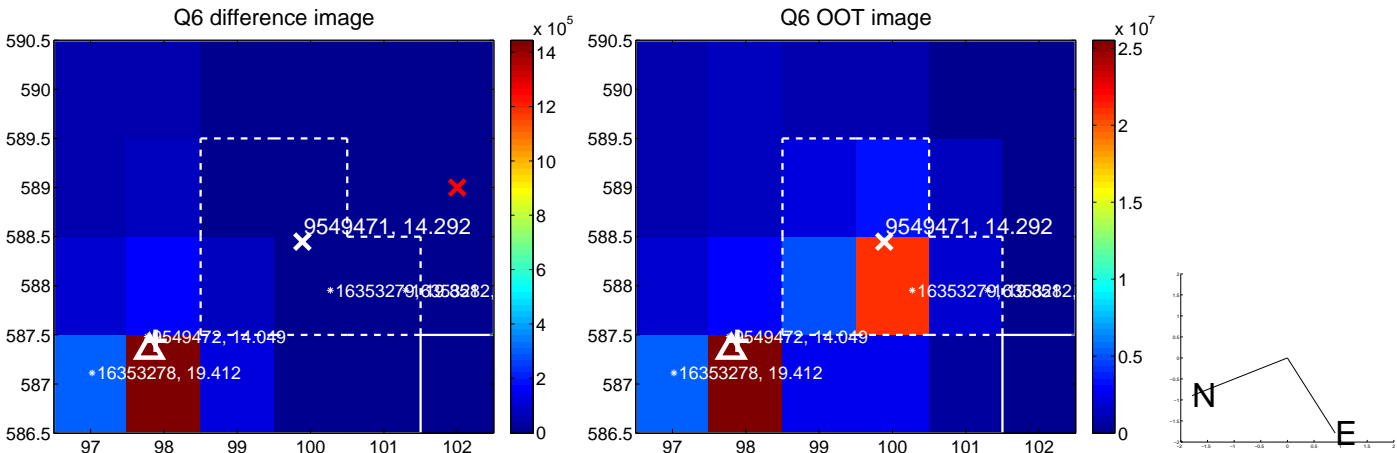
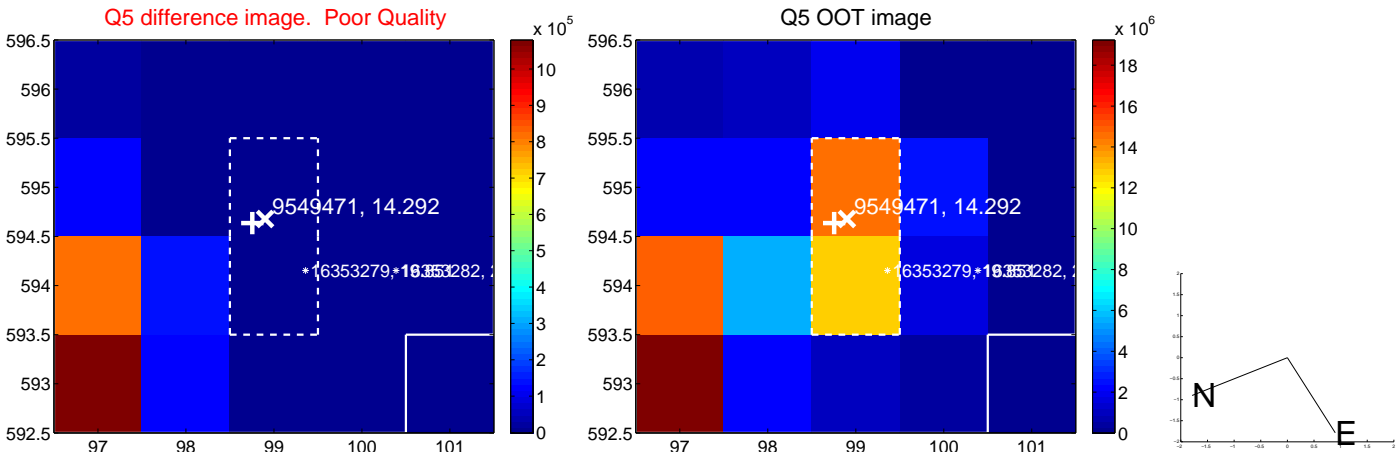


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- σ uncertainty. Blue circle: three- σ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

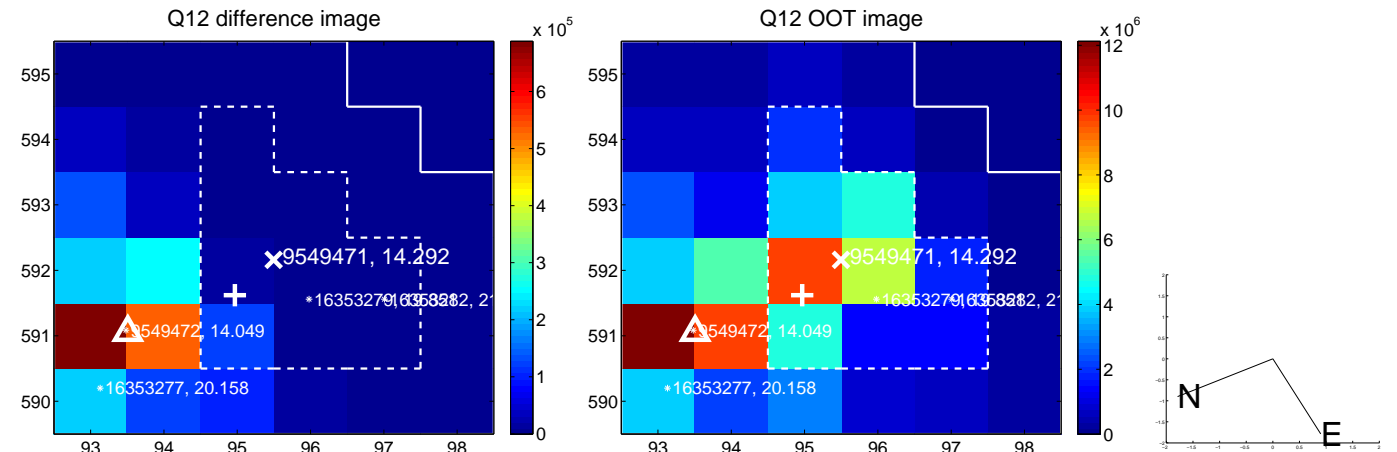
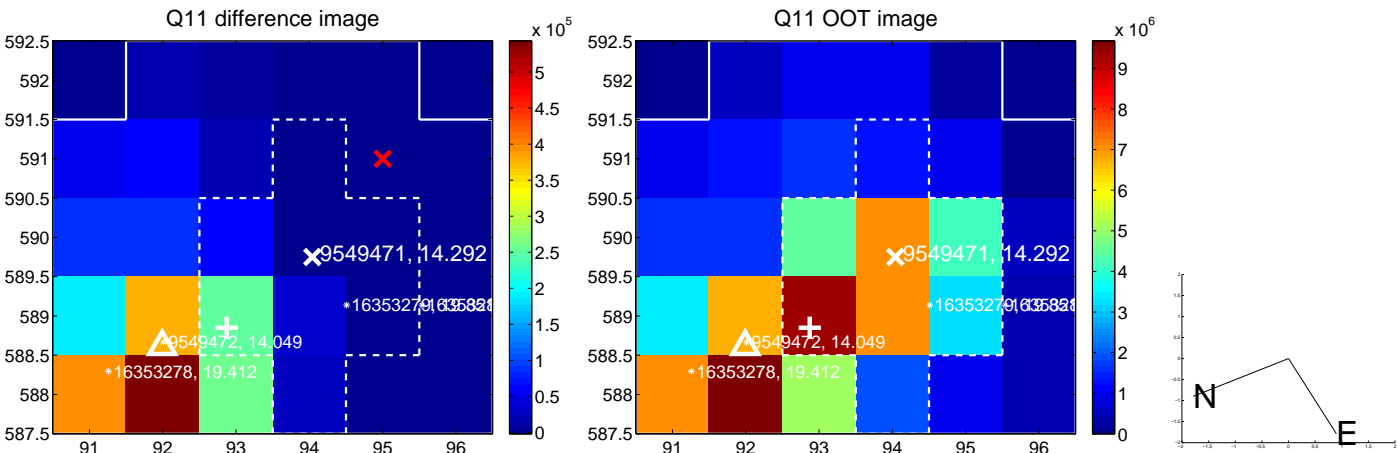
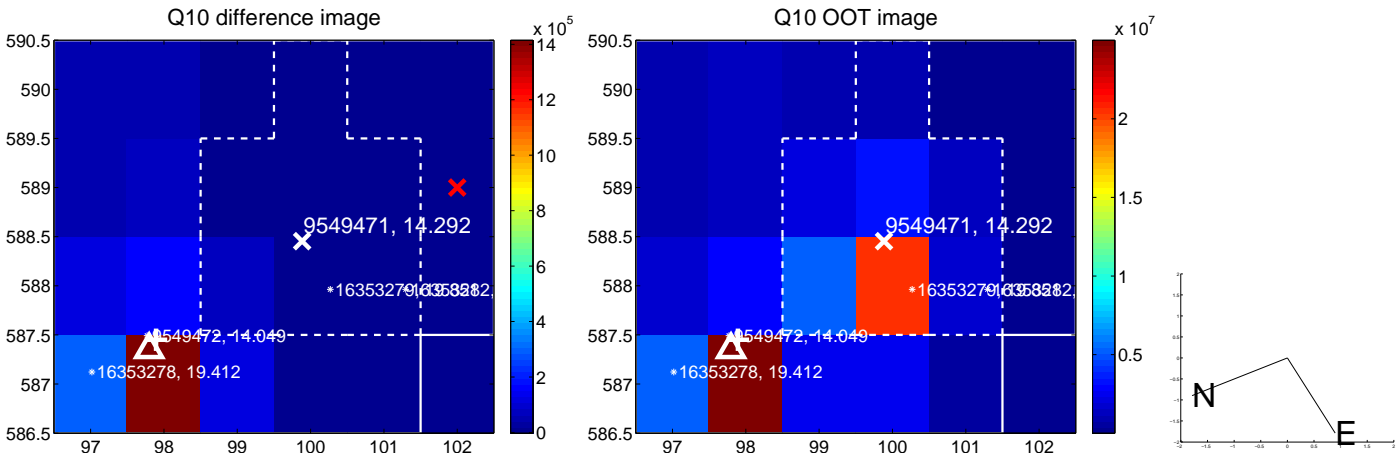
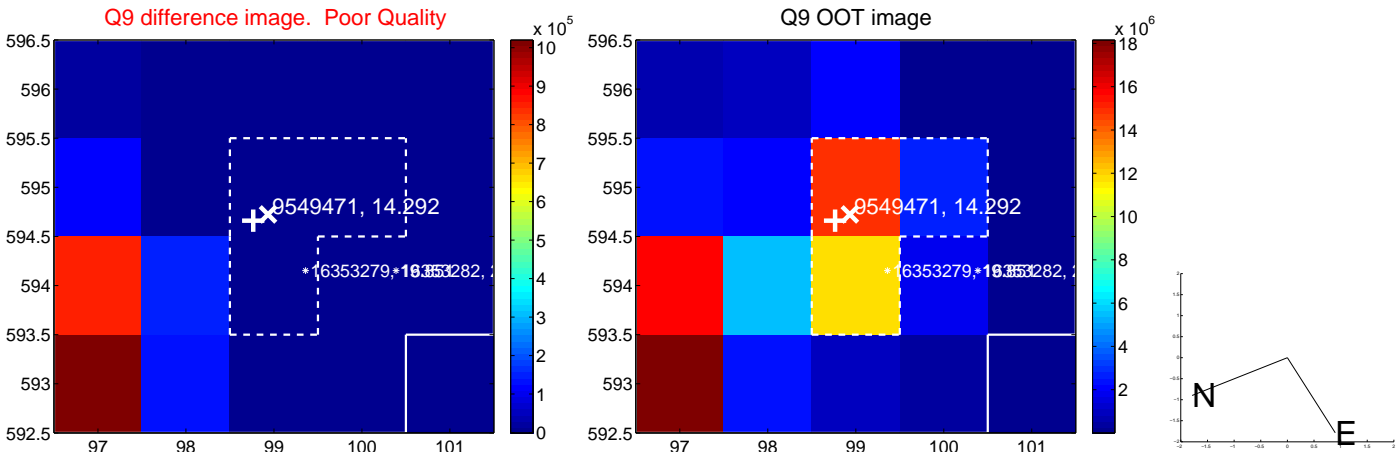
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



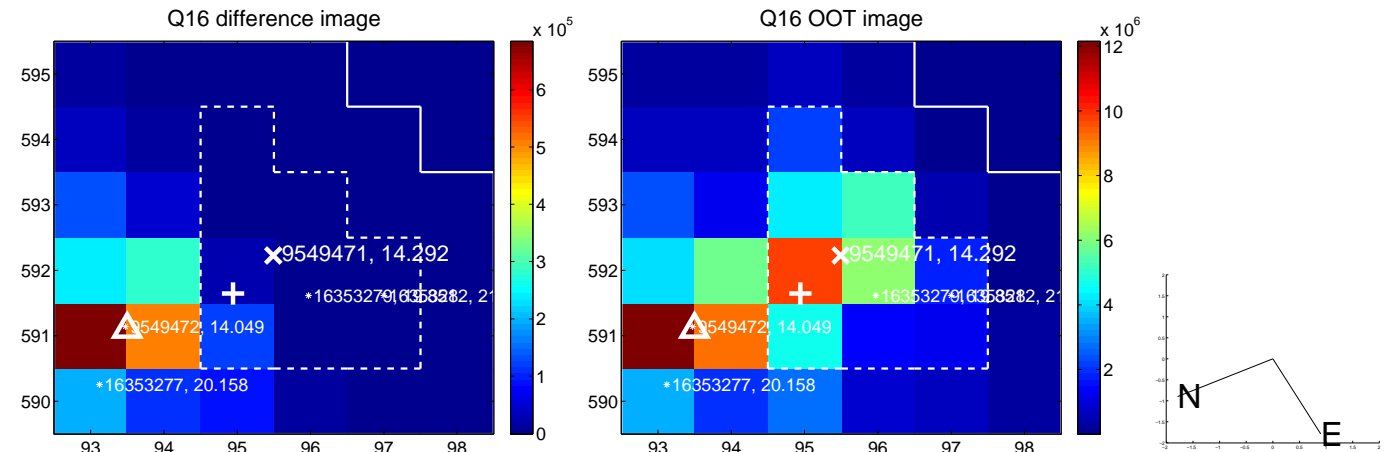
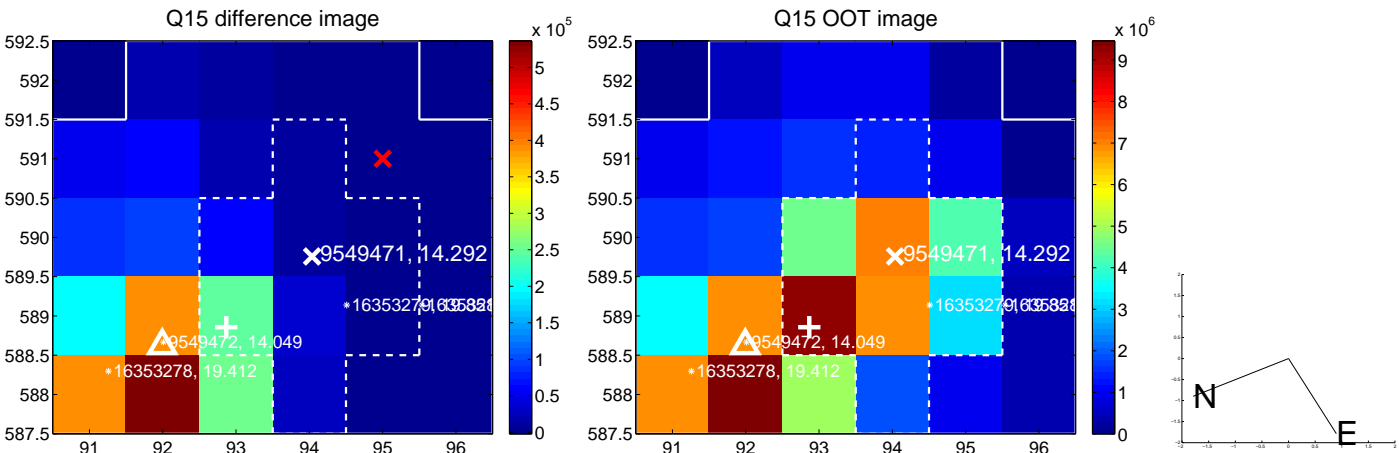
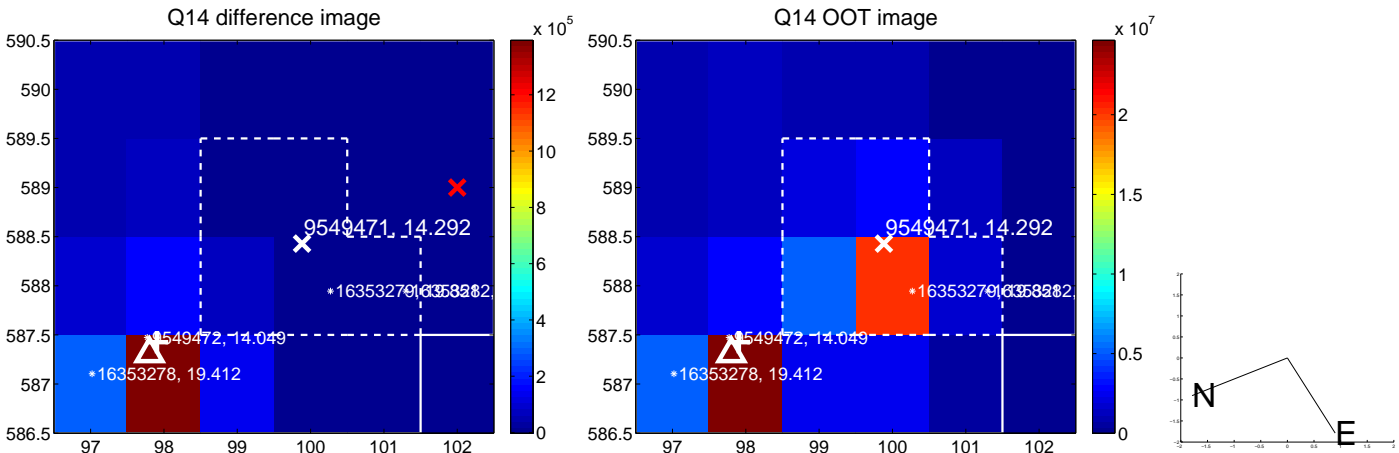
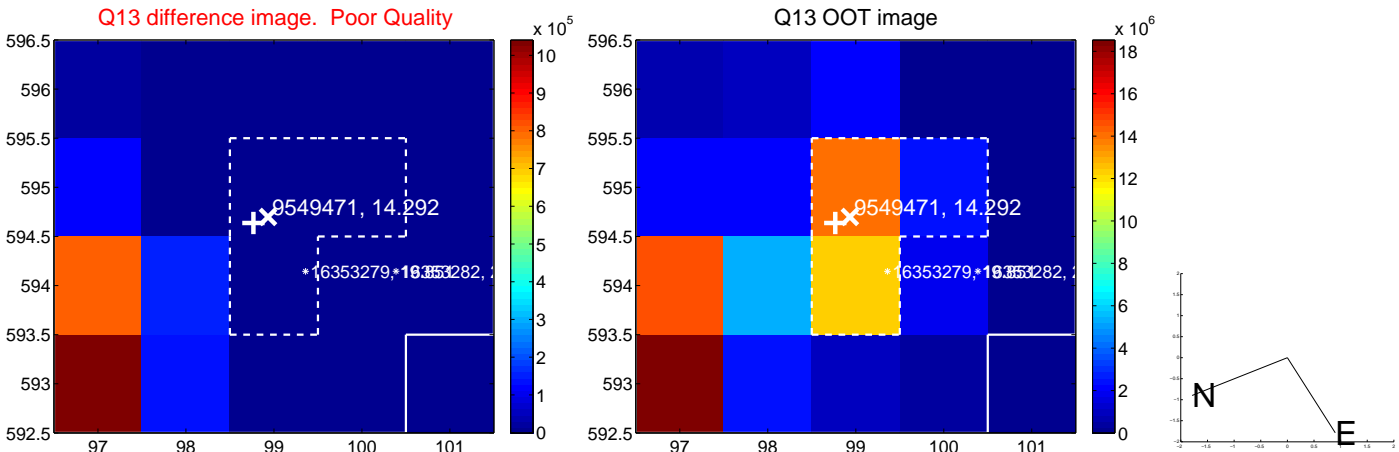
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



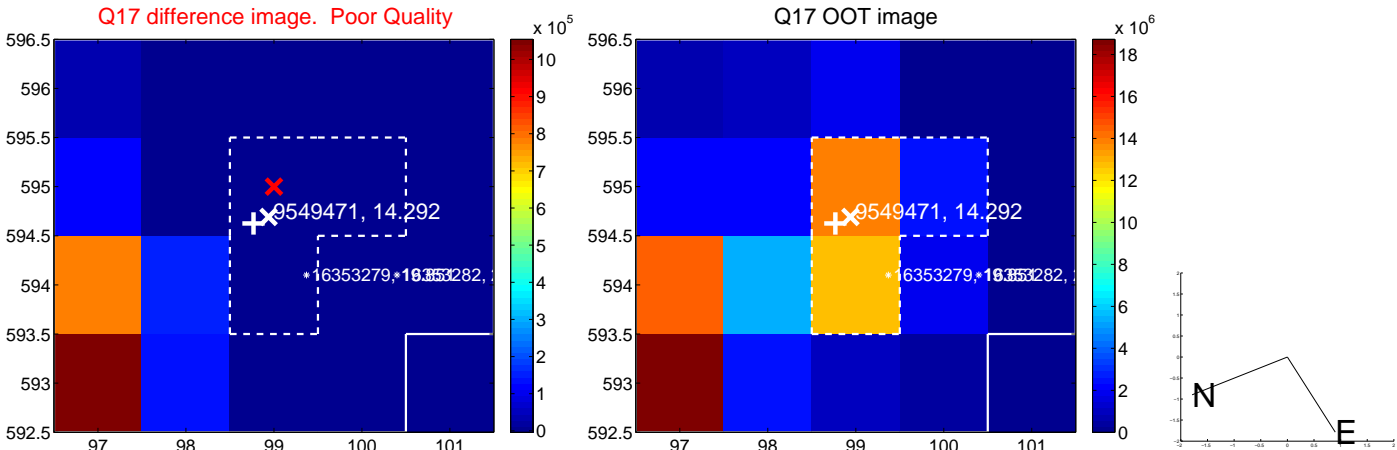
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



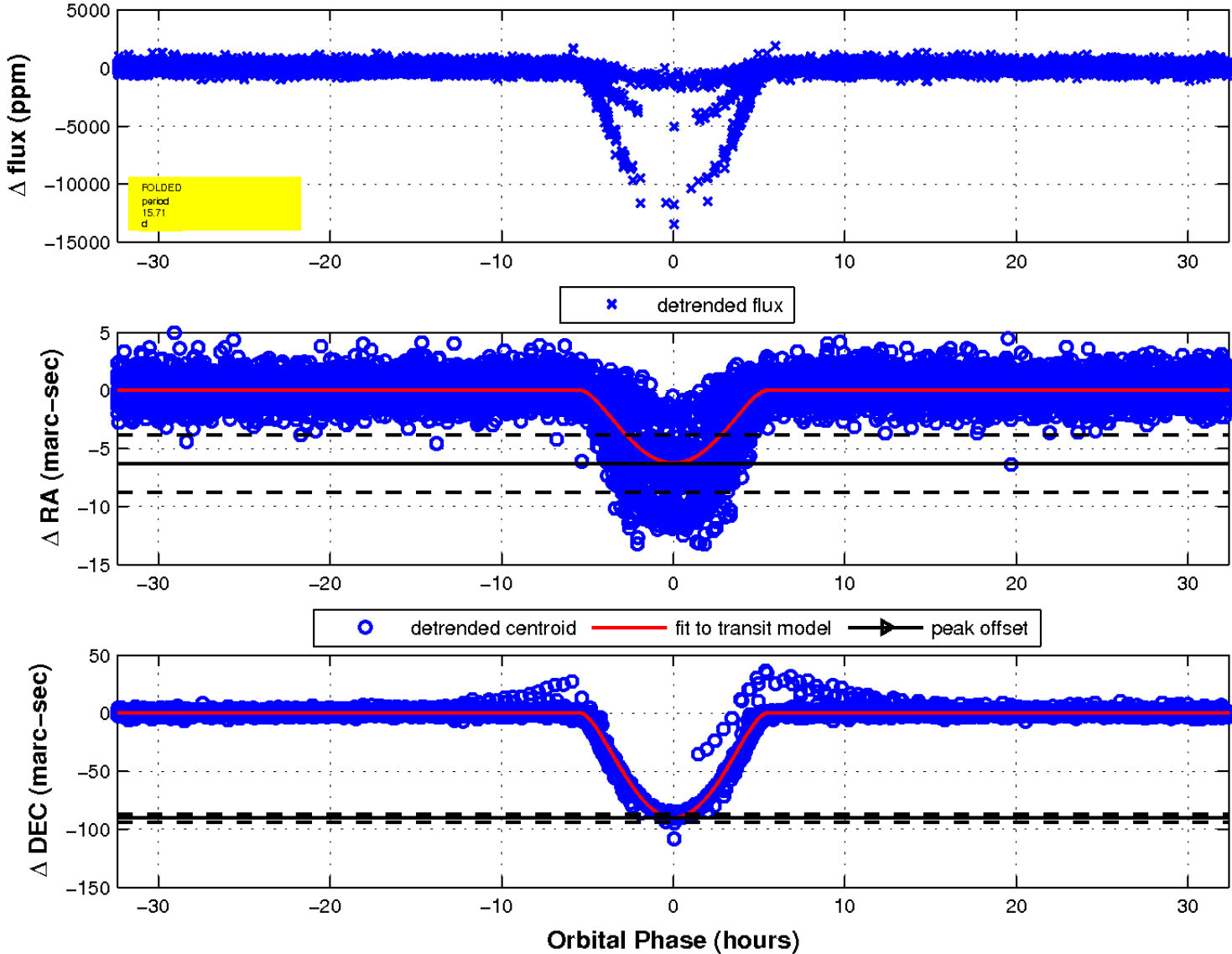
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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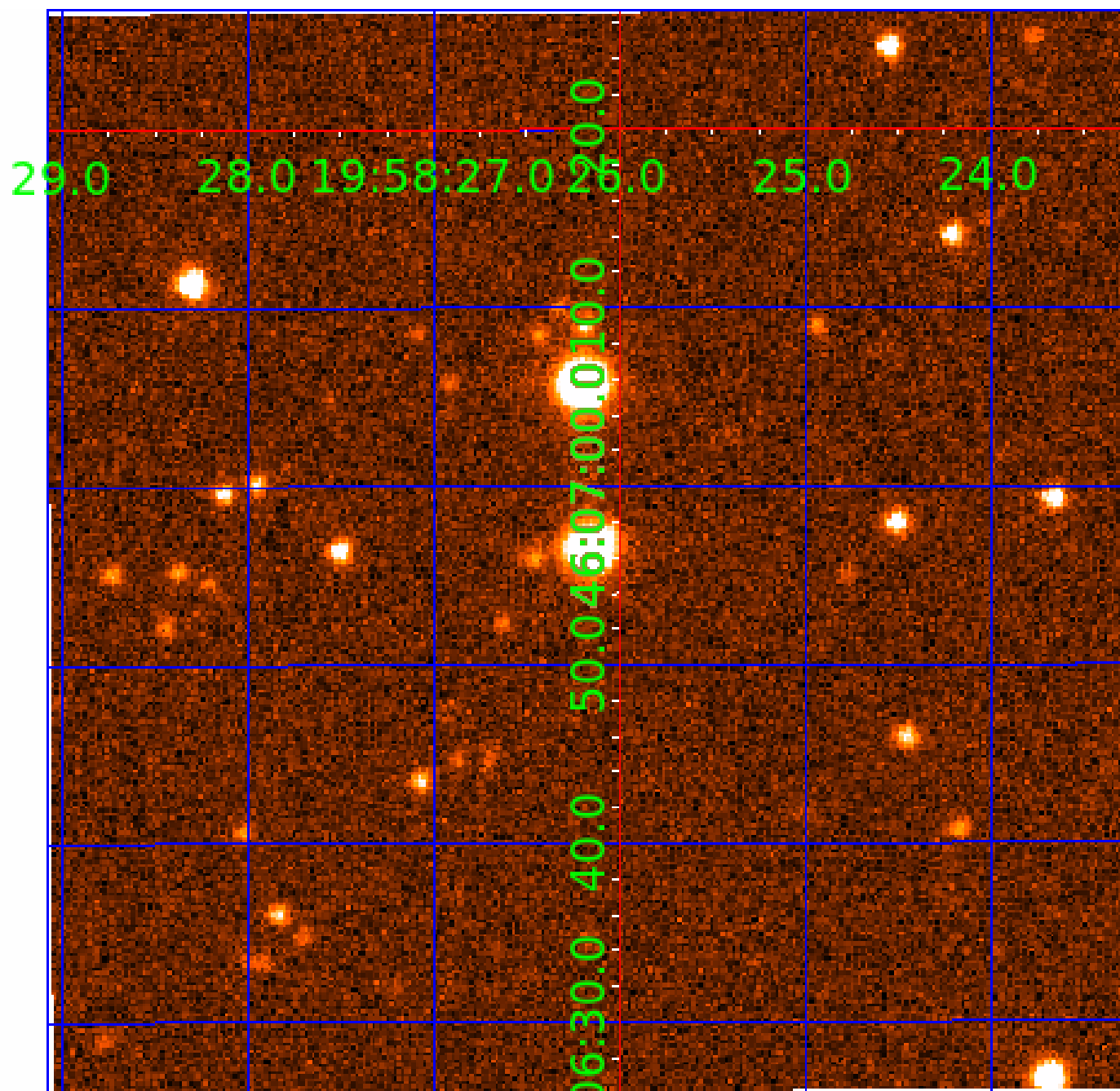


fluxWeightedCentroids, Planet 1 of 2



UKIRT Image

Declination



KIC 009549471

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}) |
|--------------|----------|---------|---------------|--------------|-------------|------------------|-------|-------|-----------------------------|-----------------|------------------------|------------------------|
| 009549471-01 | OBS | 6070.01 | 15.713770 | 132.099089 | 3639.6 | 10.800 | 313.6 | 183.6 | 0.96 | 5812 | 10.76 | 66.38 |
| 009549471-02 | OBS | No | 15.713754 | 137.331889 | 379.7 | 5.988 | 35.4 | 29.8 | 0.96 | 5812 | 2.30 | 66.38 |

Robovetter Results

| TCE | Run Type | Disp | Score | N | S | C | E | Comments |
|--------------|----------|------|-------|---|---|---|---|---|
| 009549471-01 | OBS | FP | 0.00 | 0 | 1 | 1 | 1 | MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE—SEASONAL_DEPTH_DV—SEASONAL_DEPTH_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH |
| 009549471-02 | OBS | FP | 0.00 | 1 | 1 | 1 | 1 | IS_SEC_TCE—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH |

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

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

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

Ephemeris Match Information For 009549471-02

| TCE (1) | KIC | Parent (2) | Parent KIC | P ₁ :P ₂ | Dist ($''$) | Δ Row | Δ Col | m ₂ | m ₁ | D ₂ /D ₁ | Mechanism | Flag | σ_P | σ_T |
|--------------|---------|--------------|------------|--------------------------------|---------------|--------------|--------------|----------------|----------------|--------------------------------|------------|------|------------|------------|
| 009549471-02 | 9549471 | 009549472-02 | 9549472 | 1:1 | 9.3 | 1 | 2 | 14.05 | 14.29 | 16.58 | Direct-PRF | 0 | 0.10 | 0.05 |

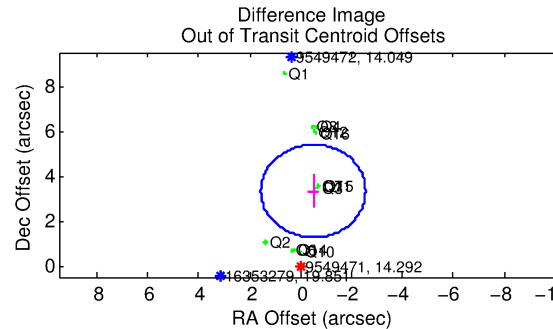
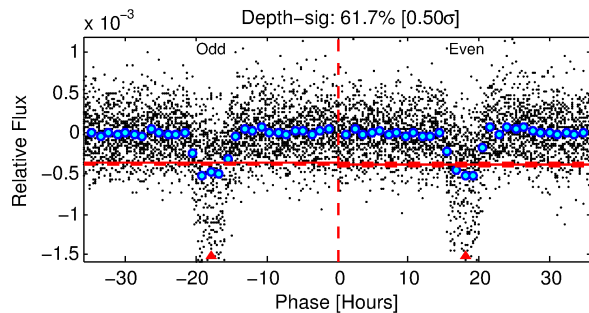
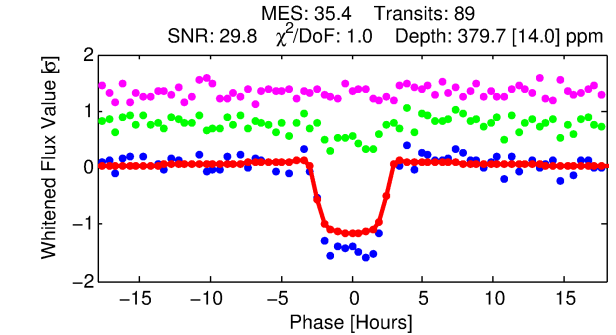
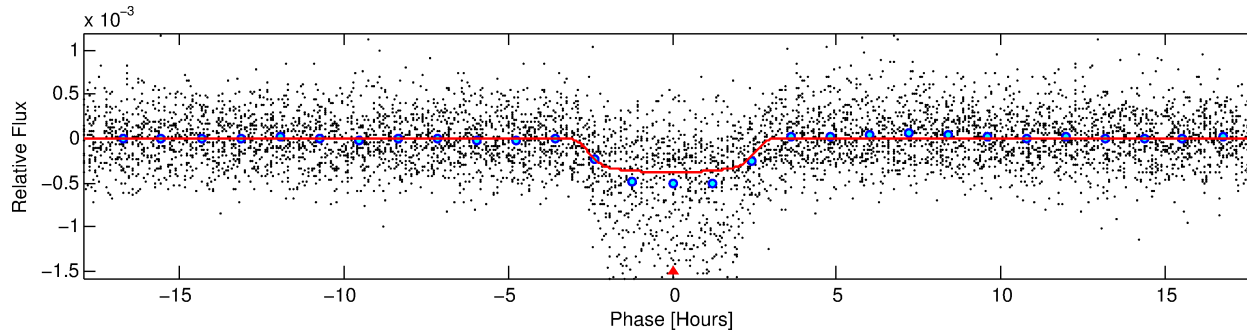
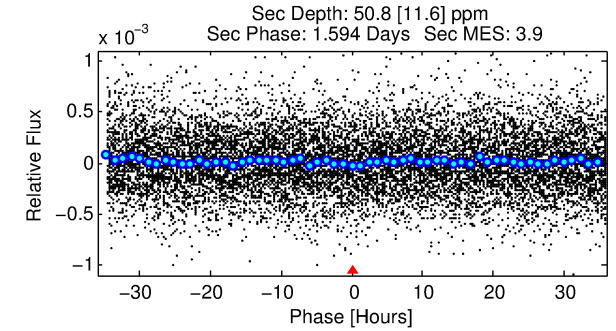
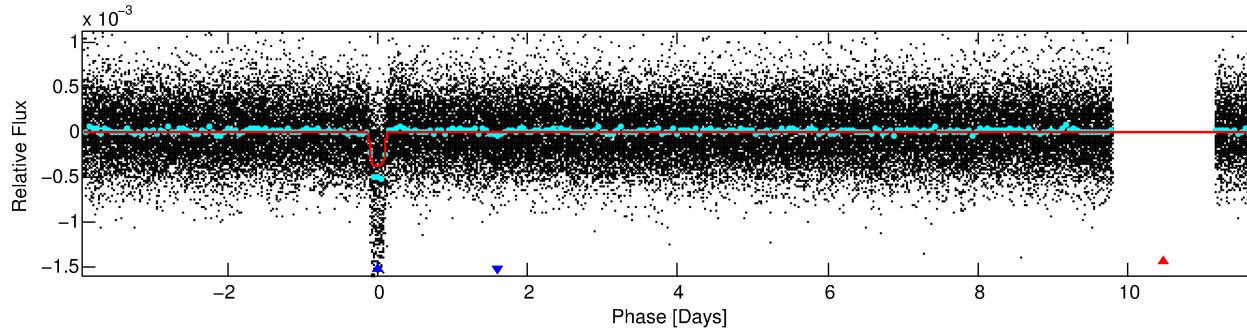
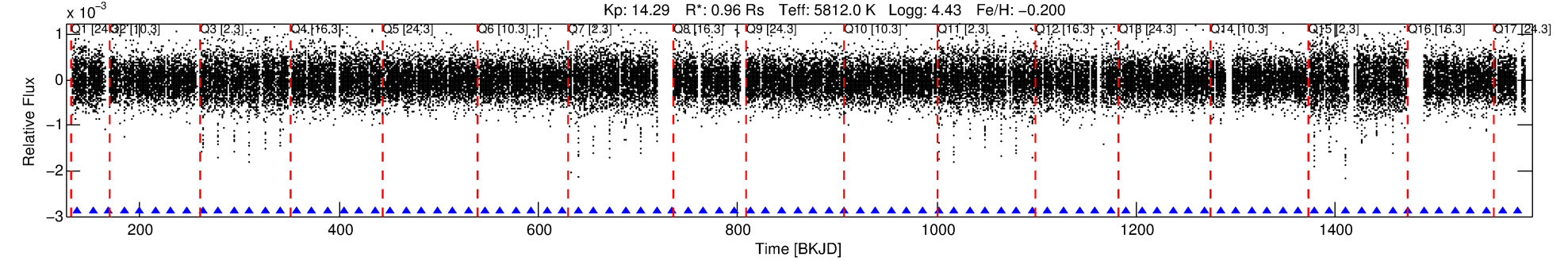
Notes: P₁:P₂ is the period ratio. Dist is the distance in arcseconds. Δ Row and Δ Col are the number of pixels apart in row and column. m₂ and m₁ are the magnitudes of the parent and child. D₂/D₁ is the parent's transit depth divided by the child's. σ_P and σ_T are the significance of the match in period and epoch. For a match to be considered significant $\sigma_P < 5.0$ and $\sigma_T < 5.0$. Matches which have σ_P and σ_T very close to this cutoff should receive extra scrutiny, especially if the period ratio is very large.

DV One-Page Summary

KIC: 9549471 Candidate: 2 of 2 Period: 15.714 d

KOI: K06070 Corr: No Ephemeris Match

Kp: 14.29 R*: 0.96 Rs Teff: 5812.0 K Logg: 4.43 Fe/H: -0.200



DV Fit Results:

Period = 15.71375 [0.00008] d
Epoch = 137.3319 [0.0043] BKJD
Rp/R* = 0.0220 [0.0009]
a/R* = 8.40 [1.51]
b = 0.93 [0.03]
Seff = 66.37 [24.00]
Teq = 728 [66] K
Rp = 2.30 [0.64] Re
a = 0.1191 [0.0277] AU
Ag = 74.87 [31.42] [2.35σ]
Teffp = 3310 [225] K [11.01σ]

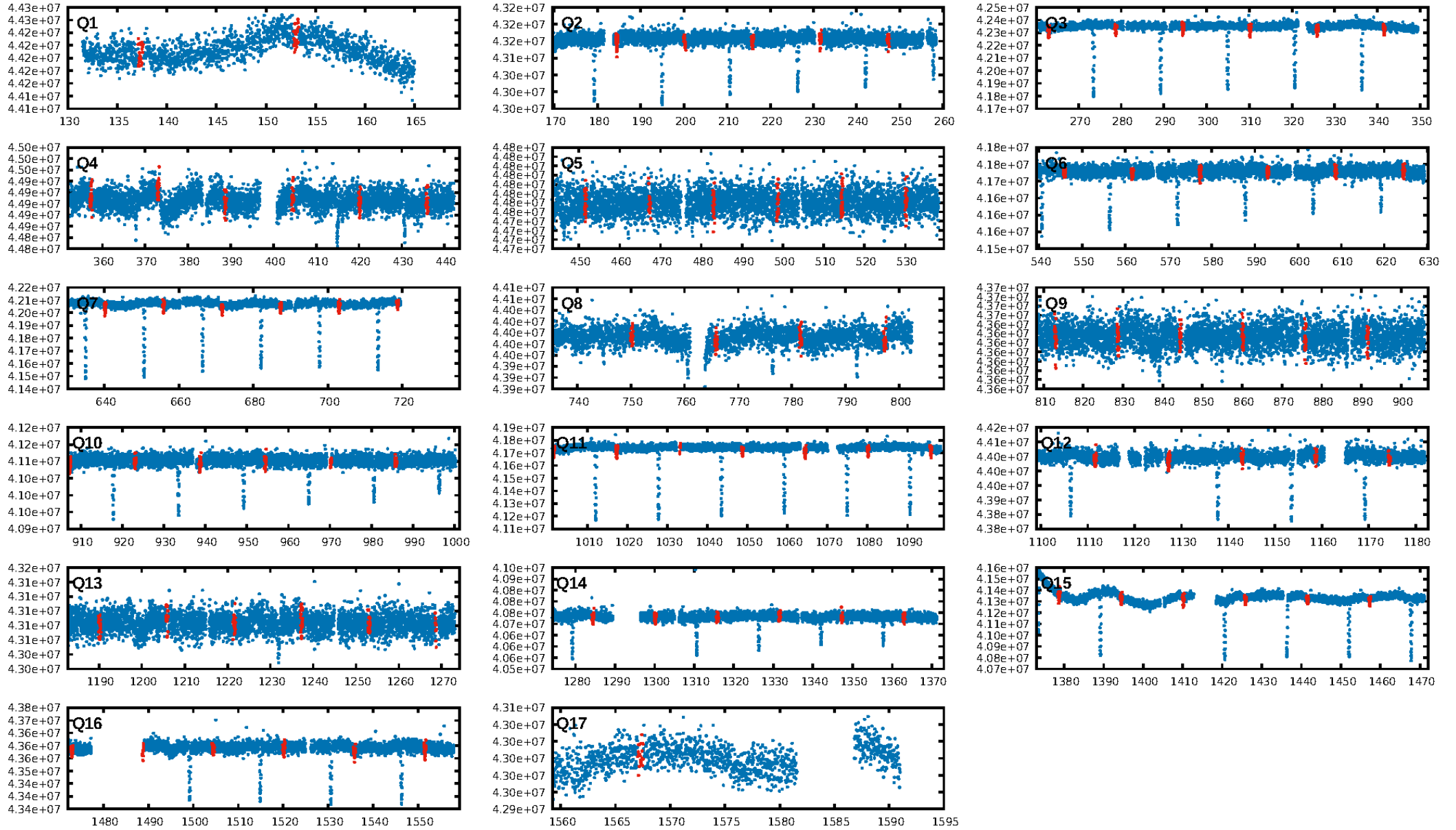
DV Diagnostic Results:

ShortPeriod-sig: N/A
LongPeriod-sig: 0.0% [0.00σ]
ModelChiSquare2-sig: 0.0%
ModelChiSquareGof-sig: 100.0%
Bootstrap-pfa: 4.32e-260
RollingBand-fgt: 1.00 [86/86]
GhostDiagnostic-chr: -0.2484
Centroid-sig: 0.0%
Centroid-so: 31.442 arcsec [78.04σ]
OotOffset-rm: 3.362 arcsec [4.89σ]
KicOffset-rm: 9.347 arcsec [95.99σ]
OotOffset-st: 4/4/4/1 [13]
KicOffset-st: 4/4/4/1 [13]
DiffImageQuality-fgm: 1.00 [13/13]
DiffImageOverlap-fno: 1.00 [17/17]

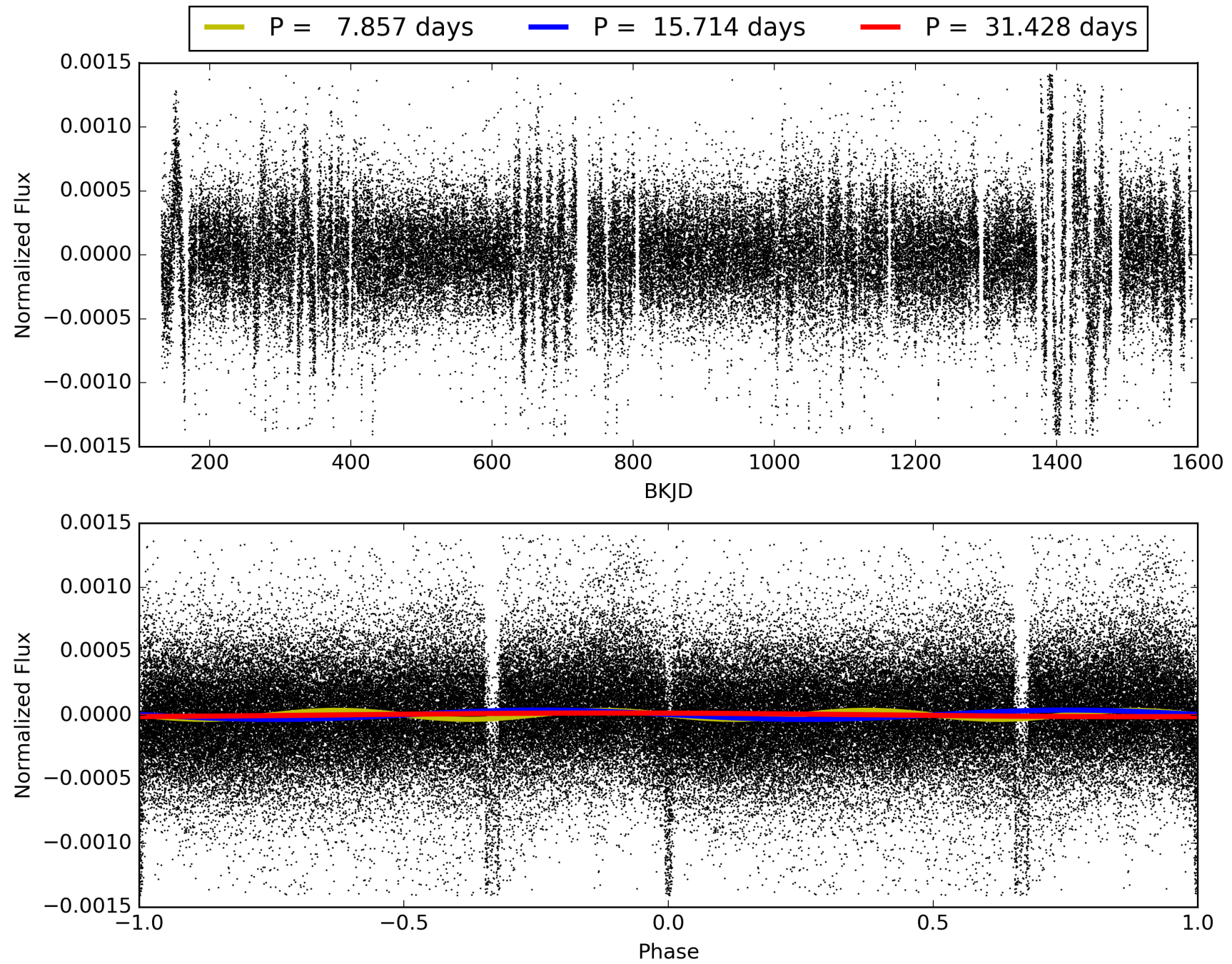
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 14:09:57 Z

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

TCE 009549471-02, PDC Light Curves

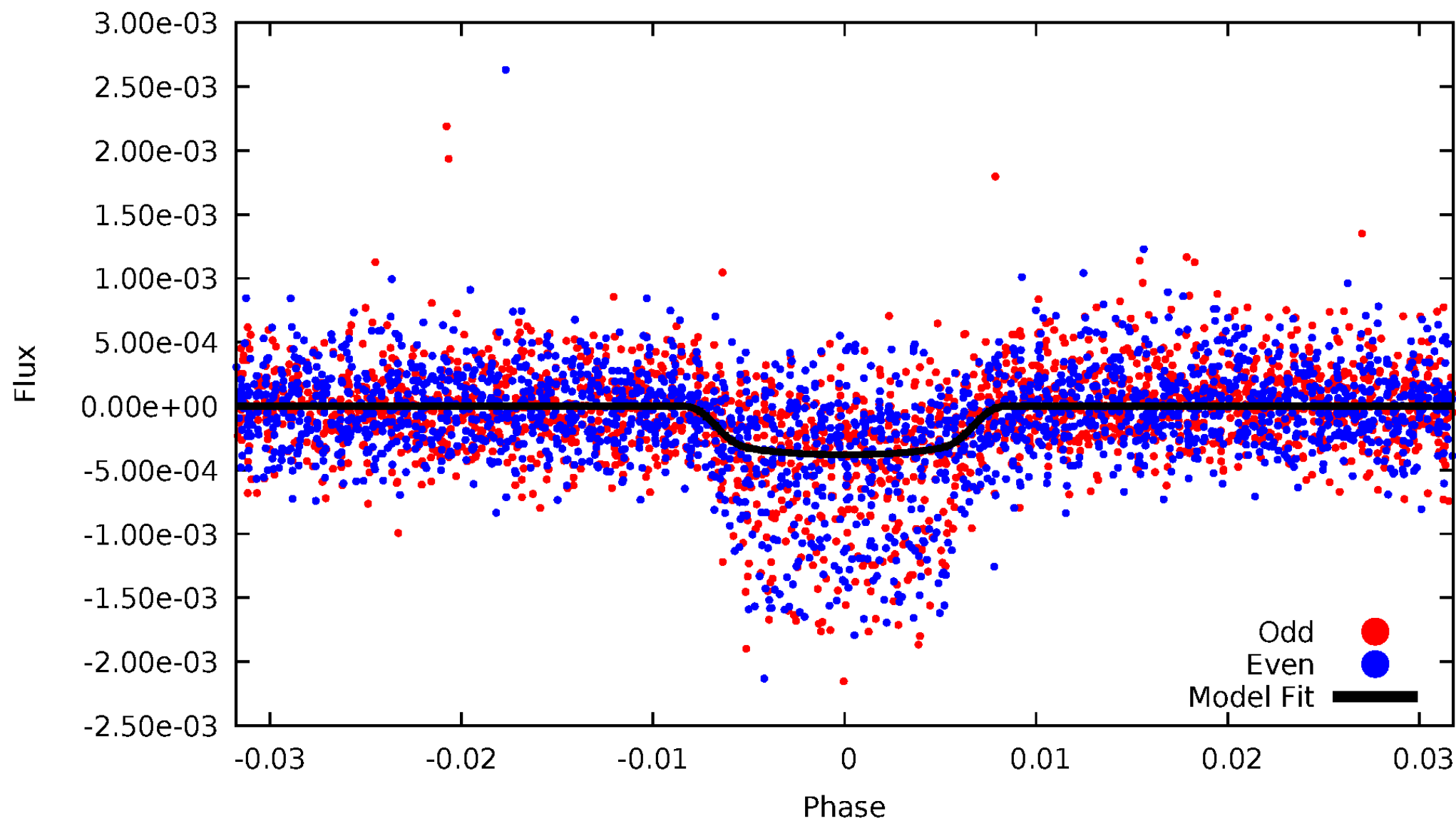


TCE 009549471-02



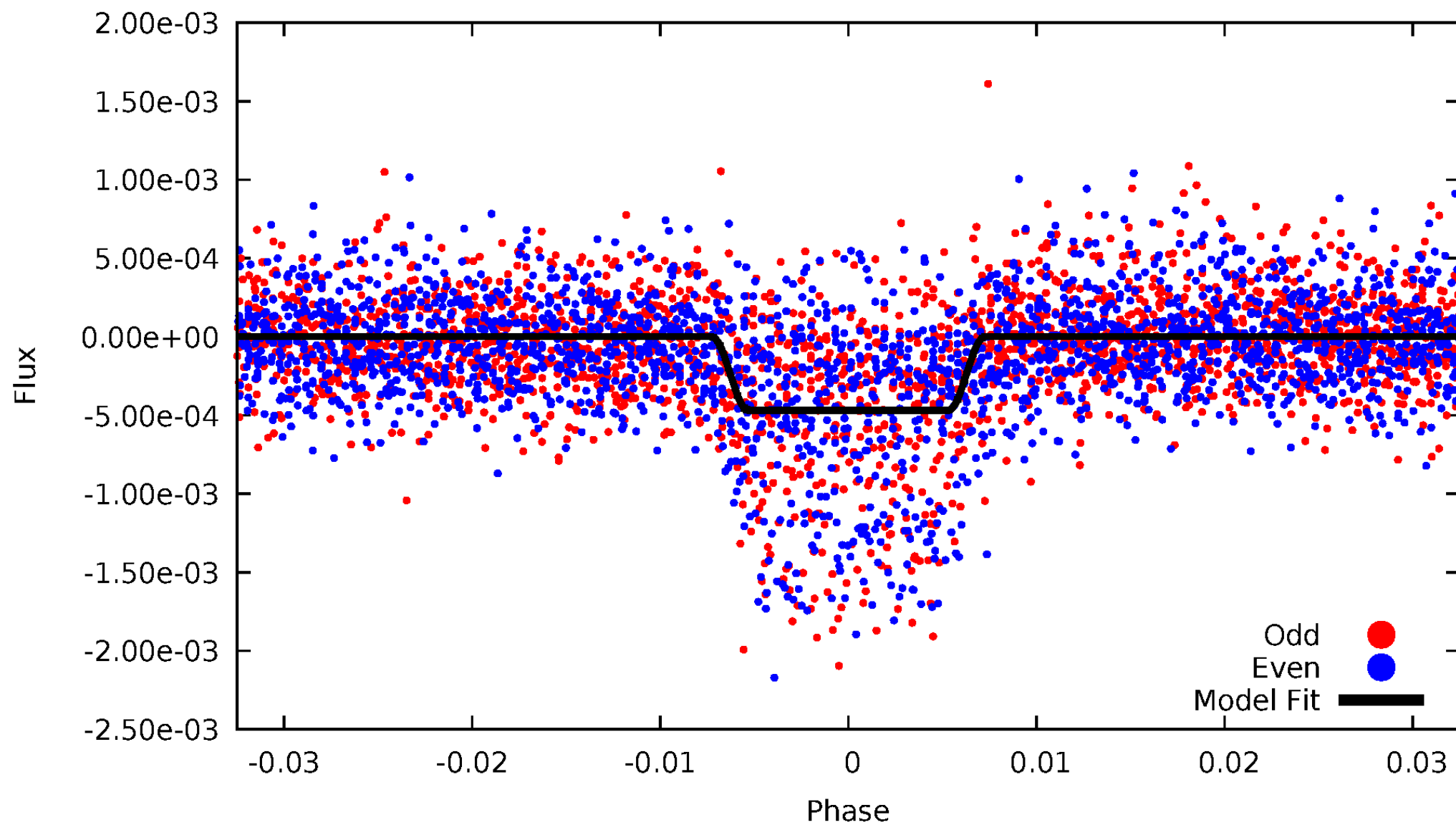
DV Odd/Even

TCE 009549471-02



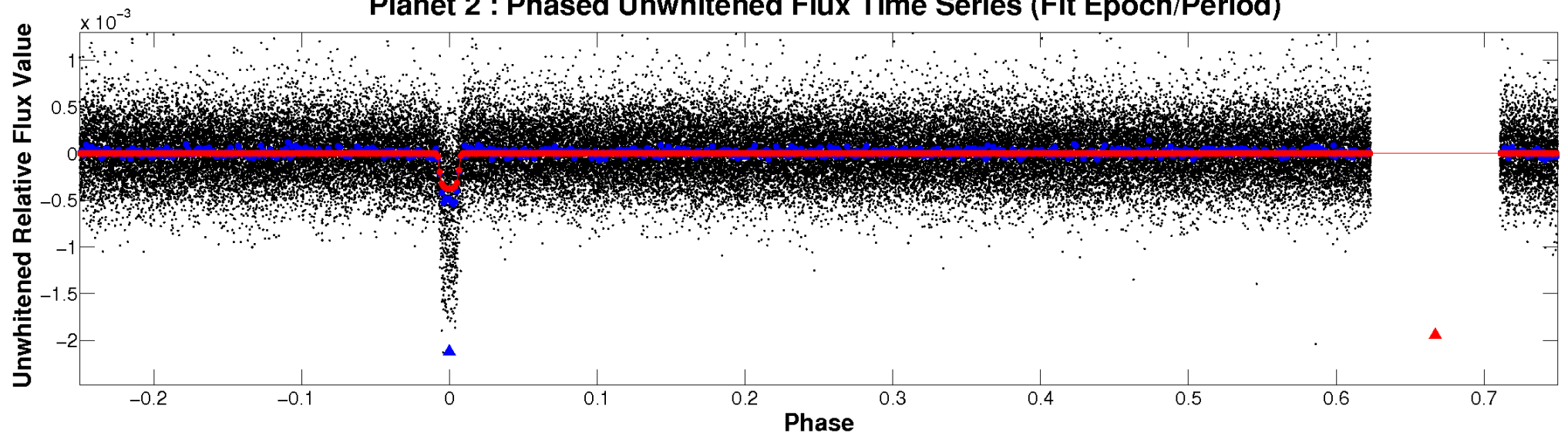
ALT Odd/Even

TCE 009549471-02

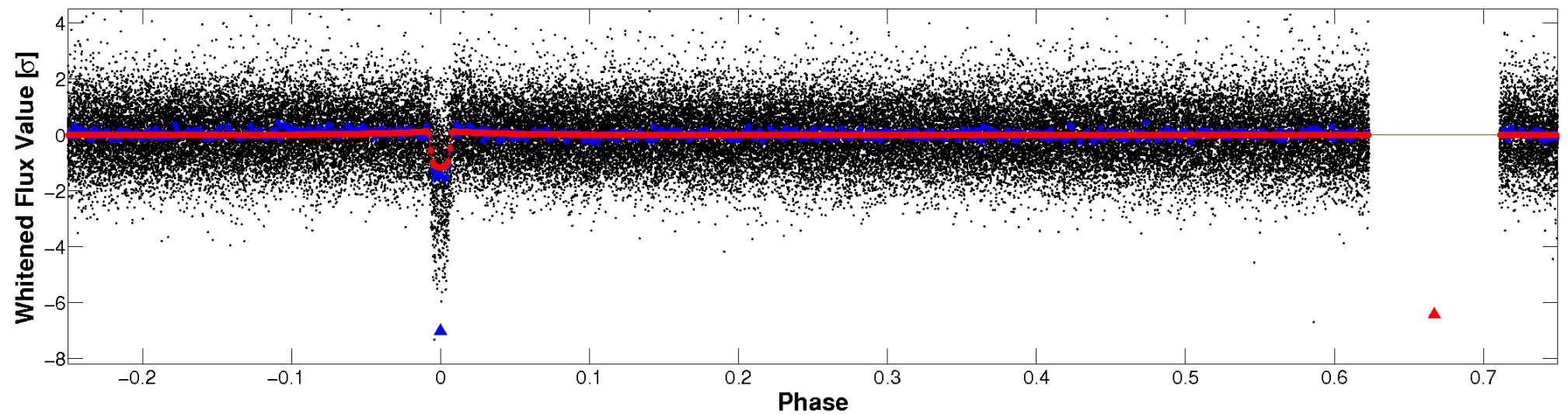


Non-Whitened Vs. Whitened Light Curve

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

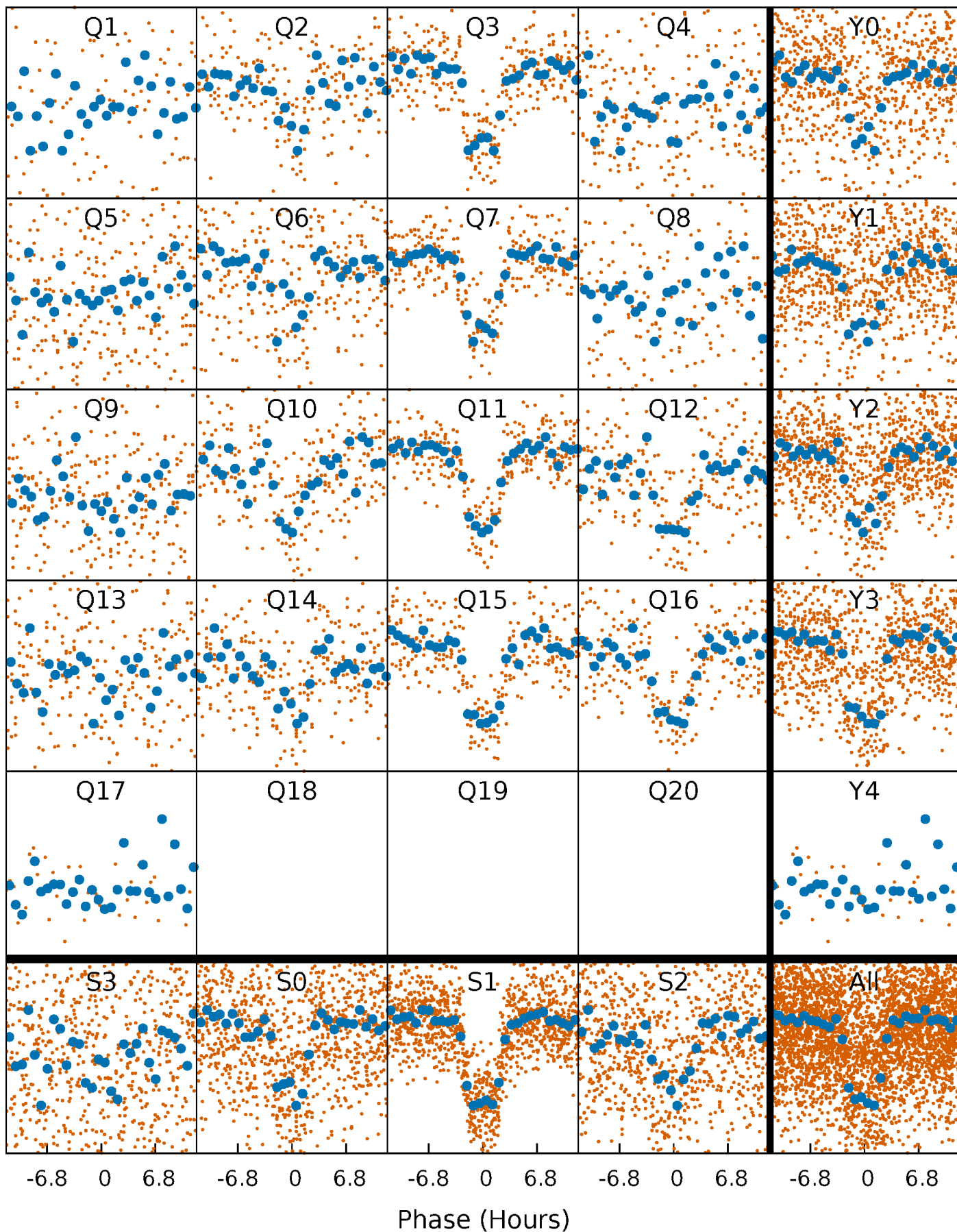


Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



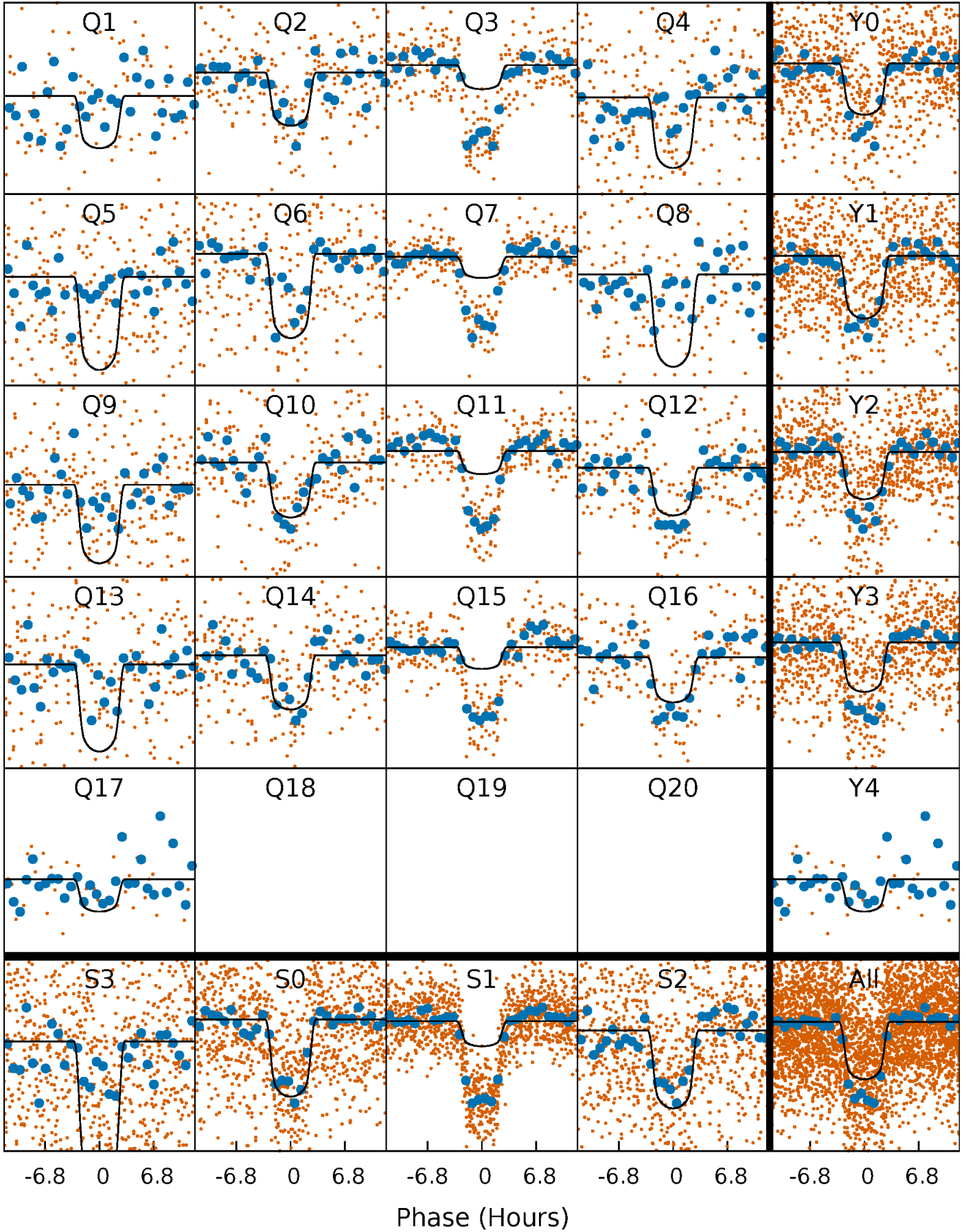
PDC Quarter-Phased Transit Curves

TCE 009549471-02 P= 15.713754 Days $T_0=137.331889$ (BKJD)



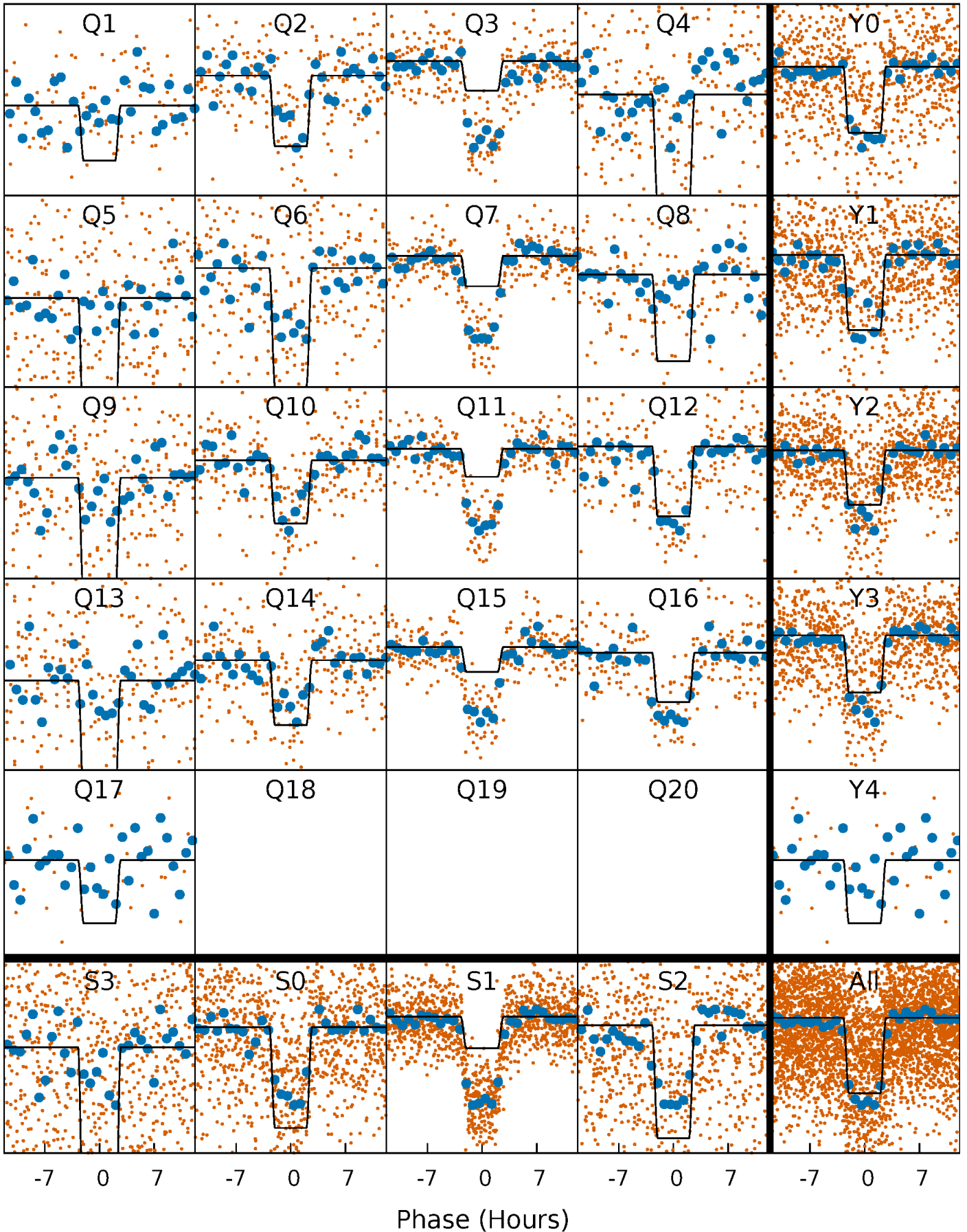
DV Quarter-Phased Transit Curves

TCE 009549471-02 P= 15.713754 Days $T_0=137.331889$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

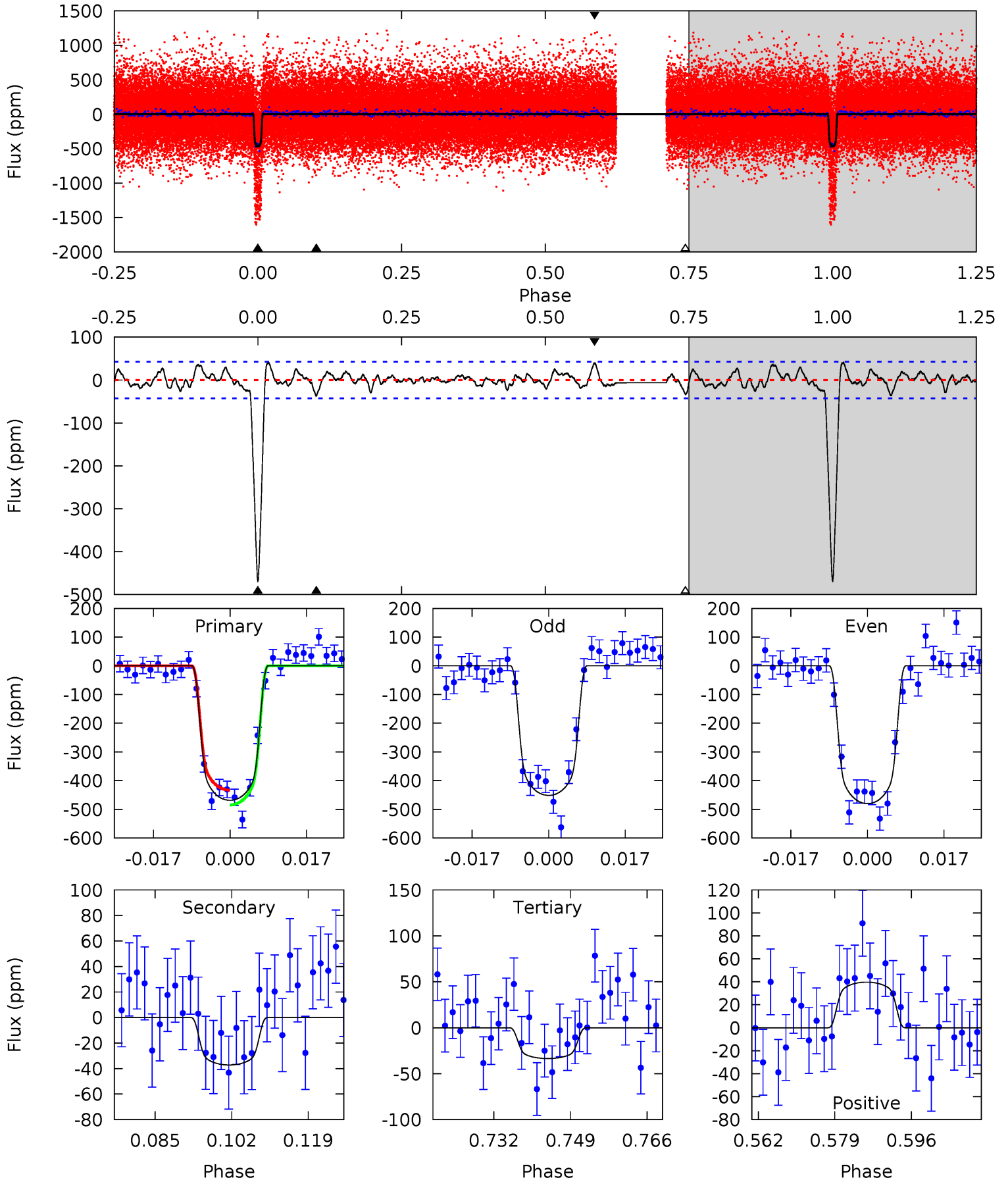
TCE 009549471-02 P= 15.713988 Days $T_0=137.320243$ (BKJD)



DV Model-Shift Uniqueness Test

009549471-02, P = 15.713754 Days, E = 121.618135 Days

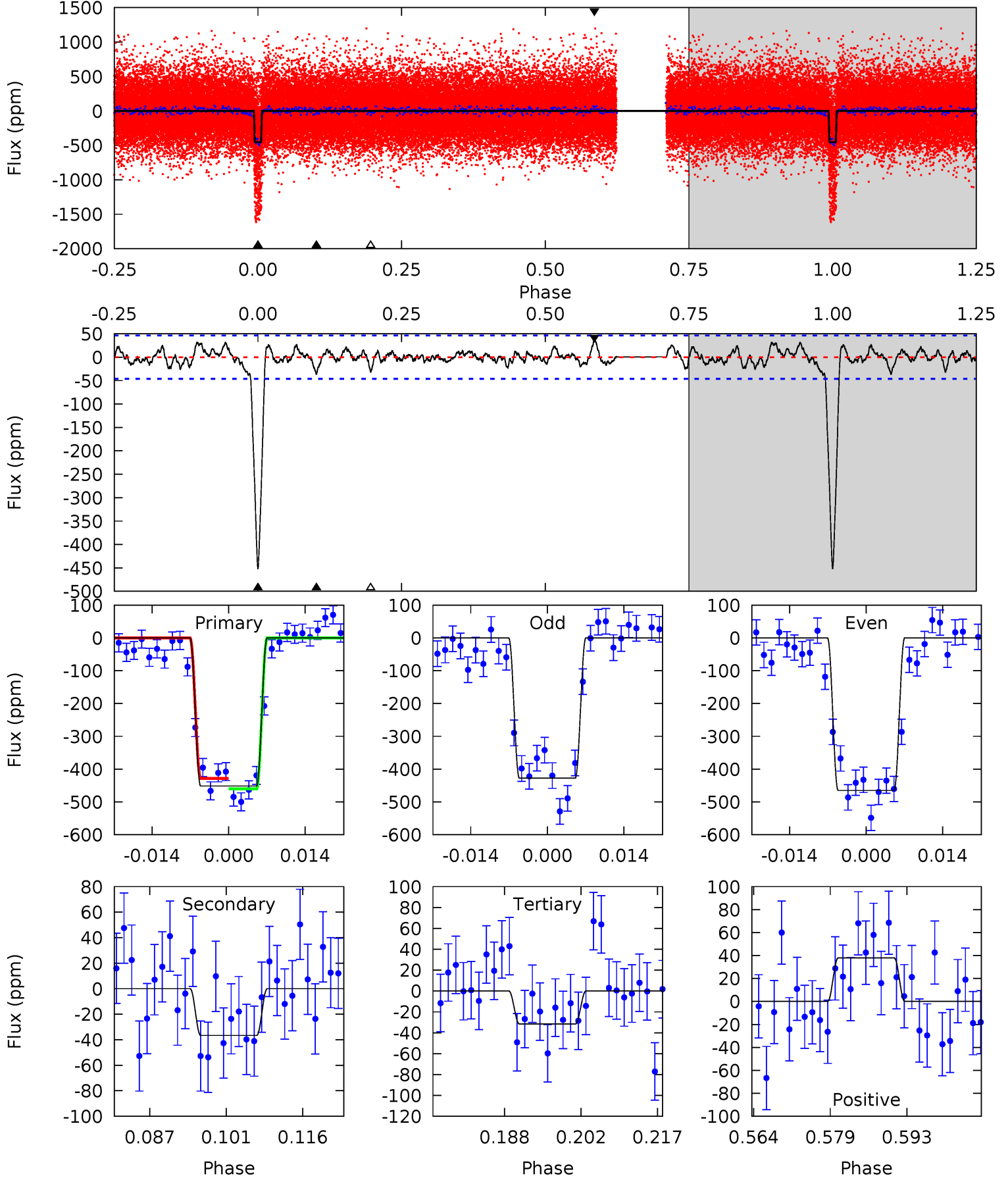
| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 53.9 | 4.28 | 3.86 | 4.57 | 4.92 | 2.39 | 1.46 | 50.1 | 49.4 | 0.42 | -0.29 | 1.65 | 1.65 | 0.08 | 2.96 |



Alt Model-Shift Uniqueness Test

009549471-02, P = 15.713988 Days, E = 121.606255 Days

| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 48.3 | 3.92 | 3.38 | 4.06 | 4.96 | 2.45 | 1.27 | 44.9 | 44.3 | 0.54 | -0.13 | 2.02 | 1.59 | 0.08 | 1.69 |



Stellar Parameters For KIC 009549471

| | $T_{\text{eff}}(K)$ | $\log(g)$ | [Fe/H] | $R (R_{\odot})$ | $M(M_{\odot})$ | $p_{\star} (\text{g}\cdot\text{cm}^{-3})$ |
|--------|----------------------|---------------------------|----------------------------|---------------------------|---------------------------|---|
| | 5812^{+156}_{-174} | $4.434^{+0.101}_{-0.188}$ | $-0.200^{+0.300}_{-0.300}$ | $0.960^{+0.262}_{-0.121}$ | $0.912^{+0.121}_{-0.091}$ | $1.453^{+0.627}_{-0.703}$ |
| | +3%/-3% | +2%/-4% | +150%/-150% | +27%/-13% | +13%/-10% | +43%/-48% |
| 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 009549471-02 / KOI

| Detrend | Depth (ppm) | $R_p (R_{\oplus})$ | $T_{max} (K)$ | $T_{obs} (K)$ | A_{obs} |
|---------|-------------|------------------------|--------------------|----------------------|------------------|
| DV | -37 ± 9 | $2.32^{+0.35}_{-0.23}$ | 1025^{+65}_{-52} | 3525^{+160}_{-164} | 52^{+19}_{-16} |
| Alt. | -37 ± 9 | $2.30^{+0.37}_{-0.23}$ | 1024^{+68}_{-51} | 3541^{+150}_{-185} | 53^{+19}_{-18} |

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 $A_{obs} \gg 1.0$

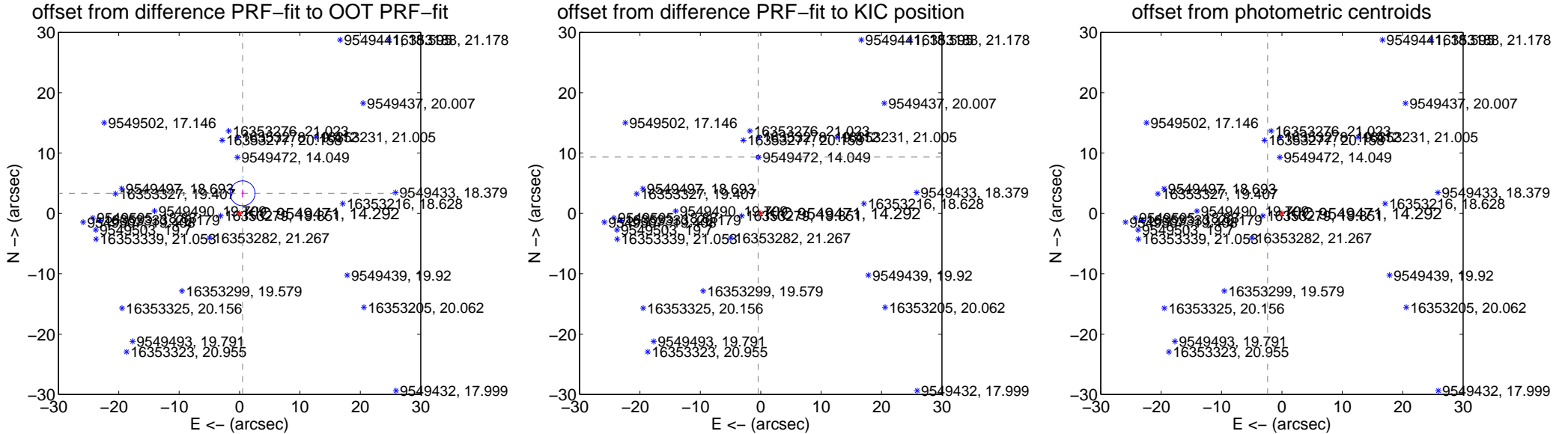
DV Centroid Data

Supplemental centroid analysis for 009549471-02. Kepler magnitude: 14.29. Transit SNR 29.77

There are 13 quarters with good PRF difference image offsets

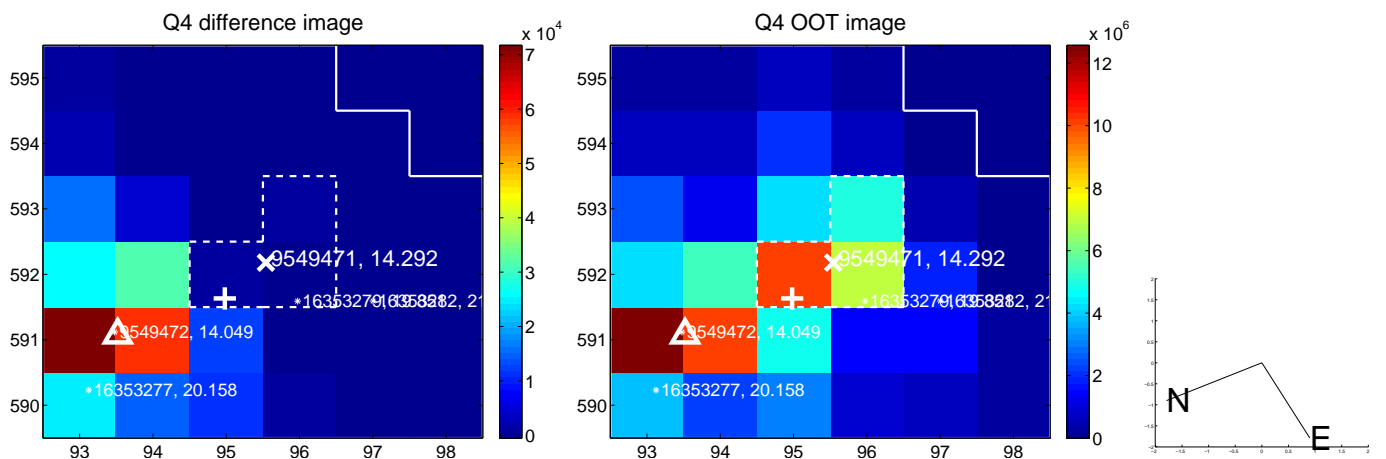
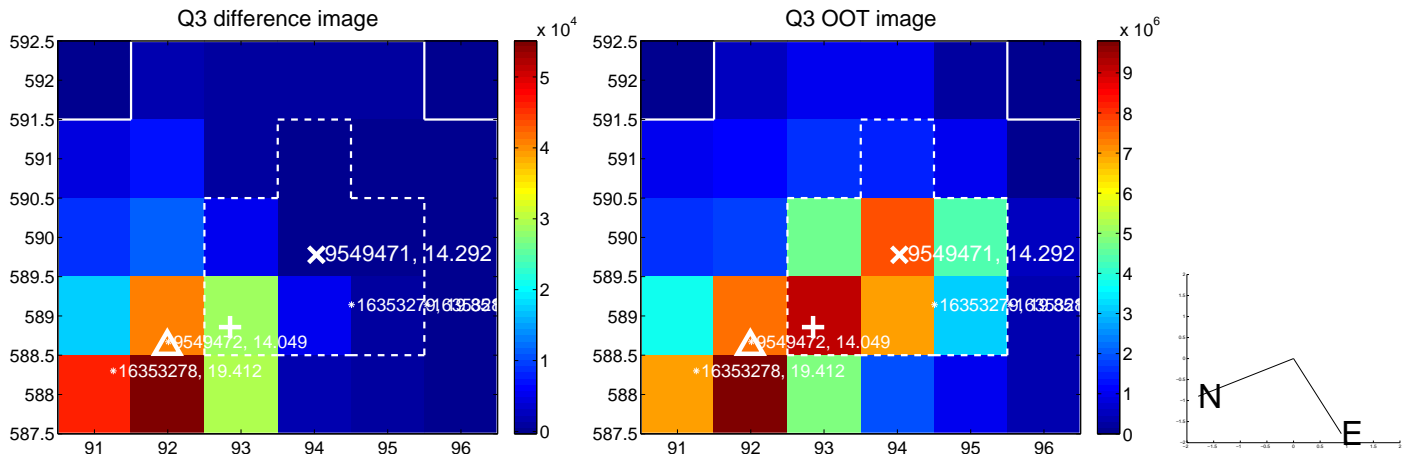
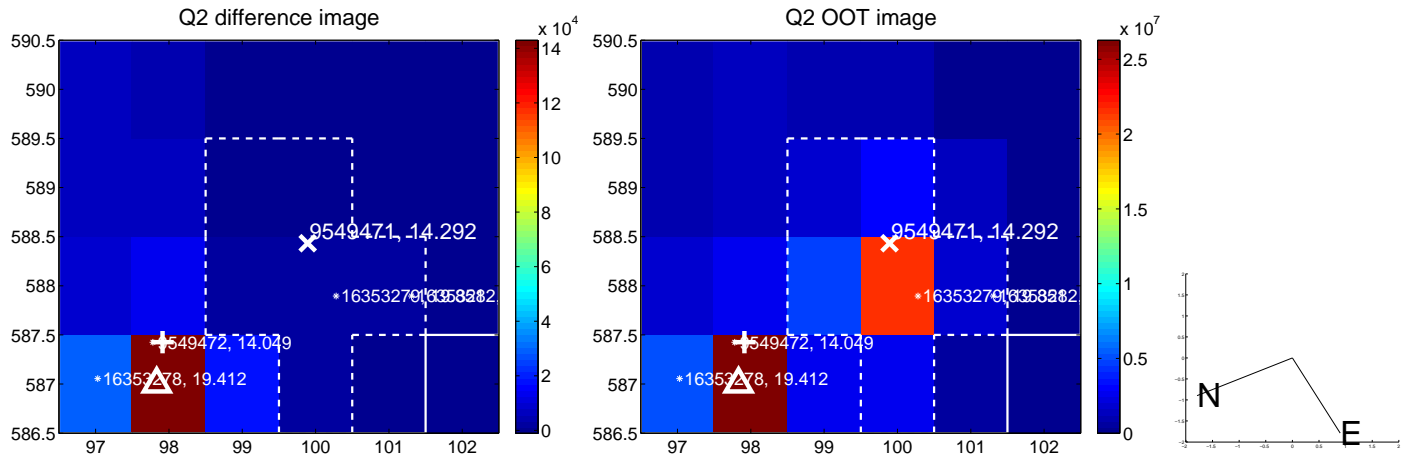
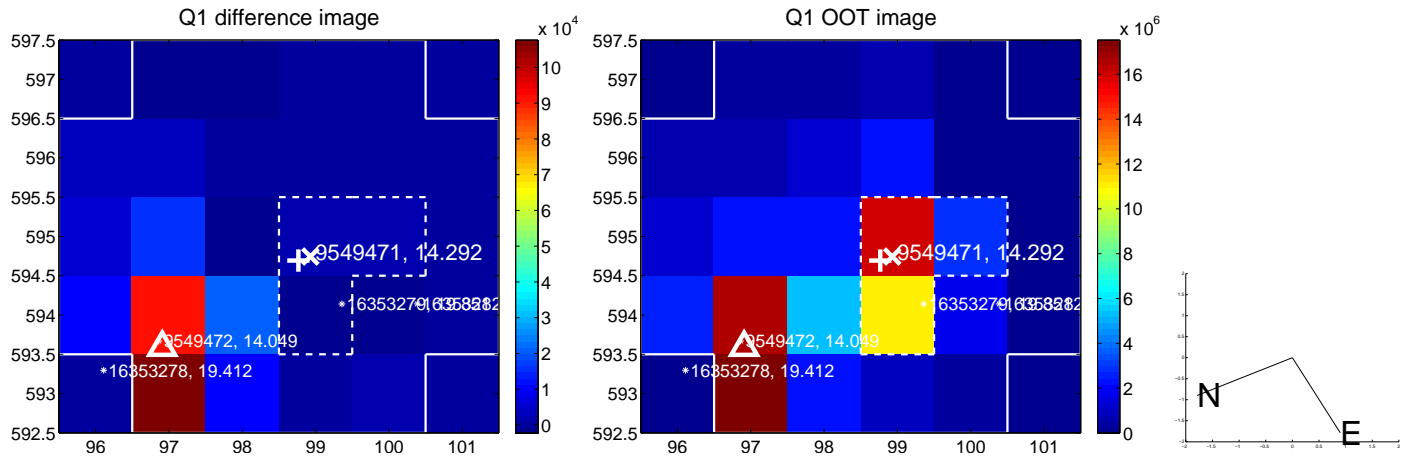
The OOT PRF centroid is offset from the target star catalog position by about 3.26 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

| | Distance in arcsec | Distance / σ | Δ RA | Δ Dec |
|---|--------------------|---------------------|--------------------|-------------------|
| PRF-fit source offset from OOT | 3.362 ± 0.687 | 4.89 | -0.502 ± 0.195 | 3.325 ± 0.685 |
| PRF-fit source offset from KIC position | 9.347 ± 0.097 | 95.99 | 0.428 ± 0.105 | 9.337 ± 0.096 |
| photometric centroid source offset | 31.44 ± 0.40 | 78.04 | 2.37 ± 0.30 | 31.35 ± 0.40 |

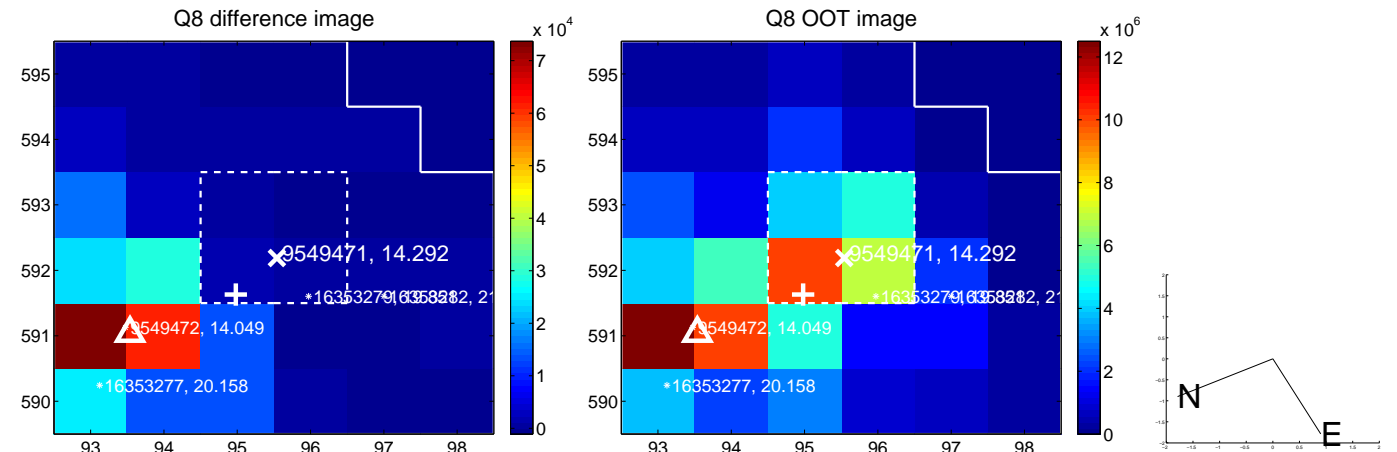
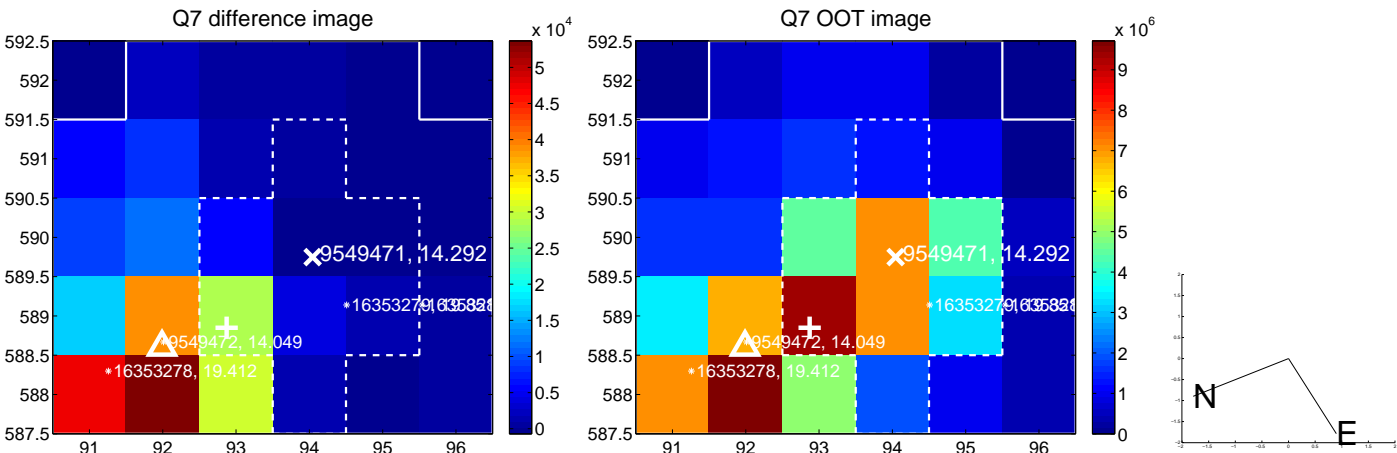
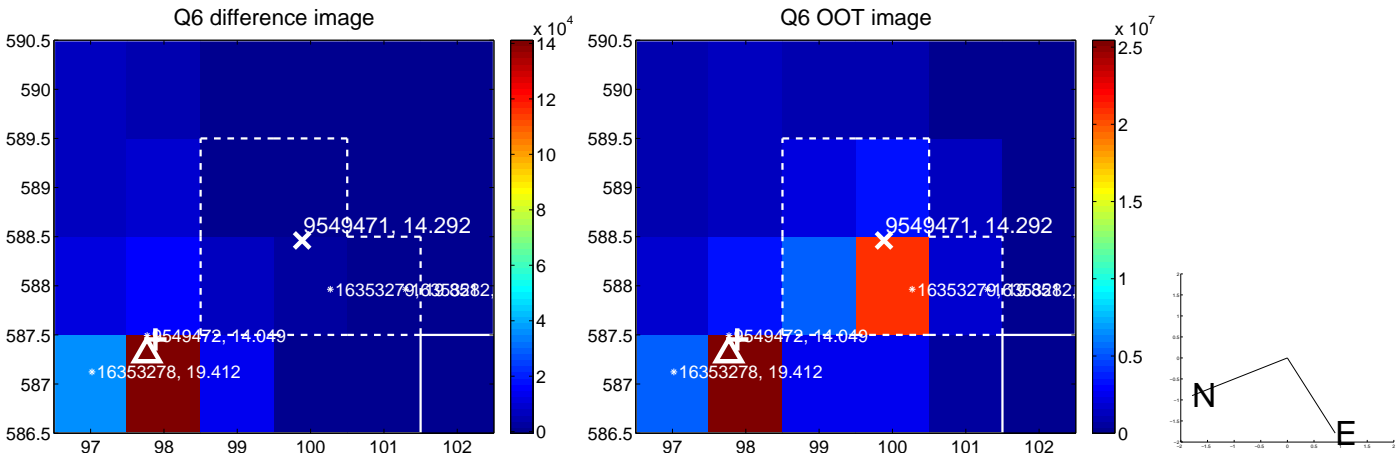
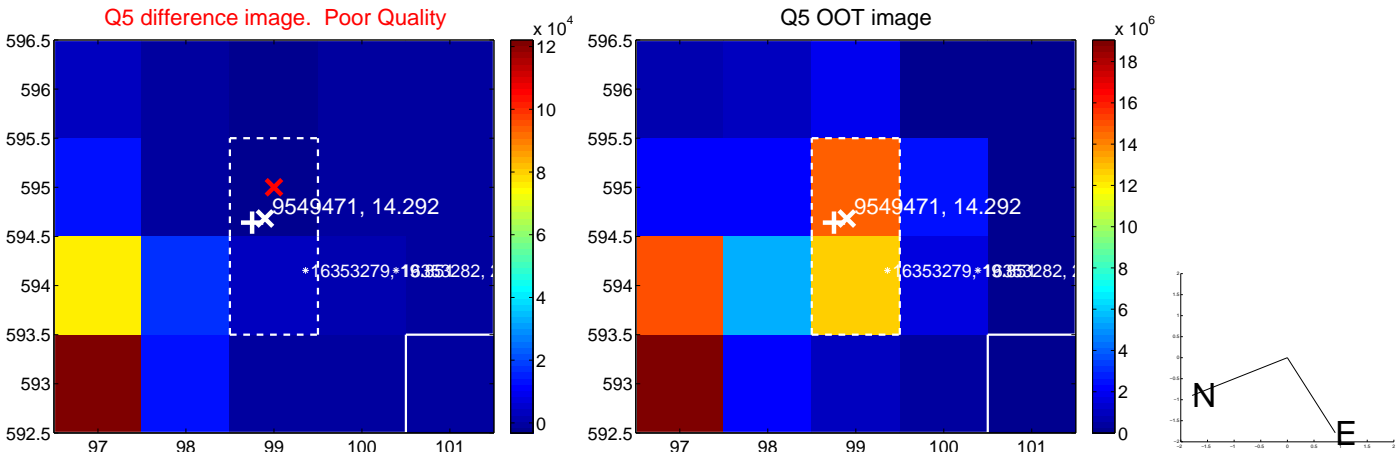


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- σ uncertainty. Blue circle: three- σ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

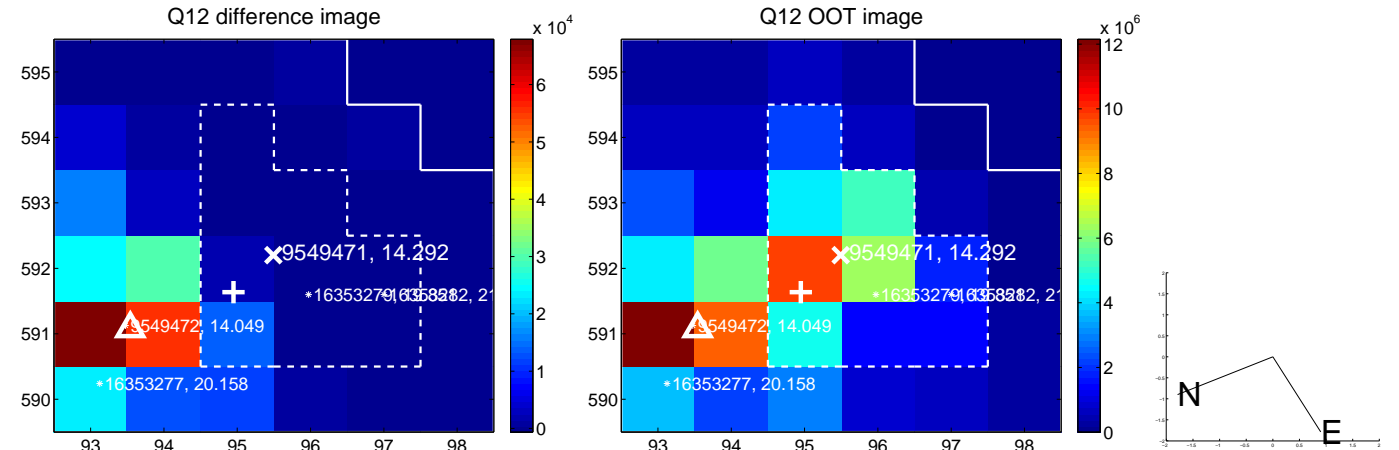
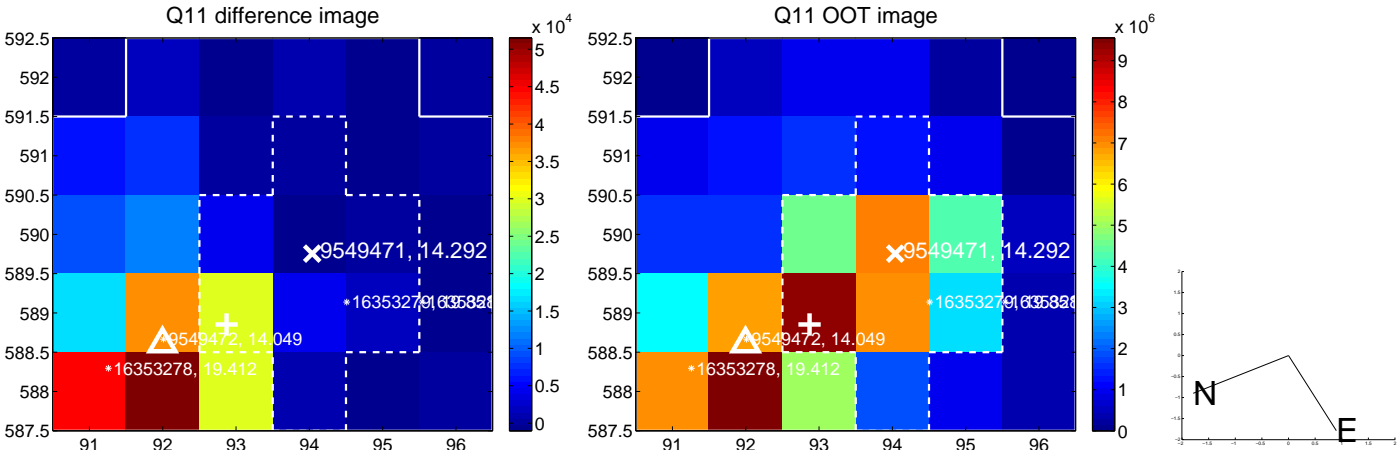
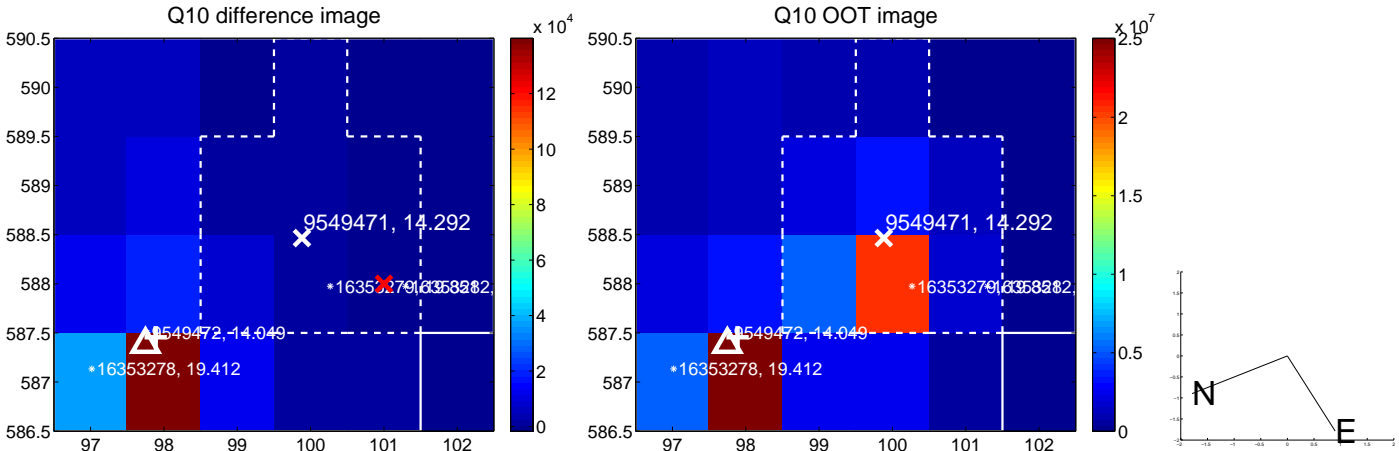
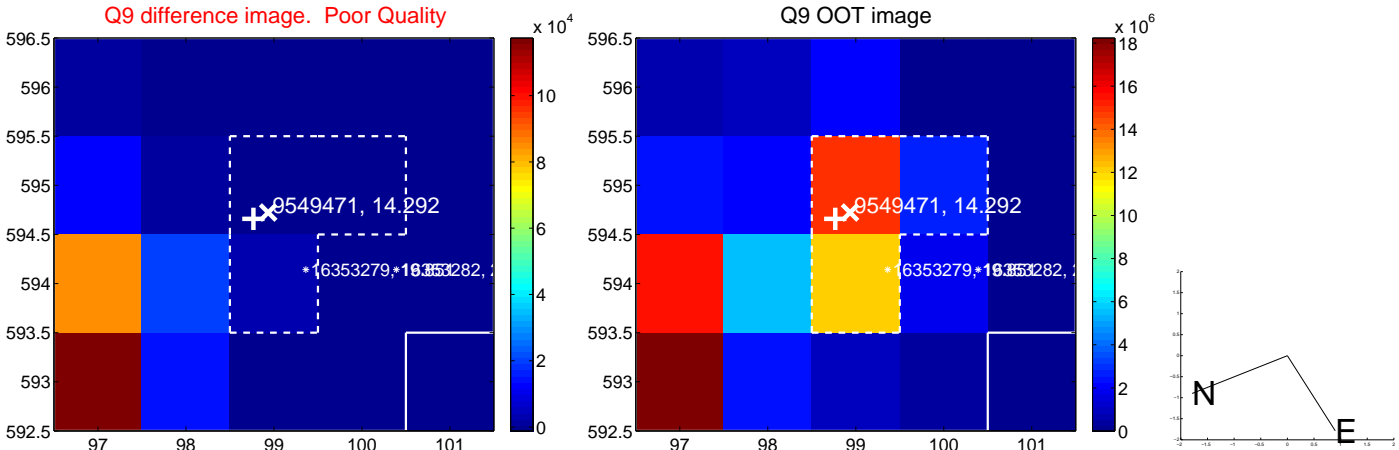
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



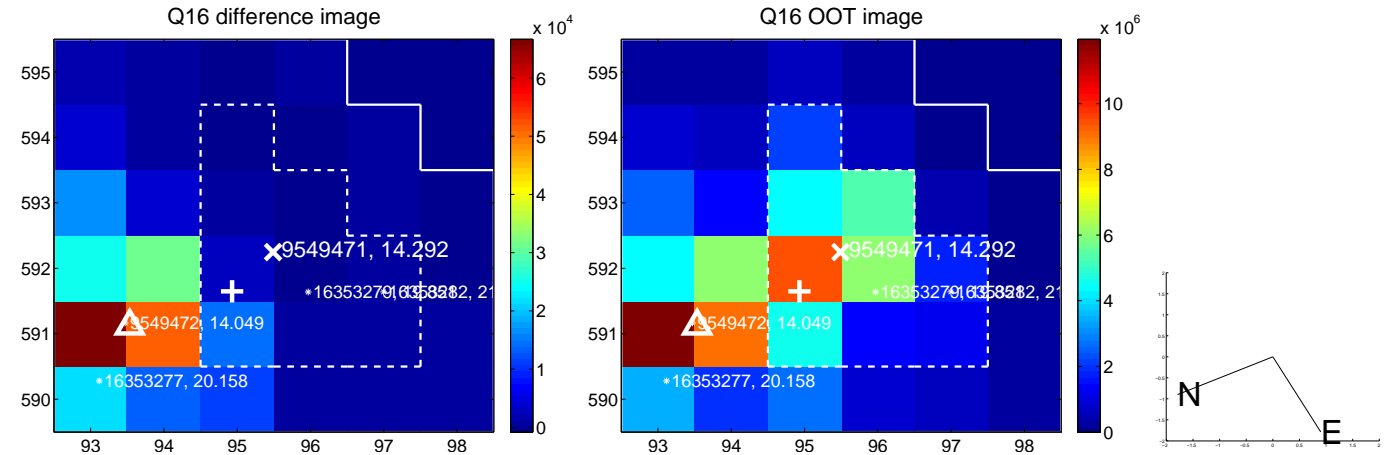
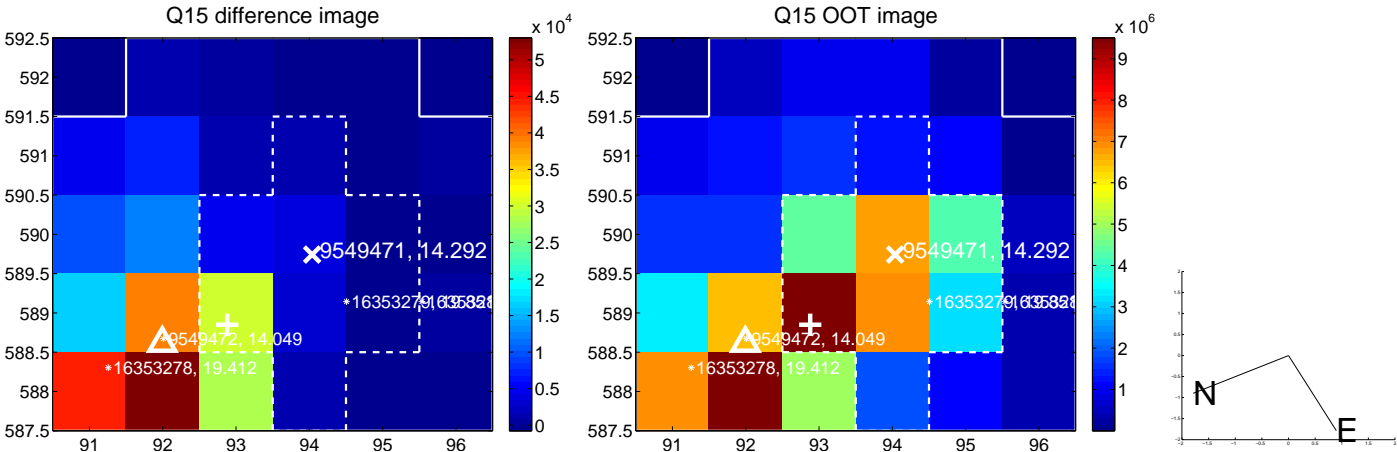
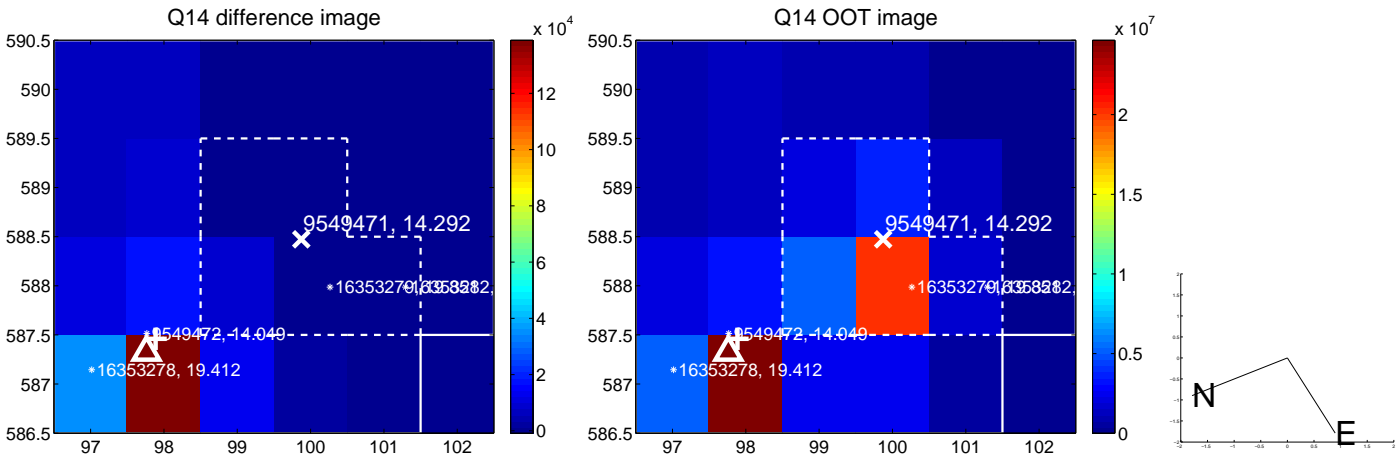
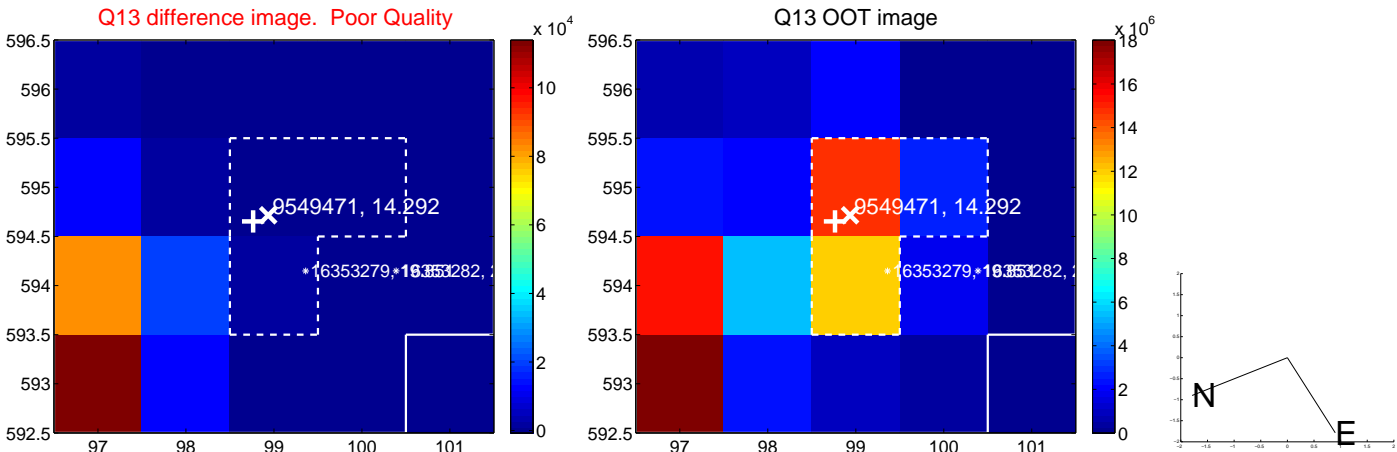
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



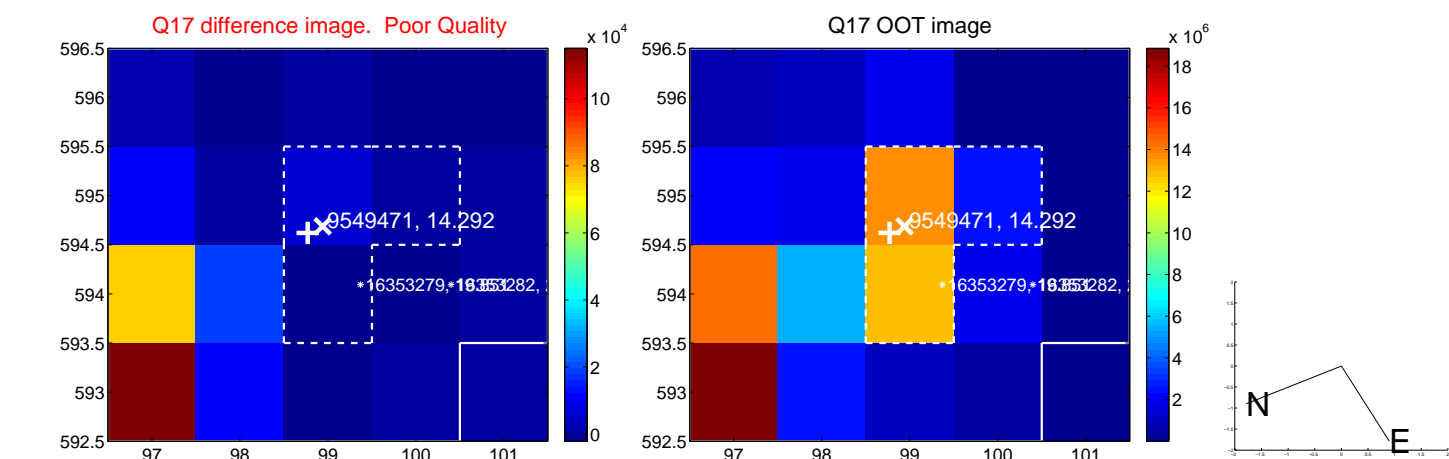
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



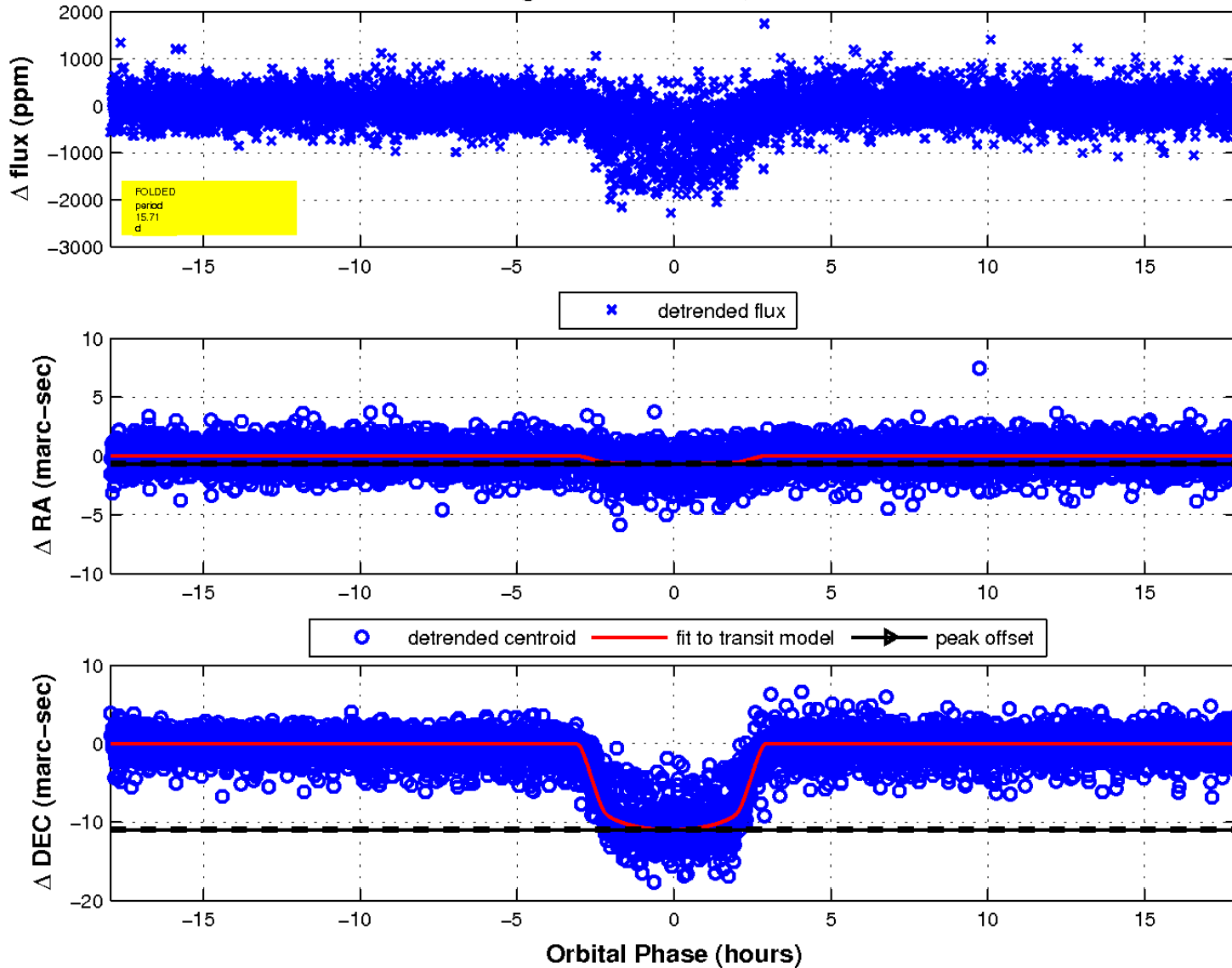
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

