

KIC 007373451

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}) |
|--------------|----------|---------|---------------|--------------|-------------|------------------|------|------|-----------------------------|-----------------|------------------------|------------------------|
| 007373451-01 | OBS | 0881.01 | 21.022496 | 144.609232 | 1779.9 | 4.260 | 47.6 | 53.2 | 0.75 | 5067 | 3.37 | 17.50 |
| 007373451-02 | OBS | 0881.02 | 226.891542 | 207.354457 | 2965.6 | 7.408 | 32.1 | 35.6 | 0.75 | 5067 | 4.41 | 0.73 |

Robovetter Results

| TCE | Run Type | Disp | Score | N | S | C | E | Comments |
|--------------|----------|------|-------|---|---|---|---|------------|
| 007373451-01 | OBS | PC | 1.00 | 0 | 0 | 0 | 0 | NO_COMMENT |
| 007373451-02 | OBS | PC | 1.00 | 0 | 0 | 0 | 0 | NO_COMMENT |

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 007373451-01

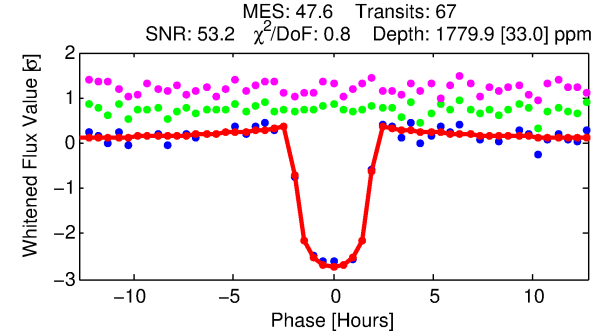
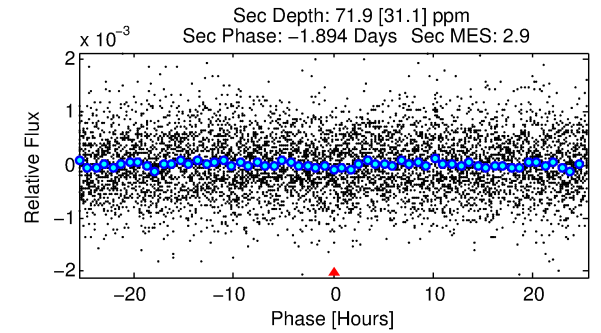
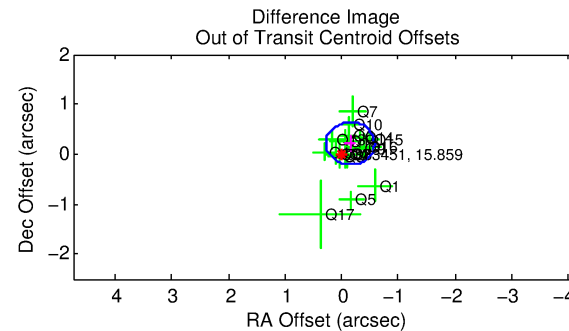
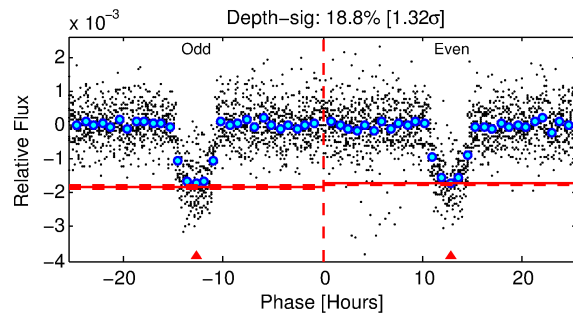
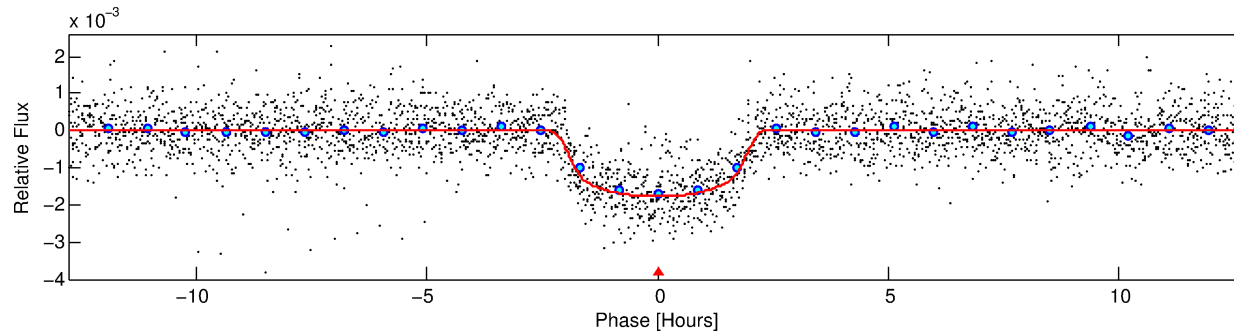
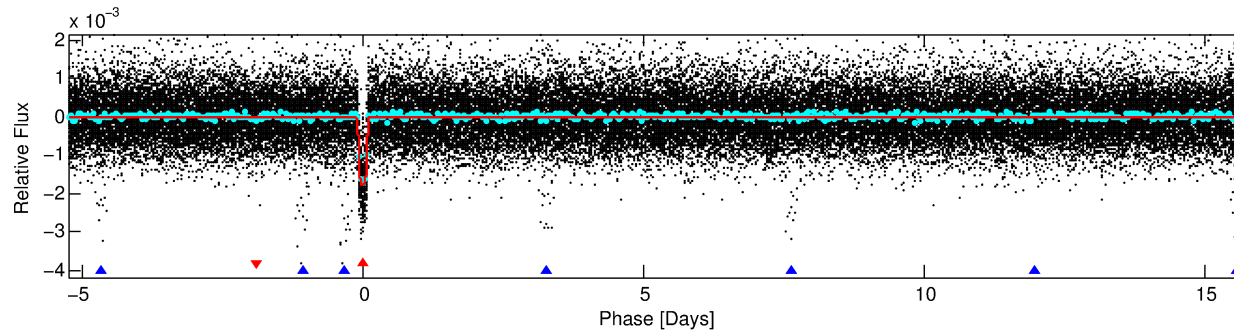
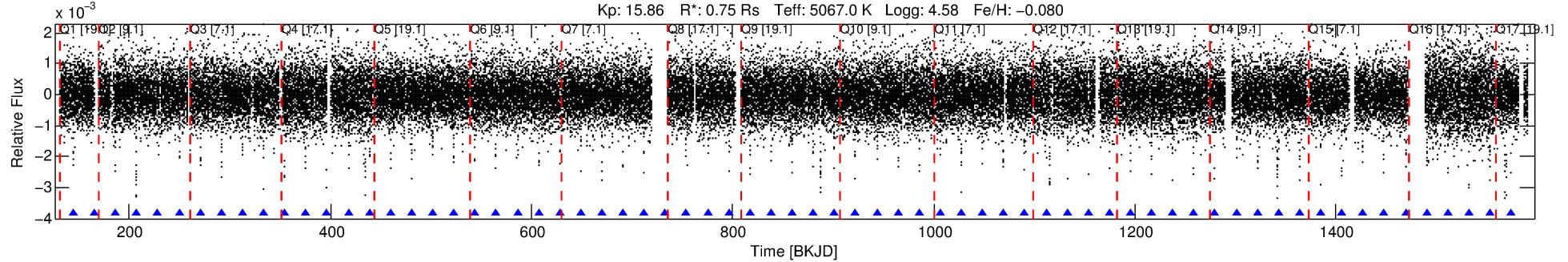
No Significant Match Found

DV One-Page Summary

KIC: 7373451 Candidate: 1 of 2 Period: 21.022 d

KOI: K00881.01 Corr: 0.980

Kp: 15.86 R*: 0.75 Rs Teff: 5067.0 K Logg: 4.58 Fe/H: -0.080



DV Fit Results:

Period = 21.02250 [0.00004] d
Epoch = 144.6092 [0.0016] BKJD
Rp/R* = 0.0412 [0.0056]
a/R* = 29.16 [14.00]
b = 0.70 [0.36]
Seff = 17.50 [2.07]
Teq = 522 [15] K
Rp = 3.37 [0.52] Re
a = 0.1378 [0.0081] AU
Ag = 65.97 [34.25] [1.90σ]
Teffp = 2298 [298] K [5.96σ]

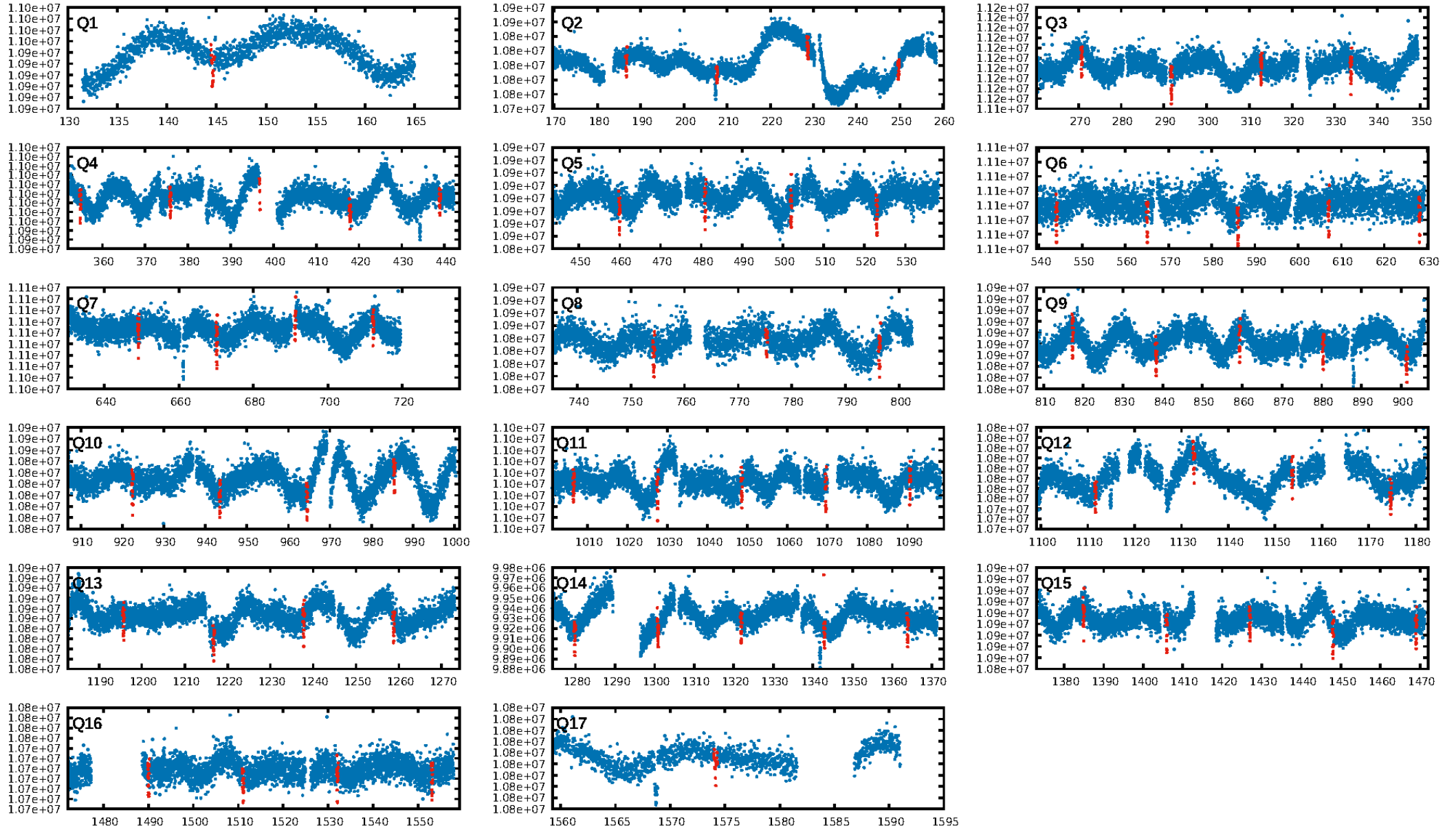
DV Diagnostic Results:

ShortPeriod-sig: N/A
LongPeriod-sig: 100.0% [578.19σ]
ModelChiSquare2-sig: 96.9%
ModelChiSquareGof-sig: 100.0%
Bootstrap-pfa: 0.00e+00
RollingBand-fgt: 1.00 [65/65]
GhostDiagnostic-chr: 5.061
Centroid-sig: 1.3%
Centroid-so: 0.360 arcsec [1.57σ]
OotOffset-rm: 0.264 arcsec [1.85σ]
OotOffset-st: 4/4/4/5 [17]
KicOffset-rm: 0.415 arcsec [3.36σ]
KicOffset-st: 4/4/4/5 [17]
DiffImageQuality-fgm: 1.00 [17/17]
DiffImageOverlap-fno: 1.00 [17/17]

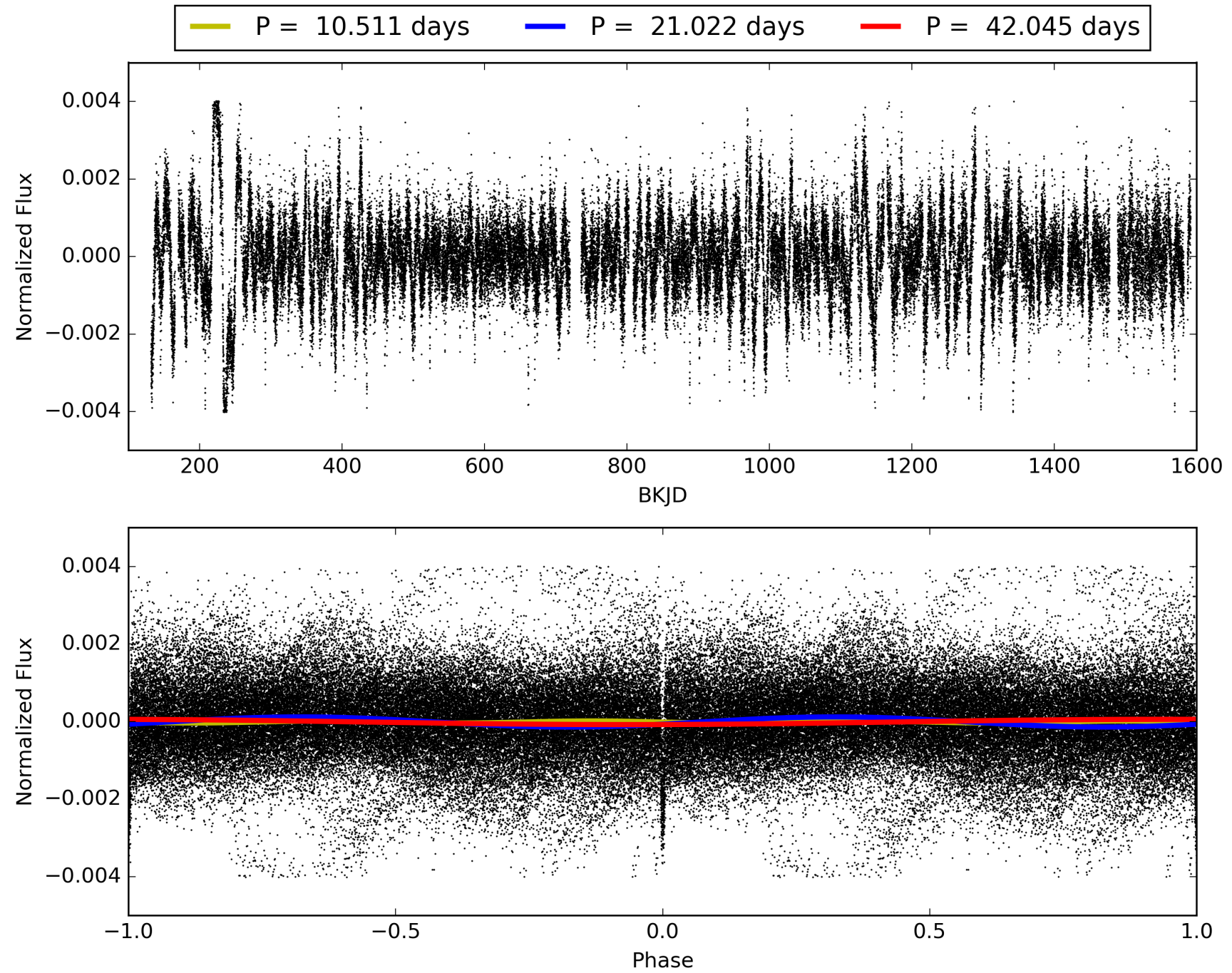
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 15:58:45 Z

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

TCE 007373451-01, PDC Light Curves

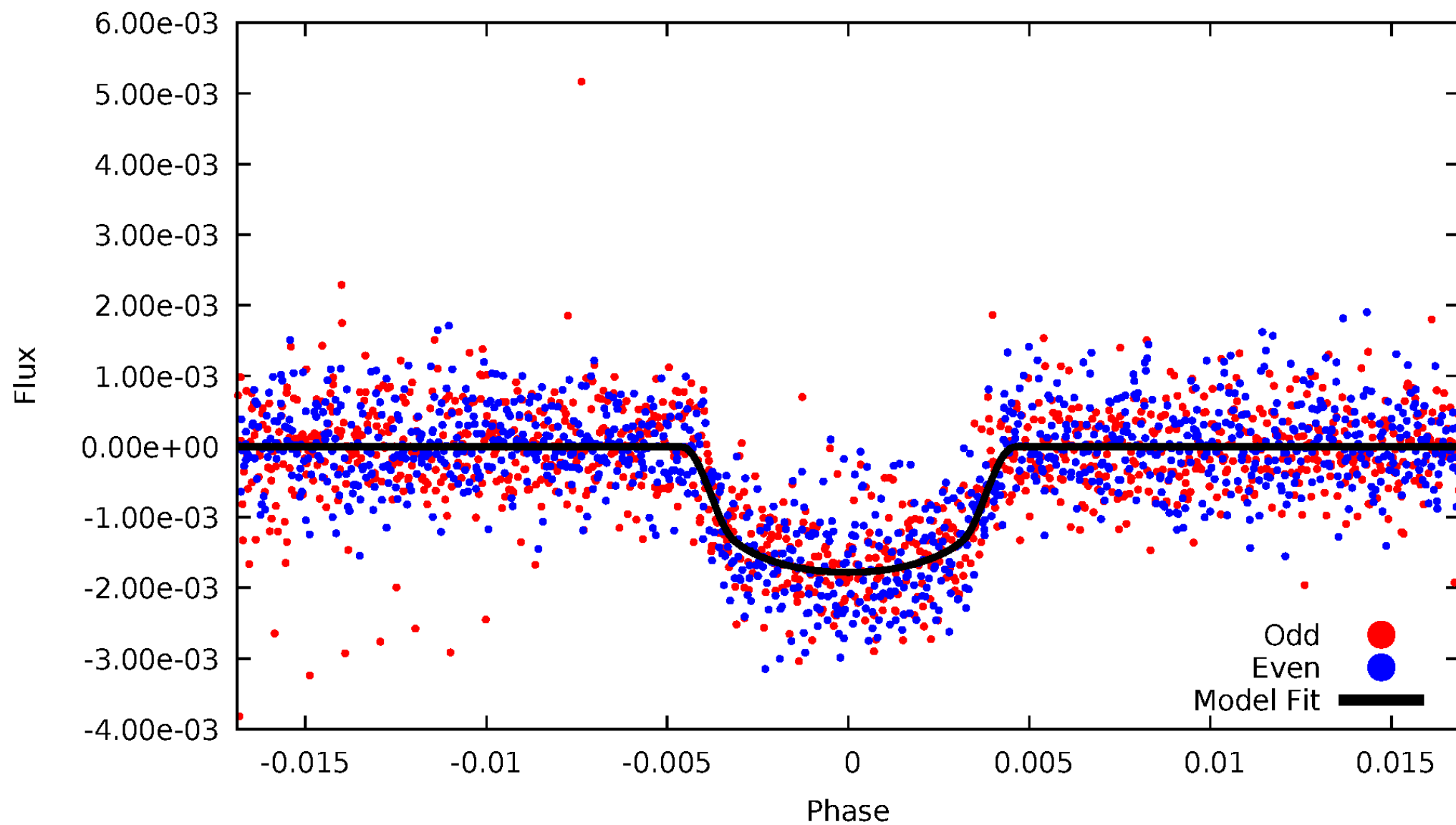


TCE 007373451-01



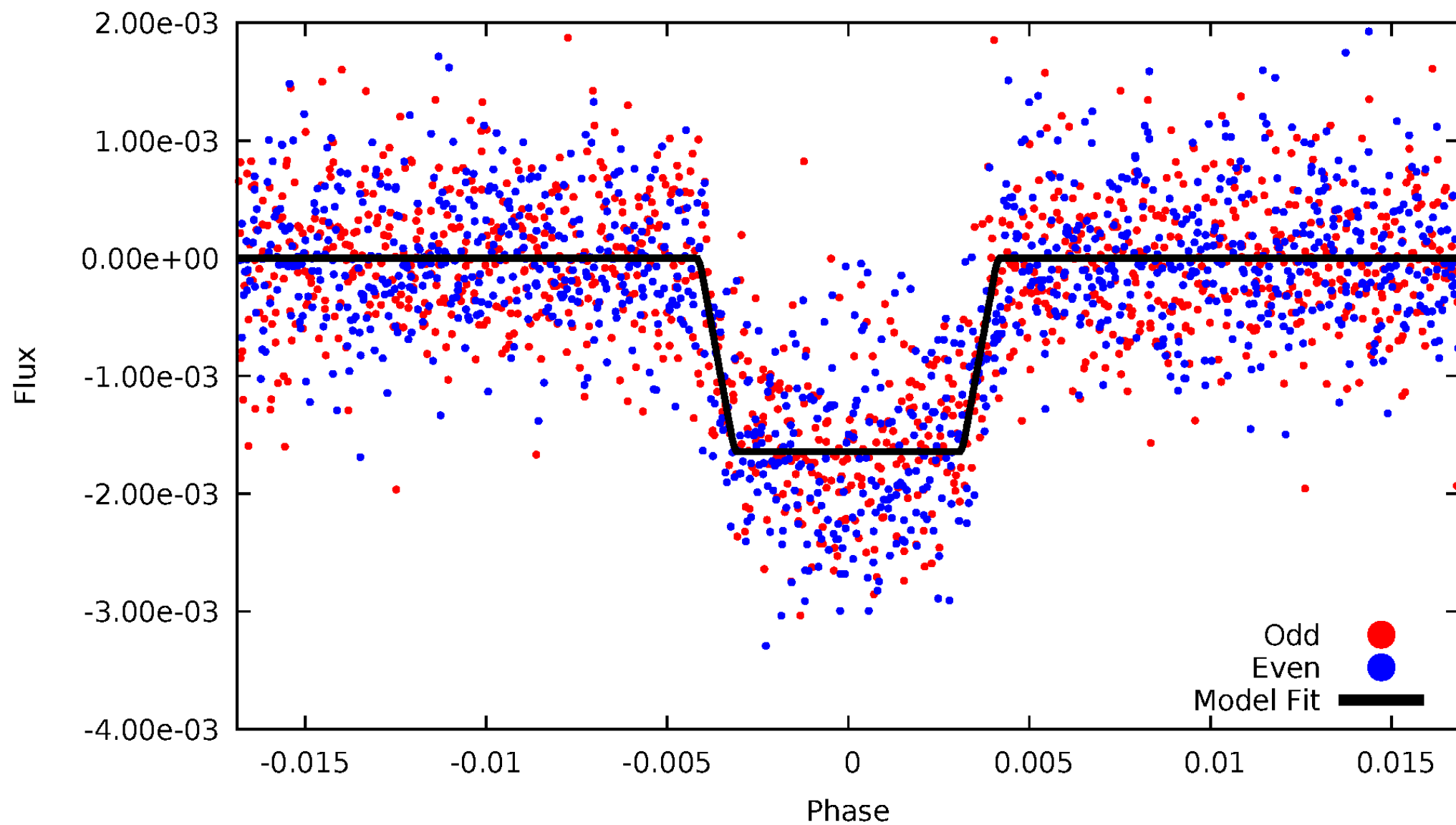
DV Odd/Even

TCE 007373451-01

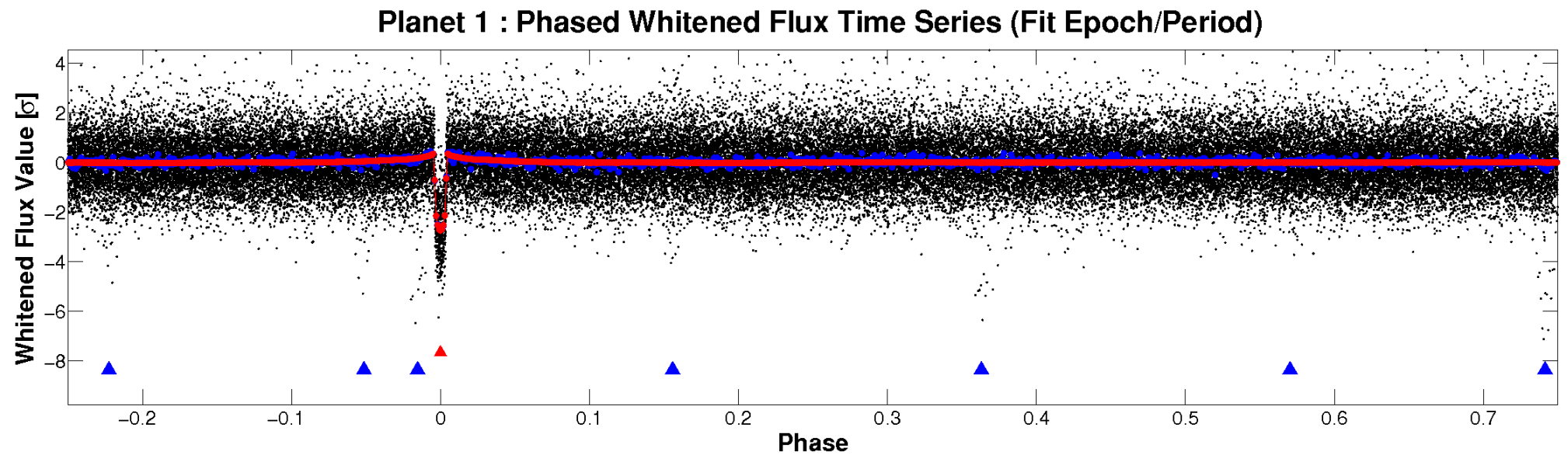
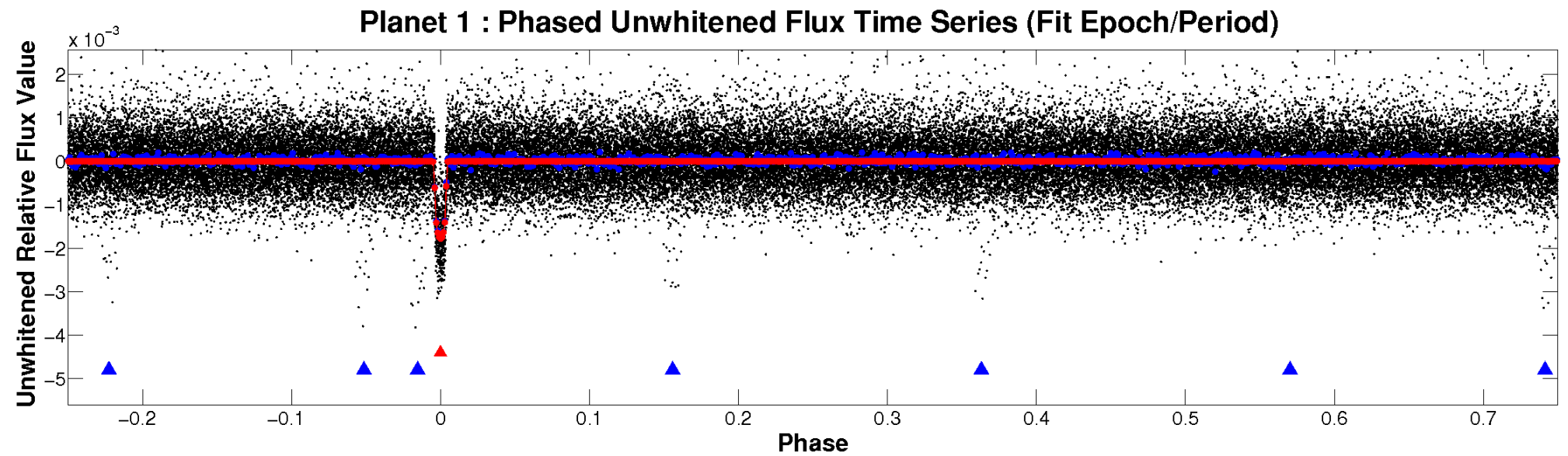


ALT Odd/Even

TCE 007373451-01

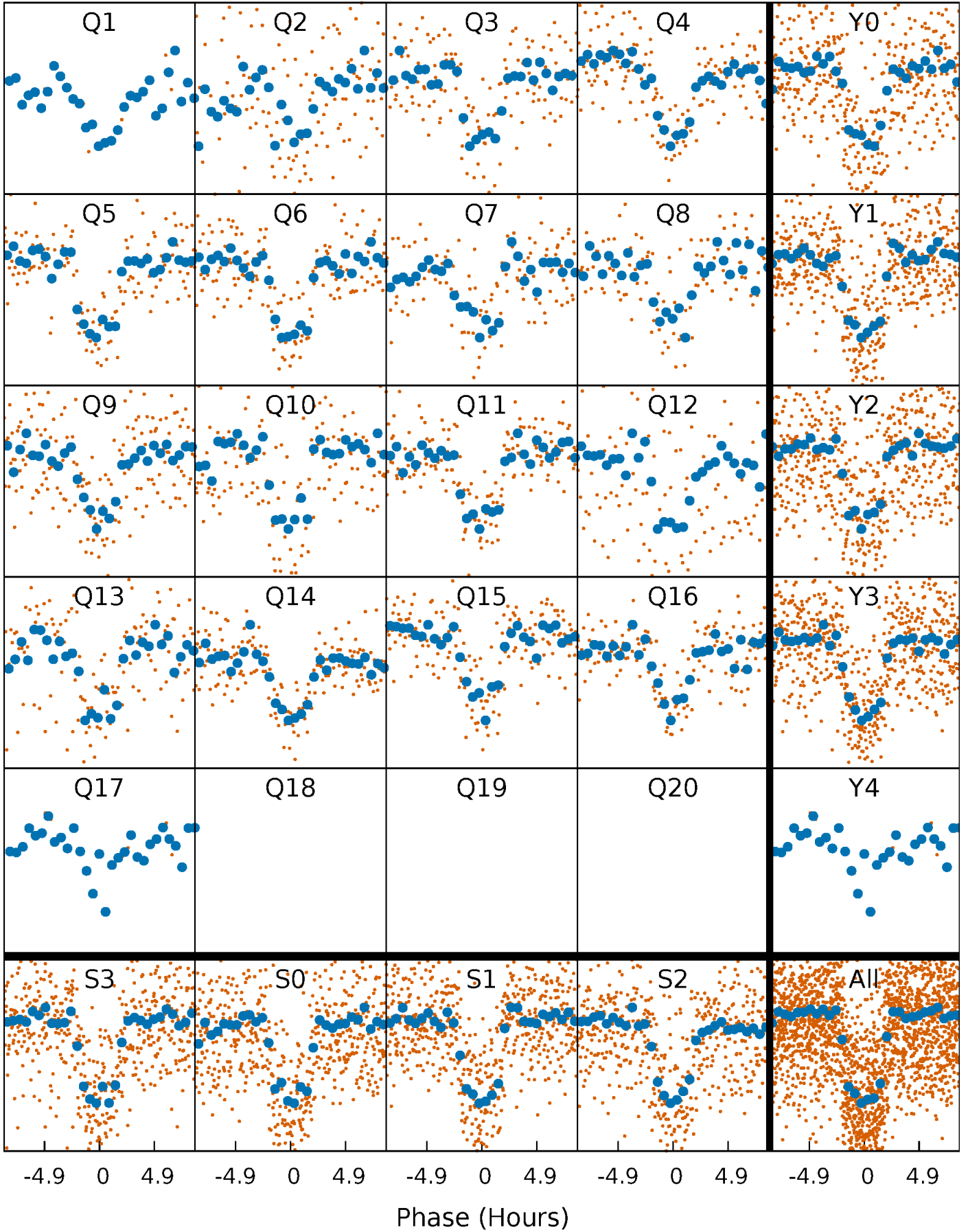


Non-Whitened Vs. Whitened Light Curve



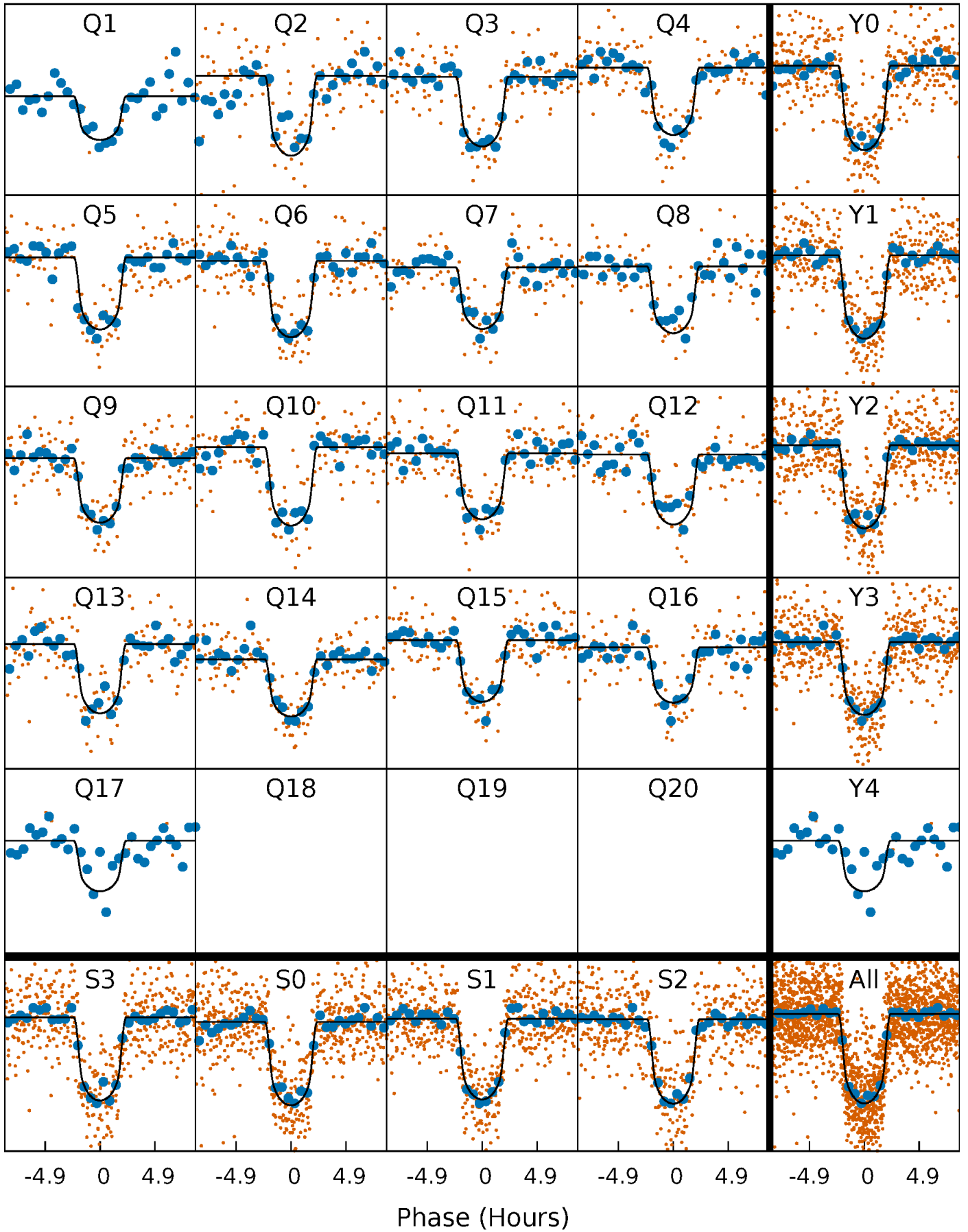
PDC Quarter-Phased Transit Curves

TCE 007373451-01 P= 21.022496 Days $T_0=144.609232$ (BKJD)



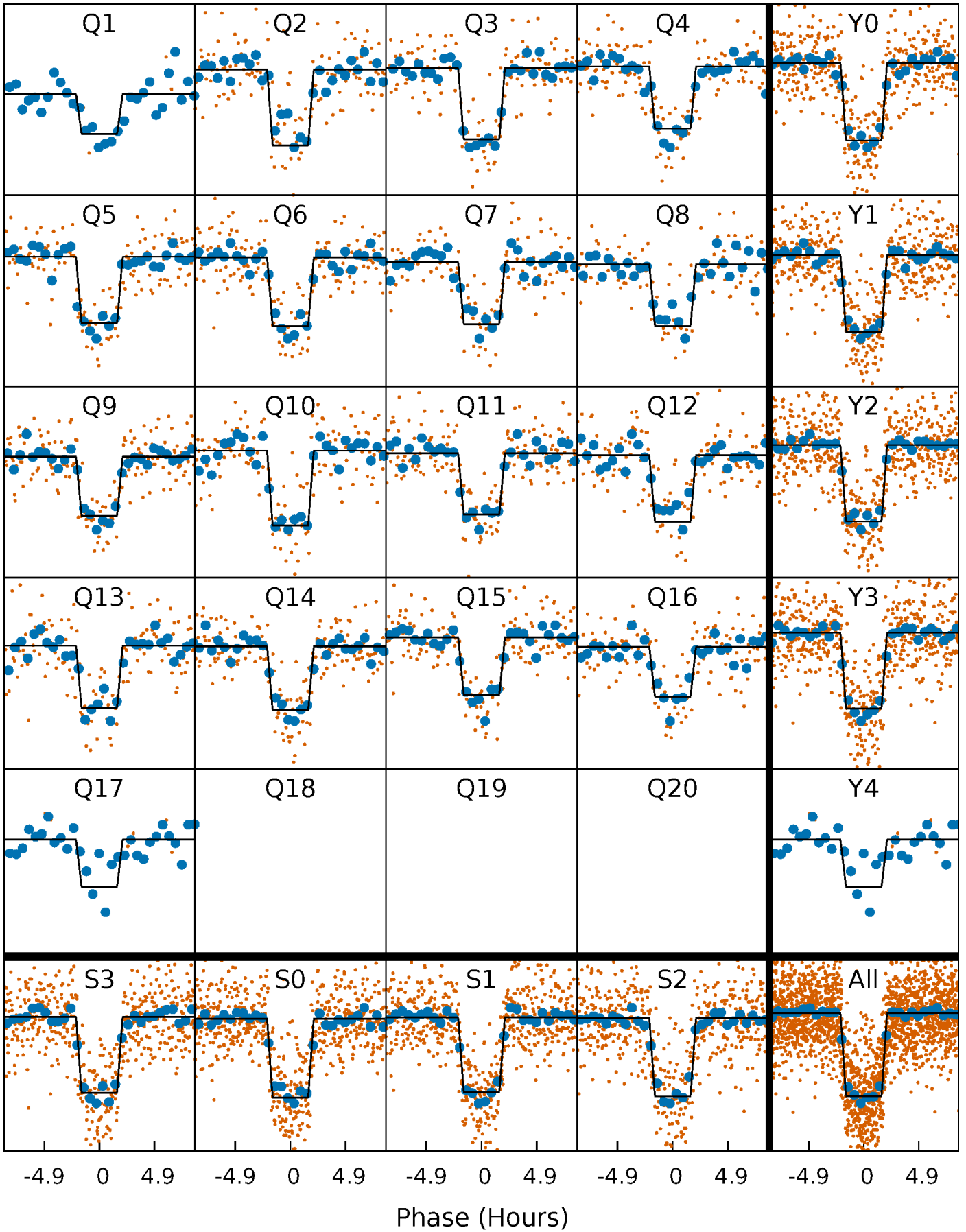
DV Quarter-Phased Transit Curves

TCE 007373451-01 P= 21.022496 Days $T_0=144.609232$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

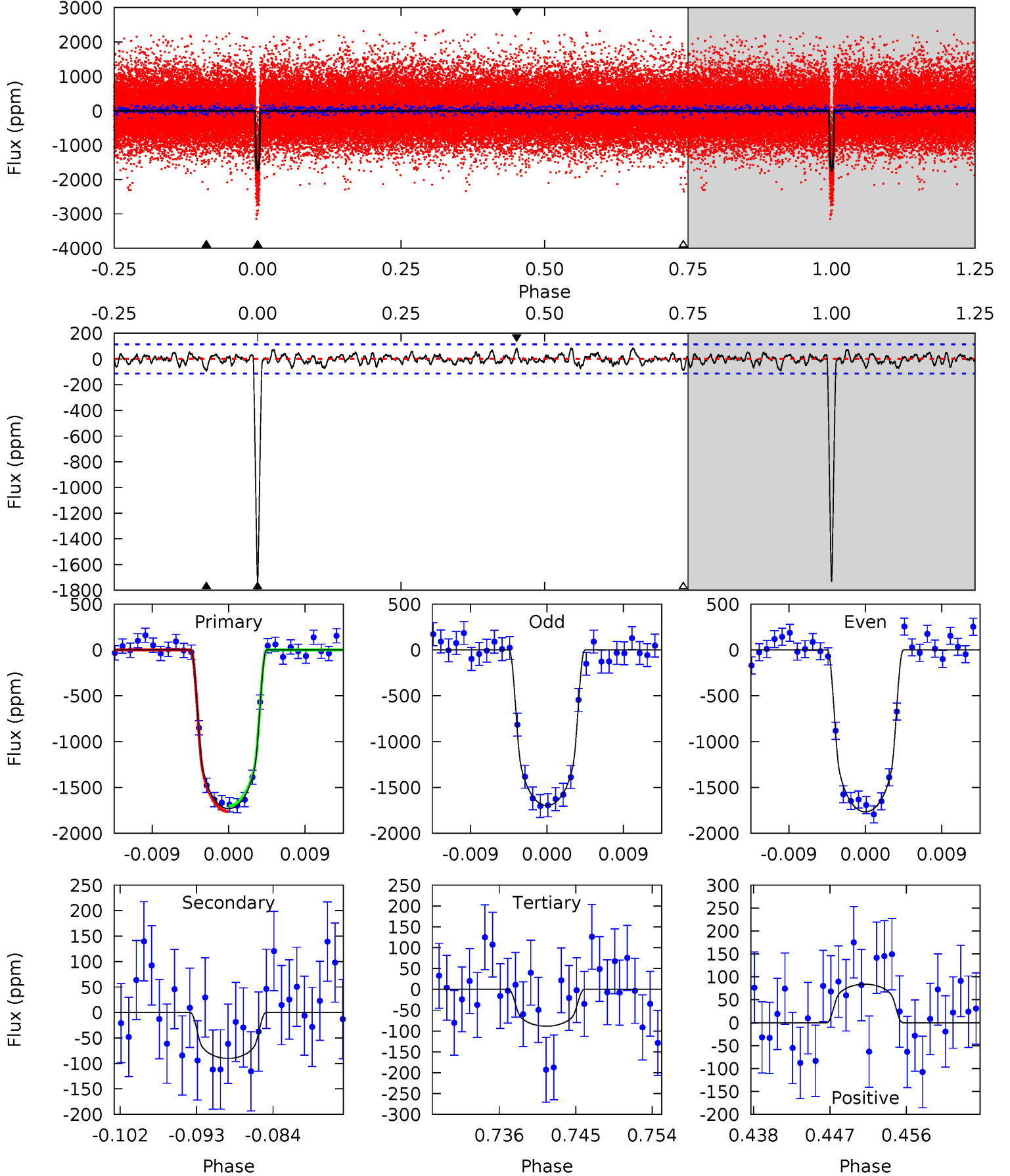
TCE 007373451-01 P= 21.022513 Days $T_0=144.608158$ (BKJD)



DV Model-Shift Uniqueness Test

007373451-01, P = 21.022496 Days, E = 123.586736 Days

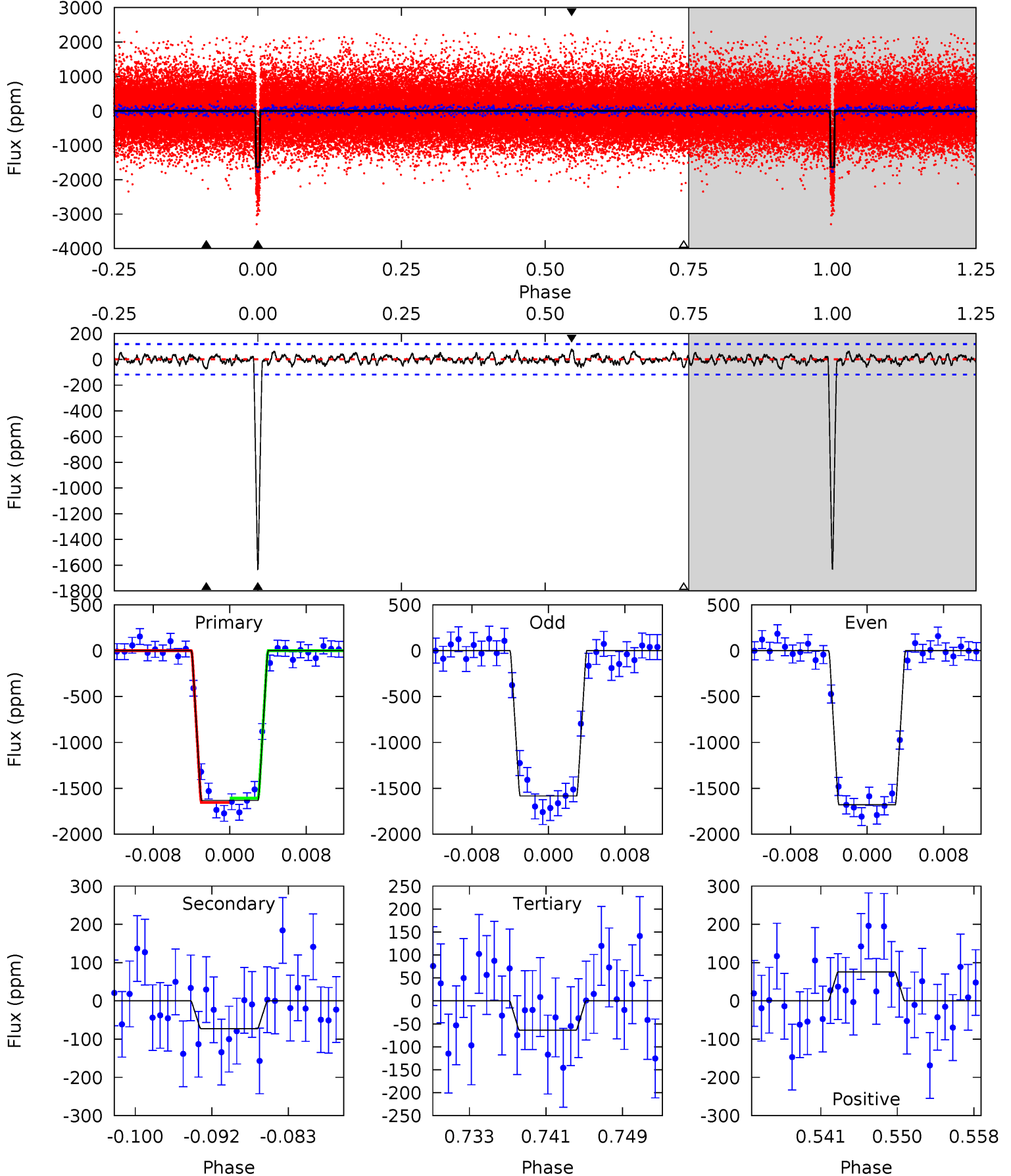
| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 76.7 | 3.99 | 3.91 | 3.72 | 5.04 | 2.60 | 1.25 | 72.8 | 73.0 | 0.08 | 0.27 | 1.53 | 1.00 | 0.05 | 1.41 |



Alt Model-Shift Uniqueness Test

007373451-01, $P = 21.022513$ Days, $E = 123.585645$ Days

| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 69.8 | 3.11 | 2.74 | 3.26 | 5.06 | 2.64 | 1.02 | 67.1 | 66.6 | 0.37 | -0.15 | 2.03 | 1.01 | 0.04 | 1.02 |



Stellar Parameters For KIC 007373451

| | $T_{\text{eff}}(K)$ | $\log(g)$ | [Fe/H] | $R (R_{\odot})$ | $M(M_{\odot})$ | $p_{\star} (\text{g}\cdot\text{cm}^{-3})$ |
|--------|----------------------|---------------------------|----------------------------|---------------------------|---------------------------|---|
| | 5067^{+102}_{-102} | $4.585^{+0.024}_{-0.048}$ | $-0.080^{+0.150}_{-0.150}$ | $0.750^{+0.052}_{-0.033}$ | $0.789^{+0.044}_{-0.044}$ | $2.633^{+0.269}_{-0.435}$ |
| | +2%/-2% | +1%/-1% | +188%/-188% | +7%/-4% | +6%/-6% | +10%/-17% |
| Source | SPE58 | SPE58 | SPE58 | DSEP | | |

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

Secondary Eclipse Parameters for KIC 007373451-01 / KOI 0881.01

| Detrend | Depth (ppm) | $R_p (R_{\oplus})$ | $T_{max} (K)$ | $T_{obs} (K)$ | A_{obs} |
|---------|--------------|------------------------|-------------------|----------------------|------------------|
| DV | -90 ± 23 | $3.43^{+0.46}_{-0.48}$ | 733^{+17}_{-17} | 3038^{+173}_{-171} | 80^{+35}_{-27} |
| Alt. | -73 ± 23 | $3.35^{+0.47}_{-0.44}$ | 731^{+18}_{-16} | 2975^{+162}_{-188} | 69^{+32}_{-25} |

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 $A_{obs} \gg 1.0$

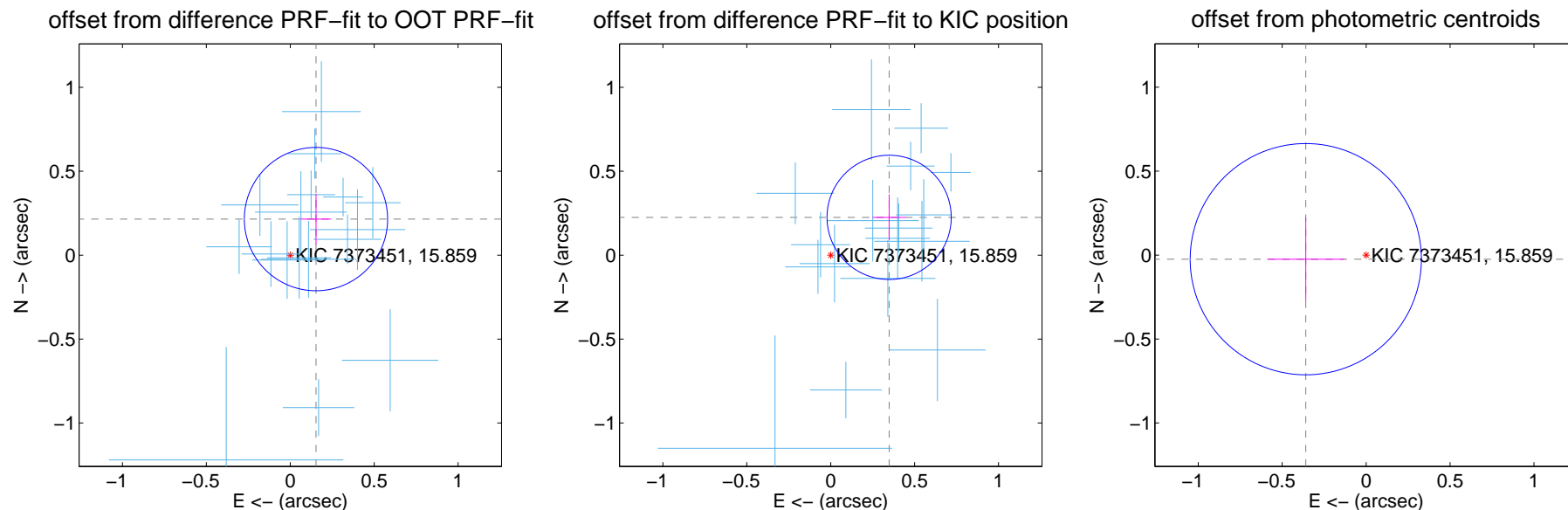
DV Centroid Data

Supplemental centroid analysis for 007373451-01. Kepler magnitude: 15.86. Transit SNR 53.21

There are 17 quarters with good PRF difference image offsets

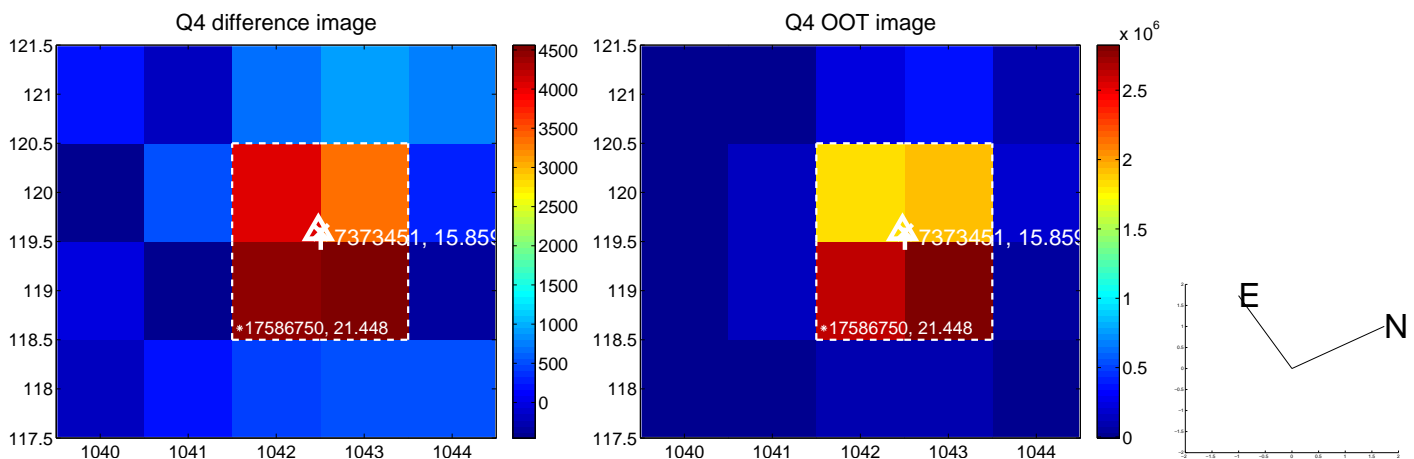
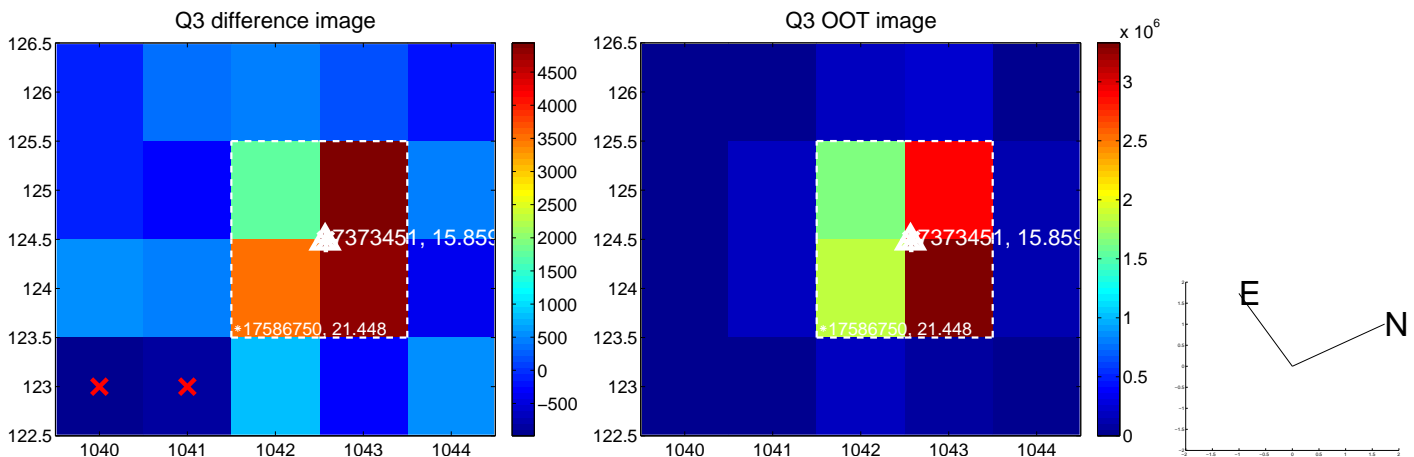
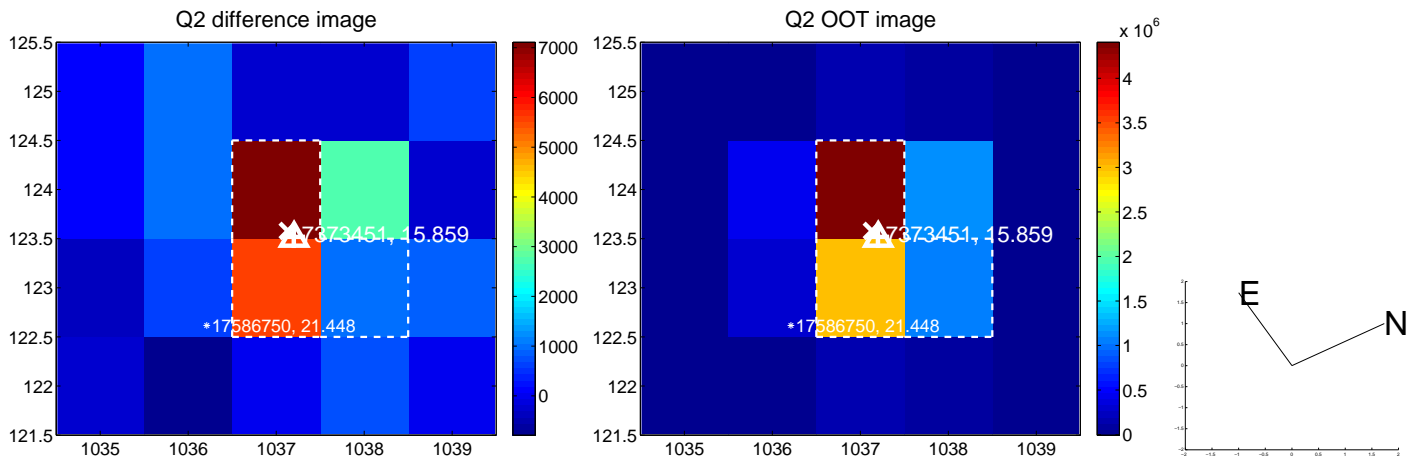
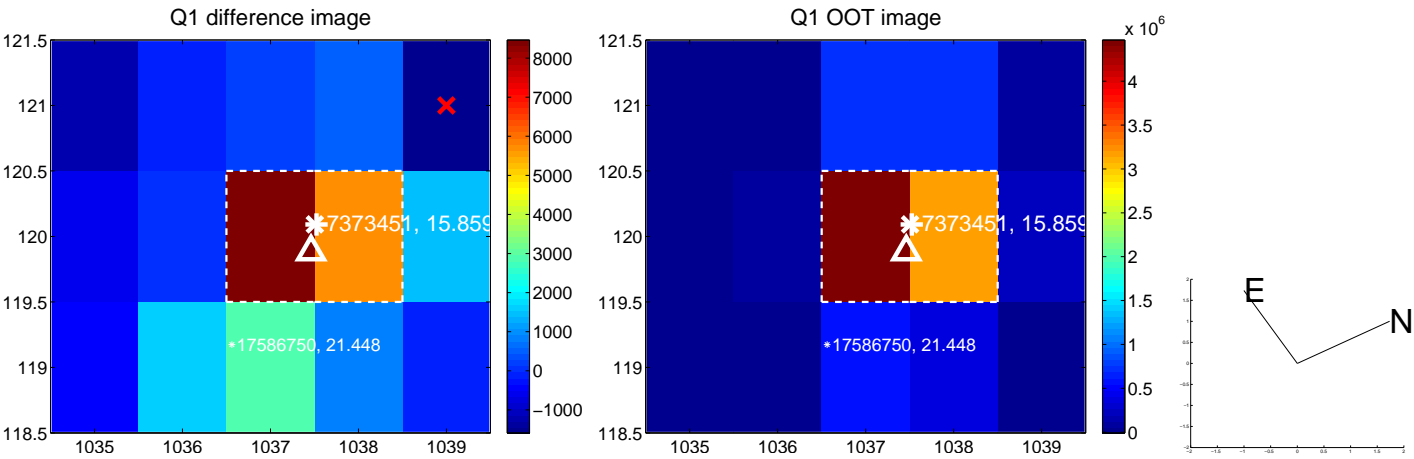
The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

| | Distance in arcsec | Distance / σ | Δ RA | Δ Dec |
|---|-------------------------------------|---------------------|--------------------|-------------------|
| PRF-fit source offset from OOT | 0.264 ± 0.142 | 1.85 | -0.153 ± 0.091 | 0.215 ± 0.150 |
| PRF-fit source offset from KIC position | 0.415 ± 0.123 | 3.36 | -0.348 ± 0.099 | 0.225 ± 0.137 |
| photometric centroid source offset | 0.36 ± 0.23 | 1.57 | 0.36 ± 0.23 | -0.02 ± 0.25 |

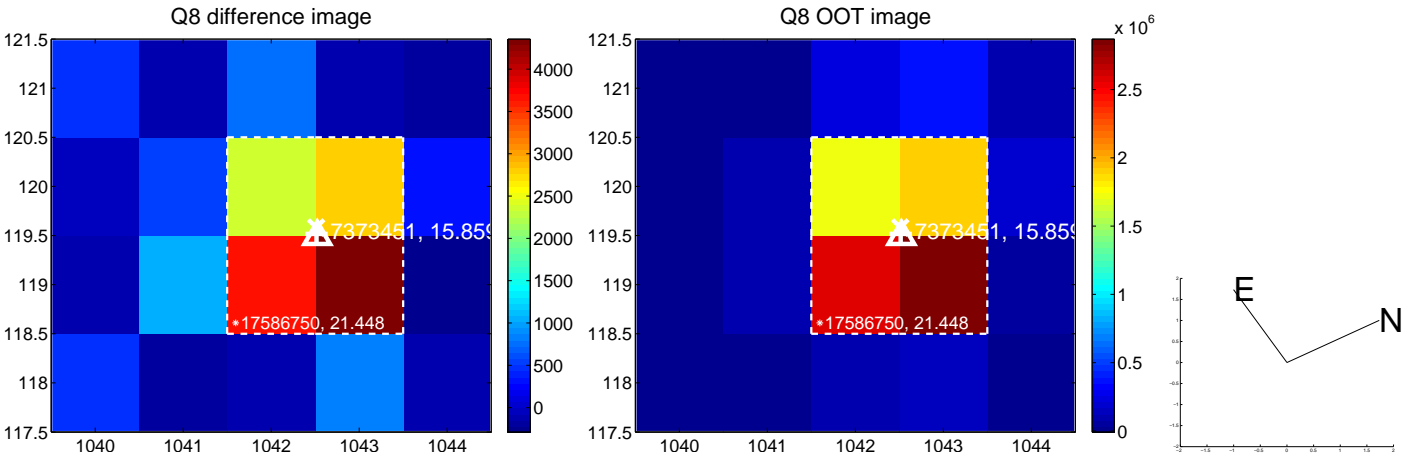
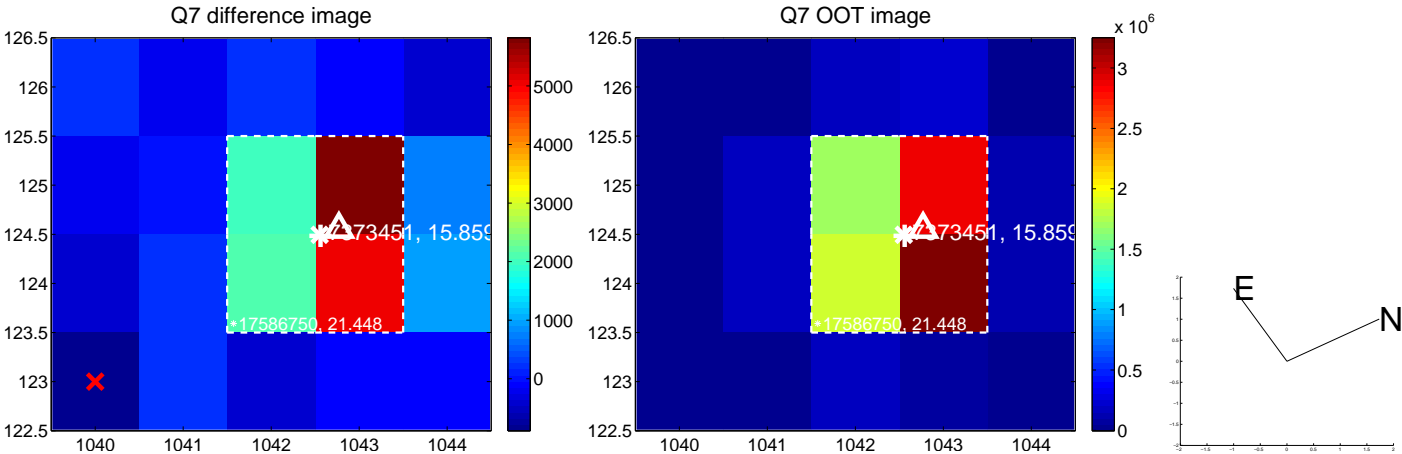
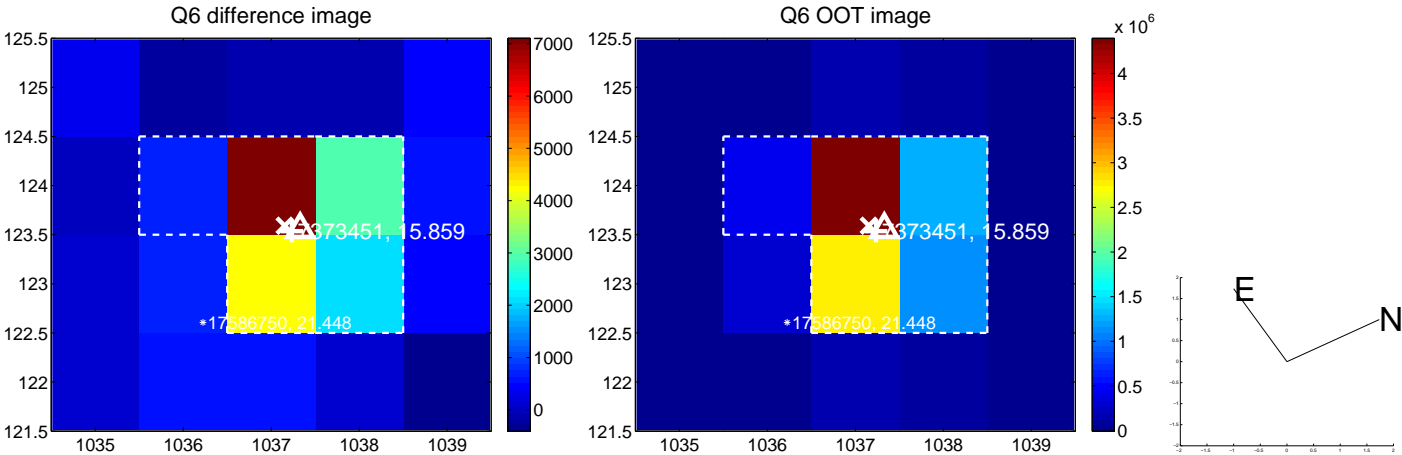
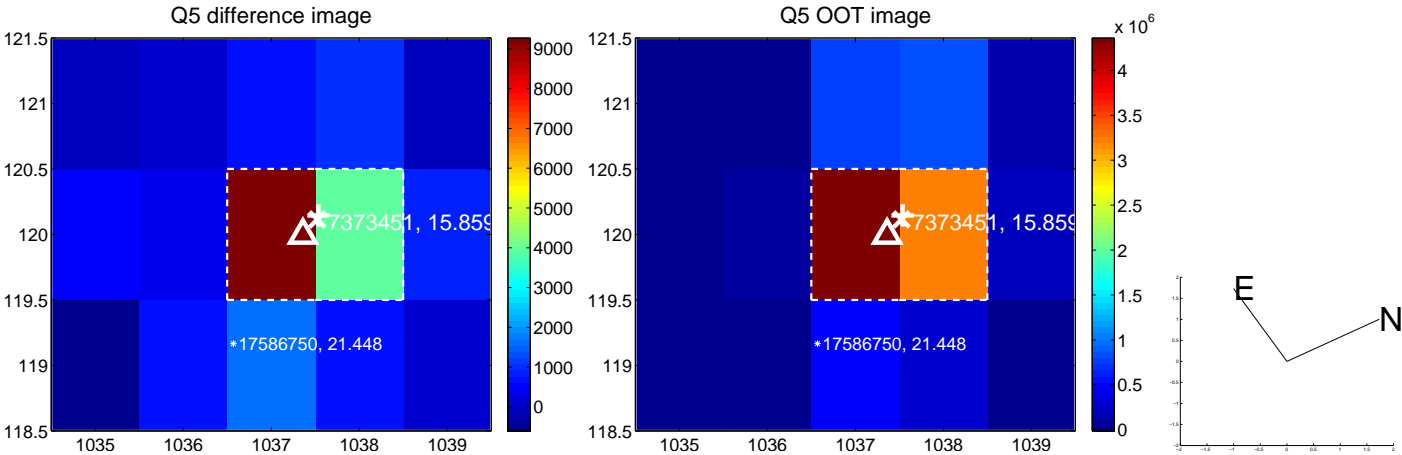


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets**; **Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- σ uncertainty. Blue circle: three-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

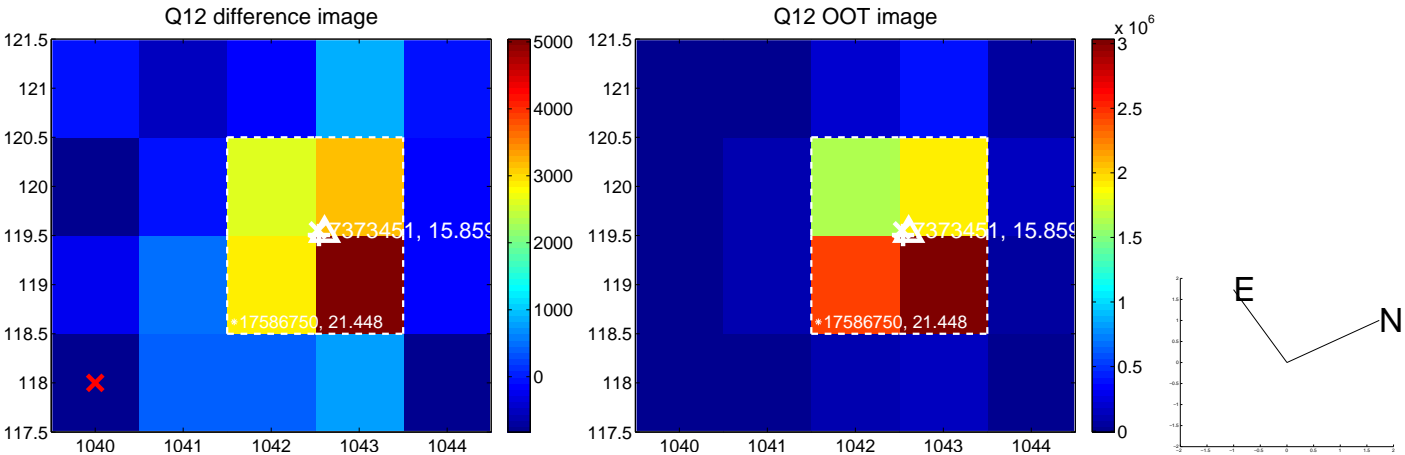
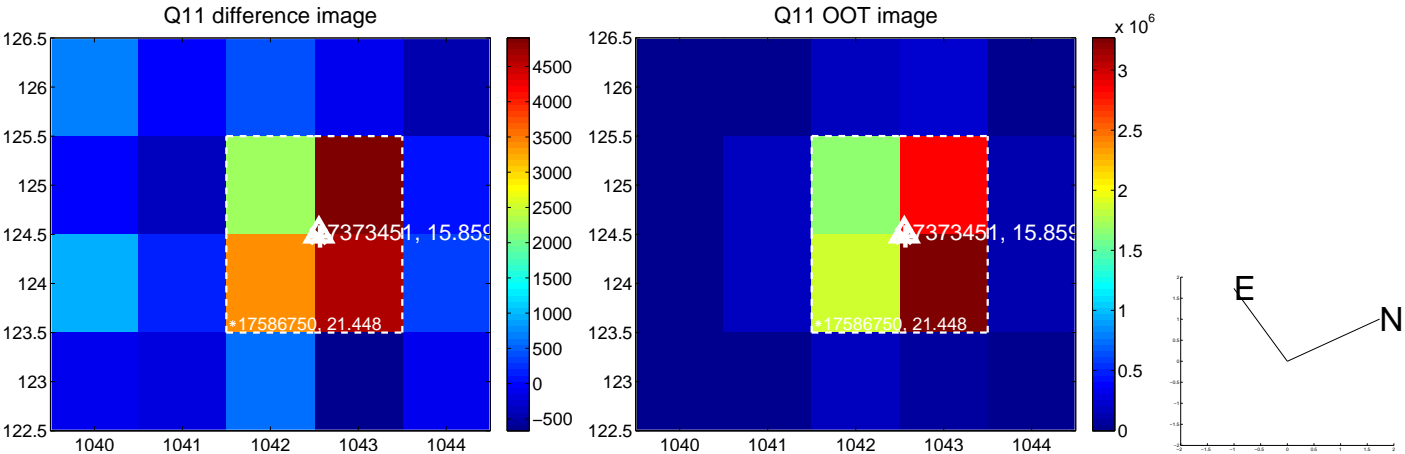
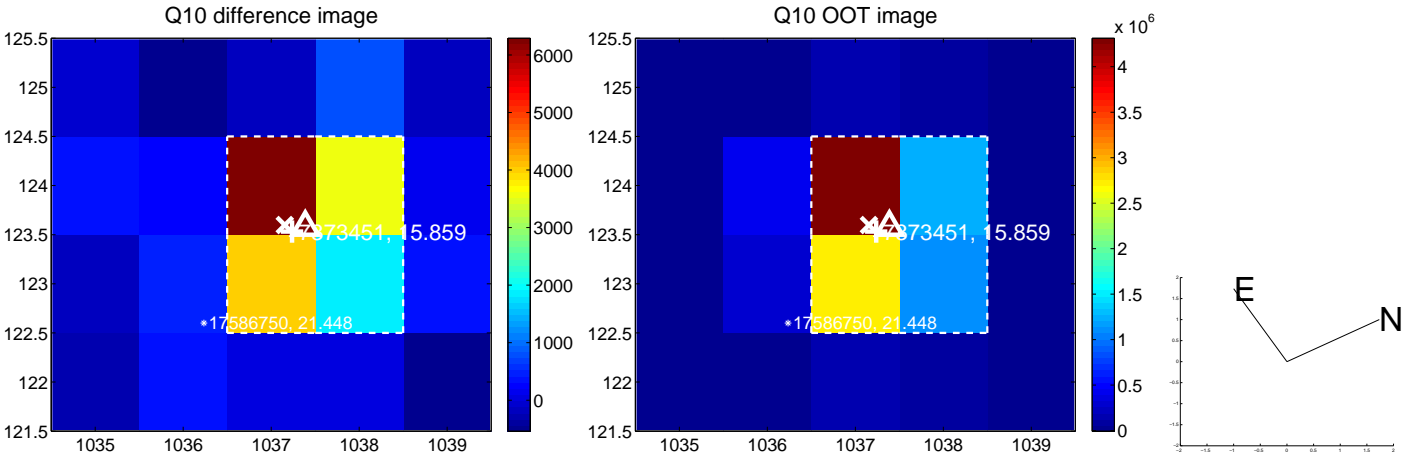
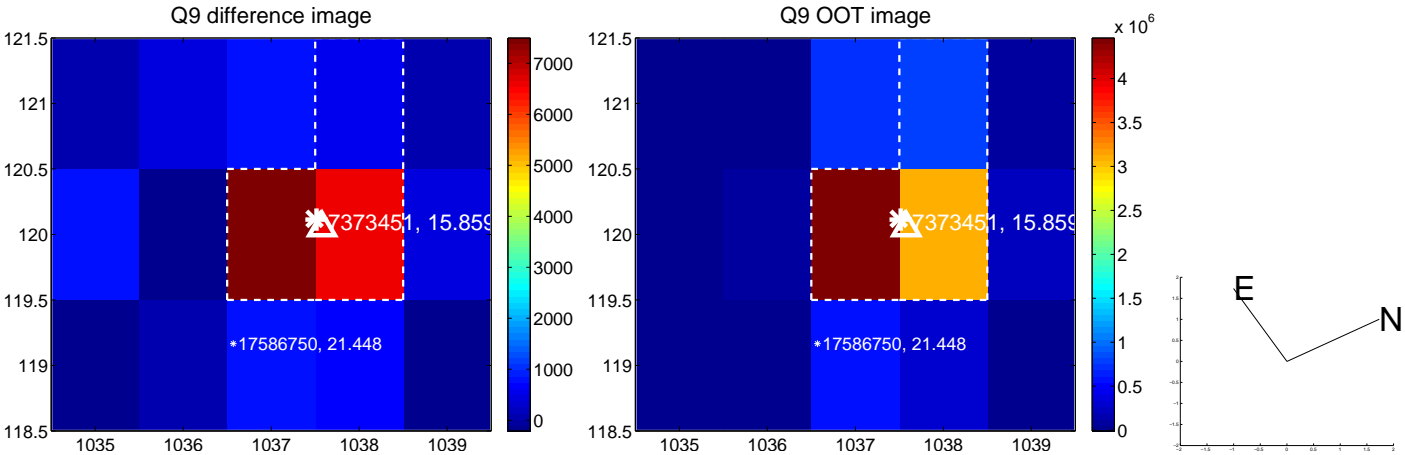
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



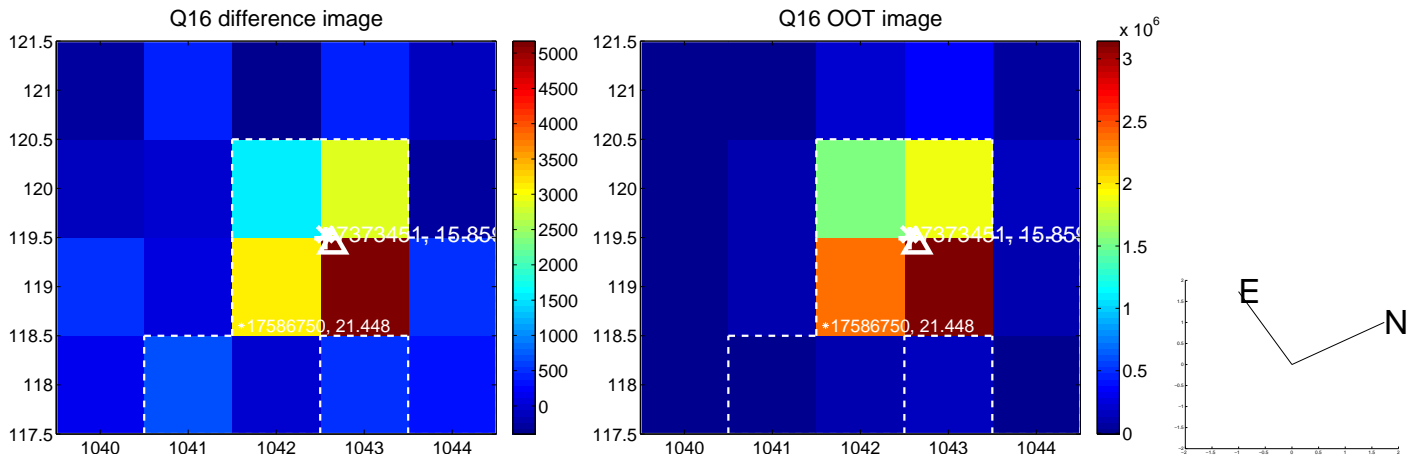
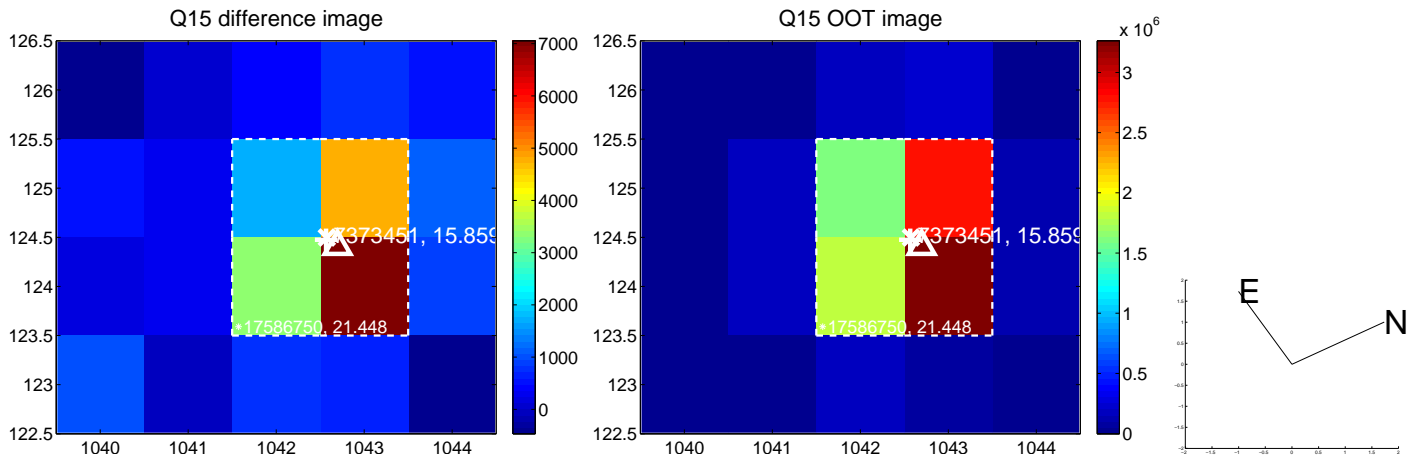
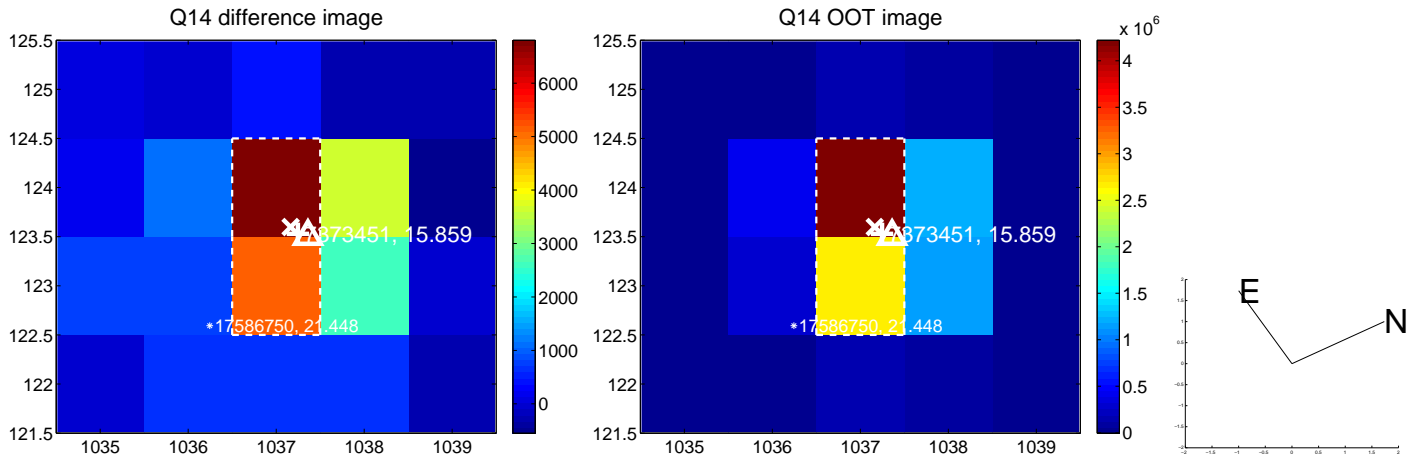
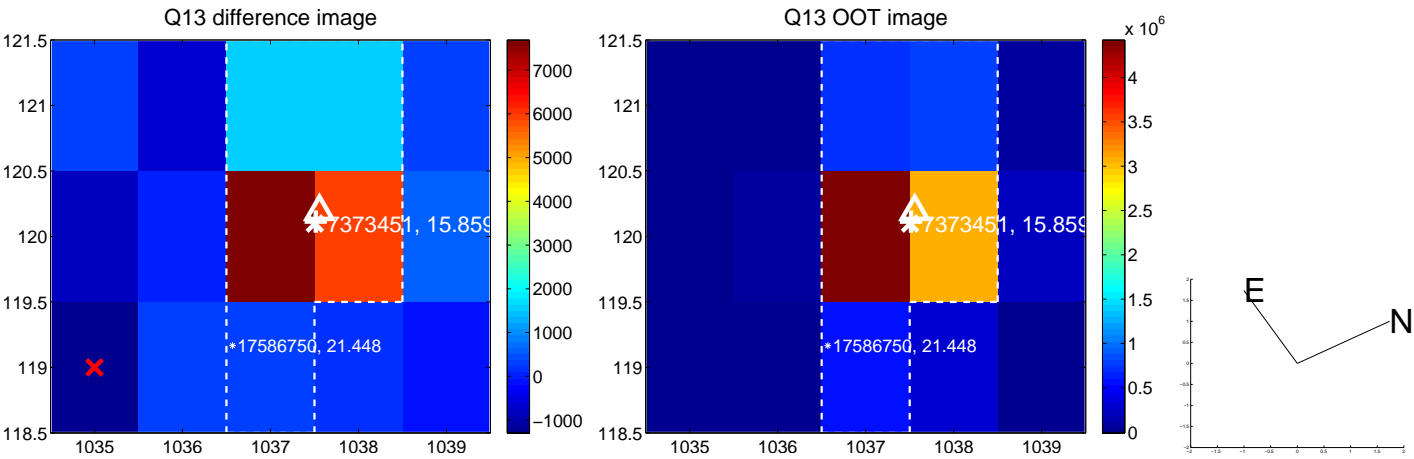
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



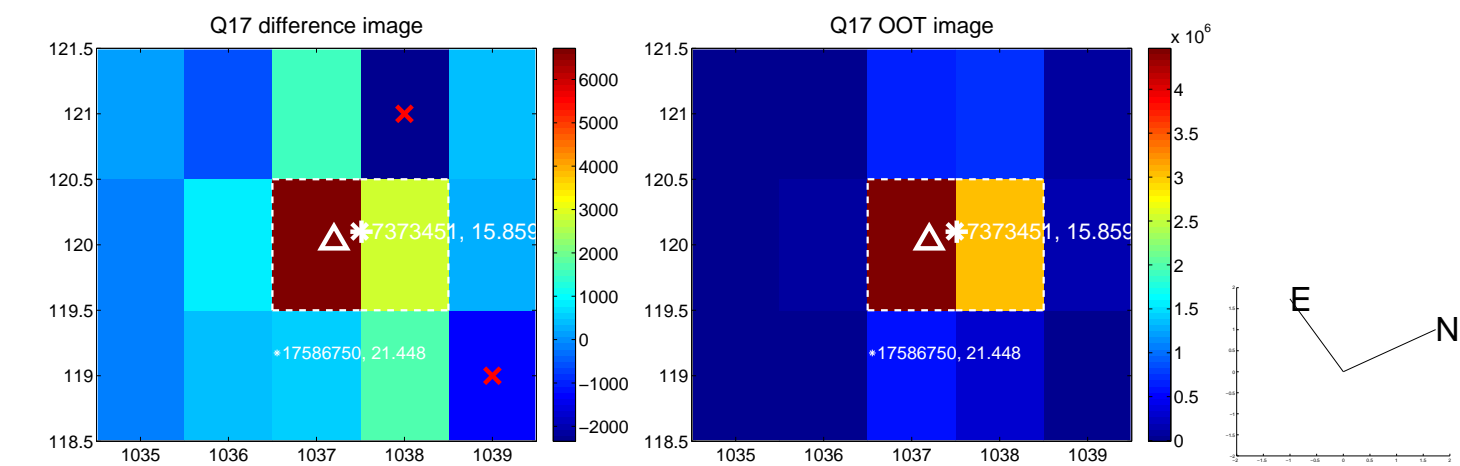
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



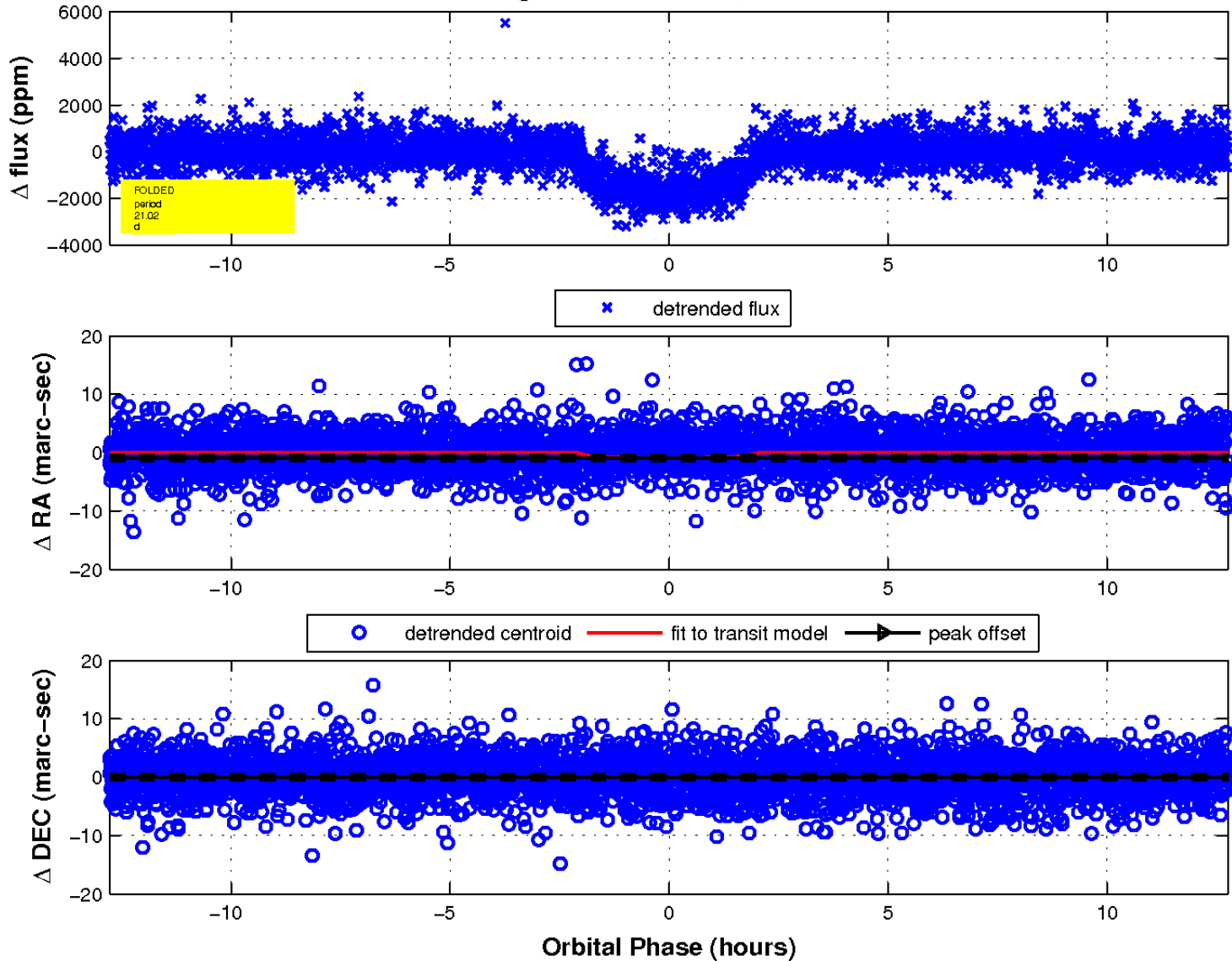
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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

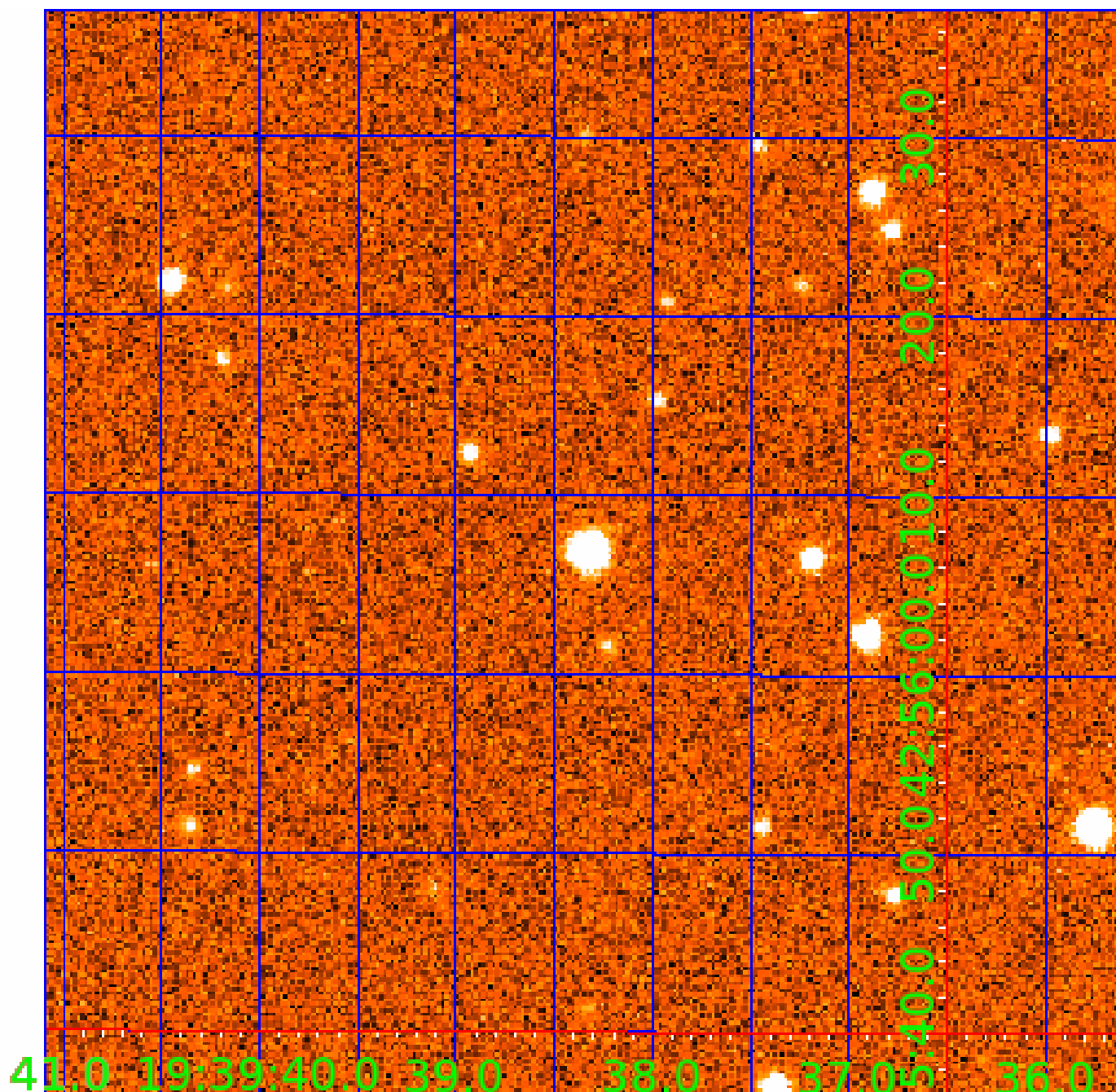


fluxWeightedCentroids, Planet 1 of 2



UKIRT Image

Declination



KIC 007373451

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}) |
|--------------|----------|---------|---------------|--------------|-------------|------------------|------|------|-----------------------------|-----------------|------------------------|------------------------|
| 007373451-01 | OBS | 0881.01 | 21.022496 | 144.609232 | 1779.9 | 4.260 | 47.6 | 53.2 | 0.75 | 5067 | 3.37 | 17.50 |
| 007373451-02 | OBS | 0881.02 | 226.891542 | 207.354457 | 2965.6 | 7.408 | 32.1 | 35.6 | 0.75 | 5067 | 4.41 | 0.73 |

Robovetter Results

| TCE | Run Type | Disp | Score | N | S | C | E | Comments |
|--------------|----------|------|-------|---|---|---|---|------------|
| 007373451-01 | OBS | PC | 1.00 | 0 | 0 | 0 | 0 | NO_COMMENT |
| 007373451-02 | OBS | PC | 1.00 | 0 | 0 | 0 | 0 | NO_COMMENT |

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.

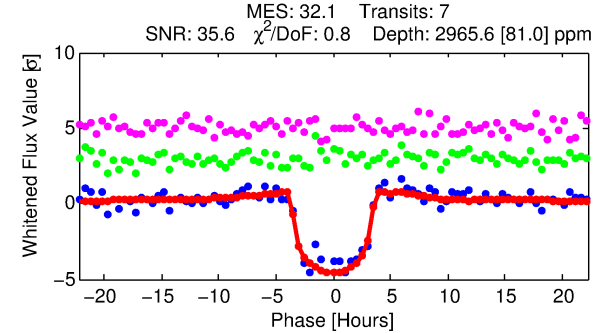
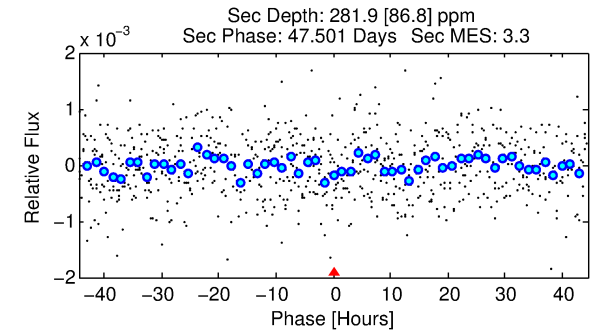
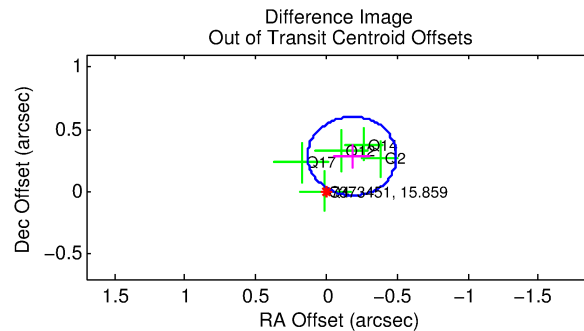
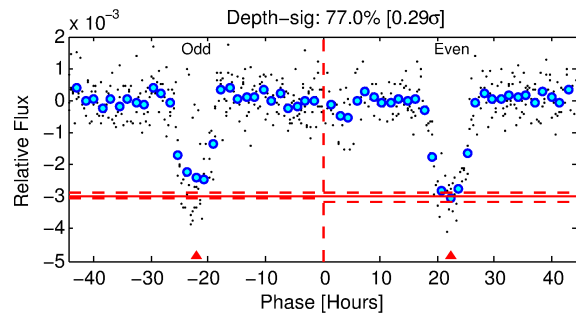
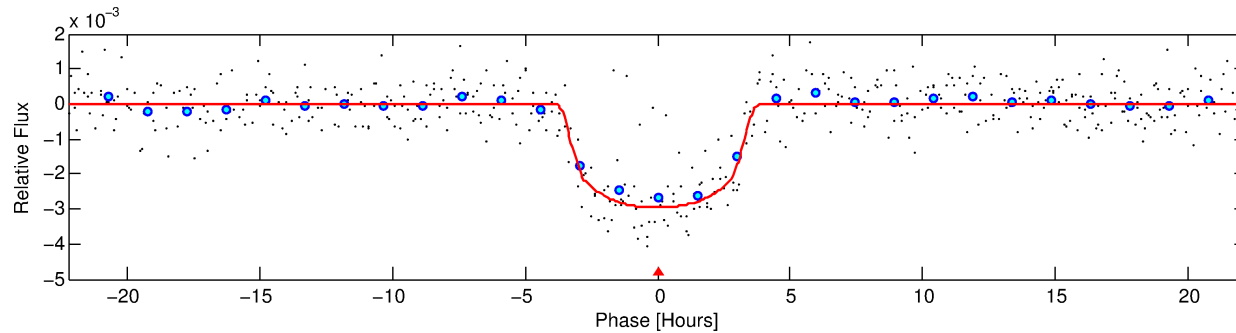
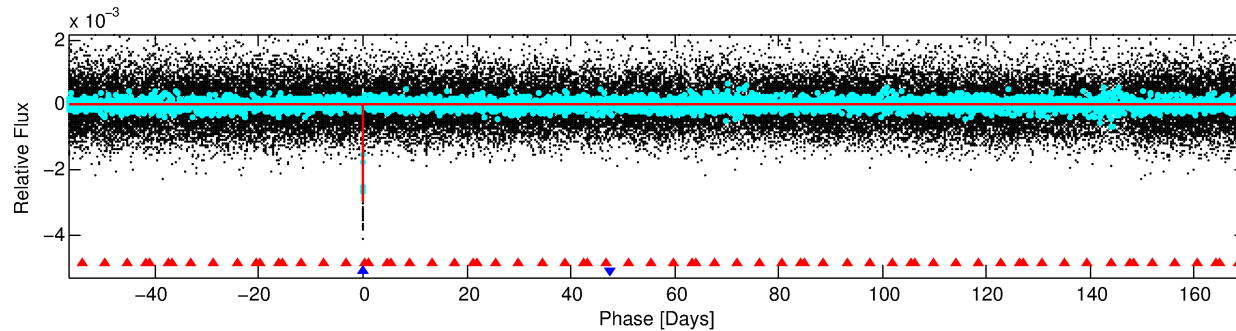
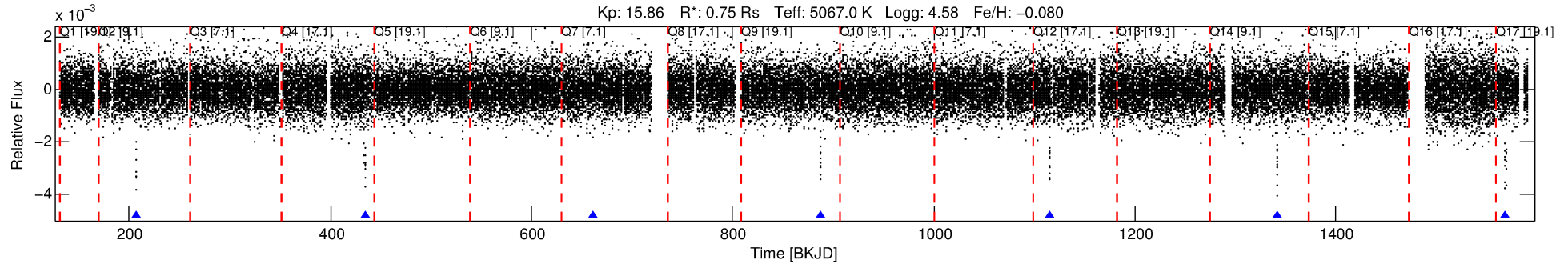
Ephemeris Match Information For 007373451-02

No Significant Match Found

DV One-Page Summary

KIC: 7373451 Candidate: 2 of 2 Period: 226.892 d

KOI: K00881.02 Corr: 0.990



DV Fit Results:

Period = 226.89154 [0.00103] d
Epoch = 207.3545 [0.0039] BKJD
Rp/R* = 0.0539 [0.0041]
a/R* = 177.76 [45.97]
b = 0.73 [0.17]
Seff = 0.73 [0.09]
Teq = 236 [7] K
Rp = 4.41 [0.45] Re
a = 0.6729 [0.0398] AU
Ag = 3606.84 [1277.25] [2.82 σ]
Teffp = 2828 [249] K [10.39 σ]

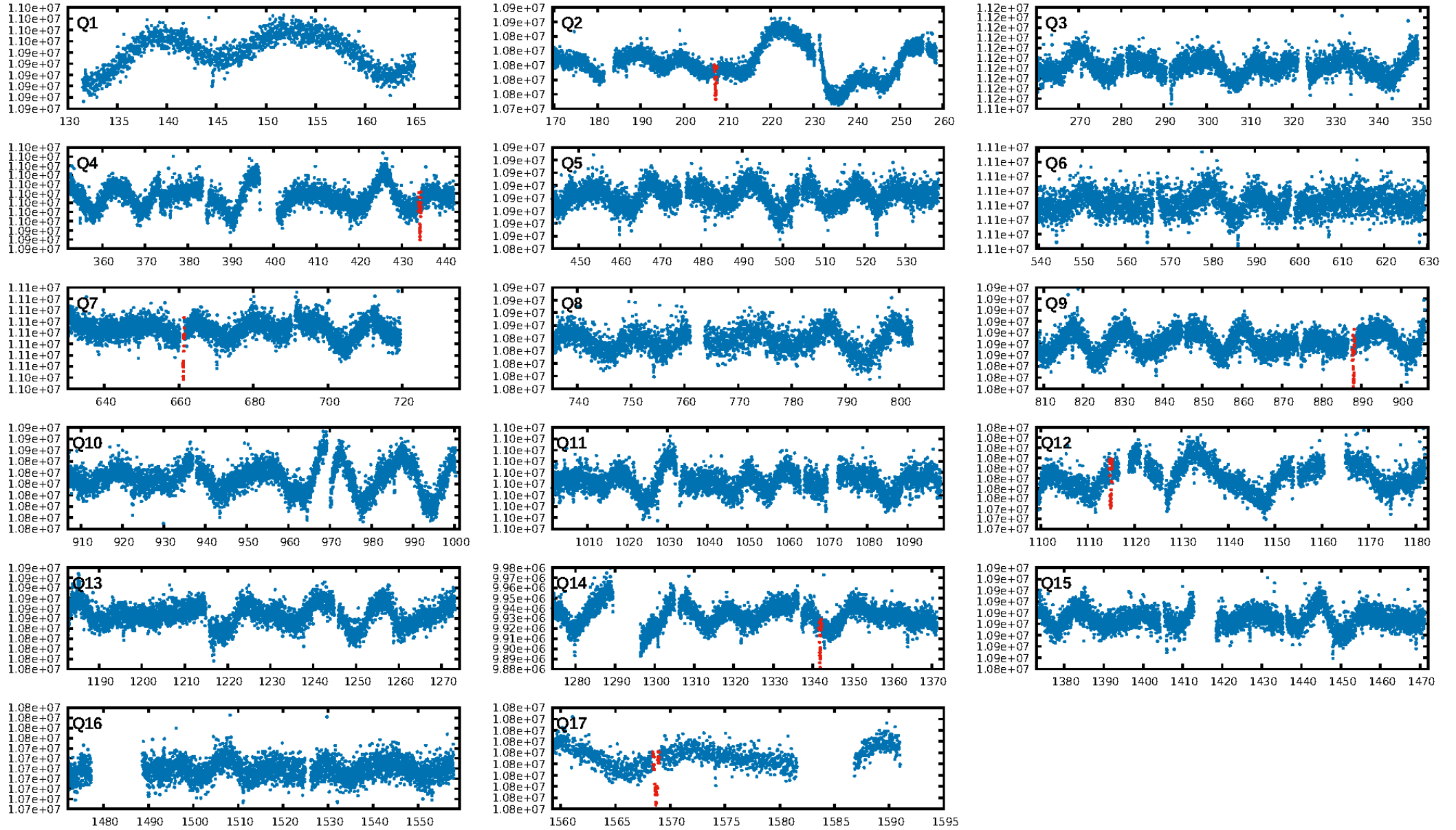
DV Diagnostic Results:

ShortPeriod-sig: 100.0% [578.19 σ]
LongPeriod-sig: N/A
ModelChiSquare2-sig: 15.3%
ModelChiSquareGof-sig: 100.0%
Bootstrap-pfa: 4.48e-113
RollingBand-fgt: 1.00 [6/6]
GhostDiagnostic-chr: 2.704
Centroid-sig: 63.1%
Centroid-so: 0.067 arcsec [0.21 σ]
OotOffset-rm: 0.337 arcsec [3.21 σ]
KicOffset-rm: 0.593 arcsec [3.74 σ]
OotOffset-st: 2/0/2/1 [5]
KicOffset-st: 2/0/2/1 [5]
DiffImageQuality-fgm: 1.00 [5/5]
DiffImageOverlap-fno: 0.80 [4/5]

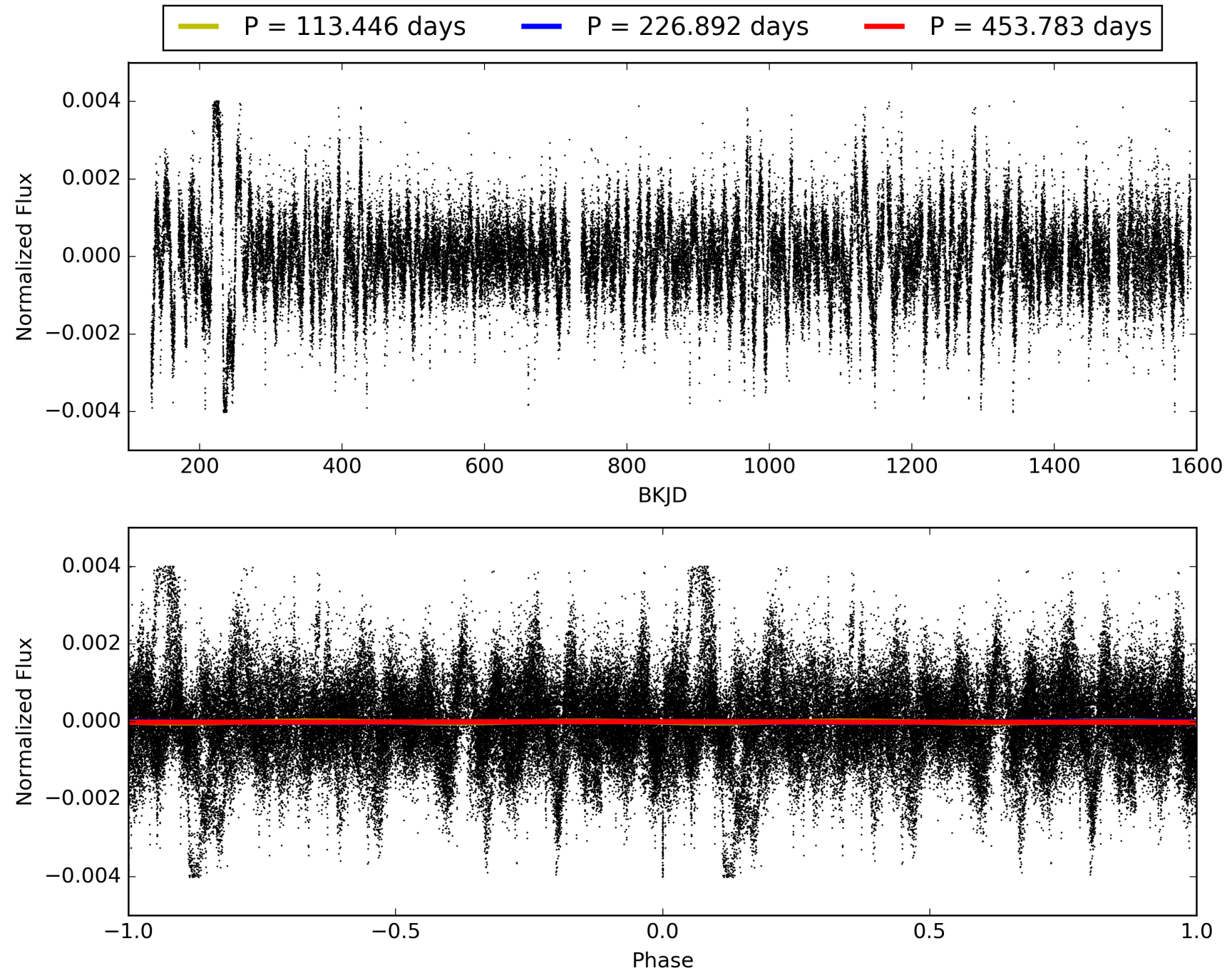
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 15:58:54 Z

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

TCE 007373451-02, PDC Light Curves

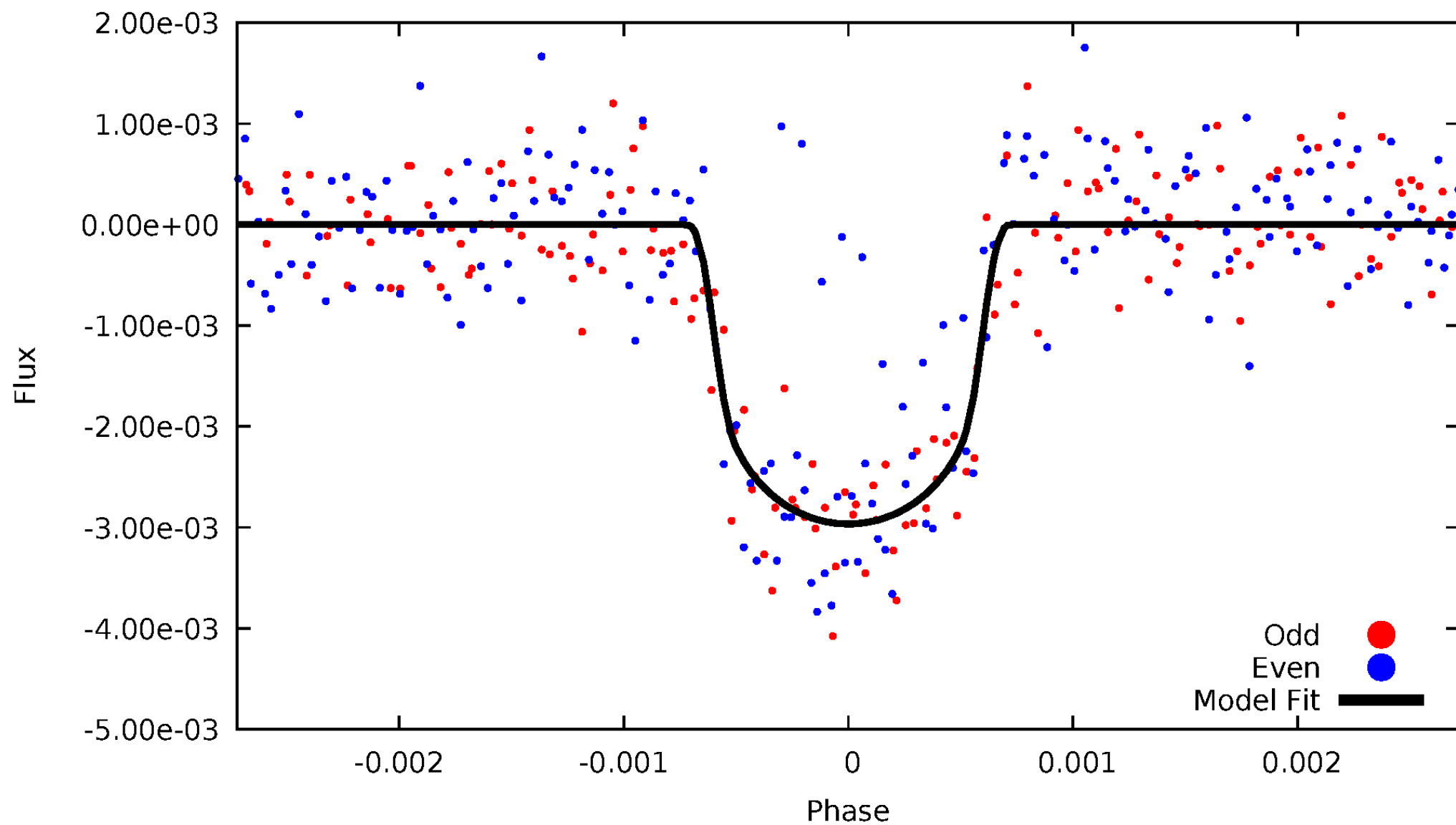


TCE 007373451-02



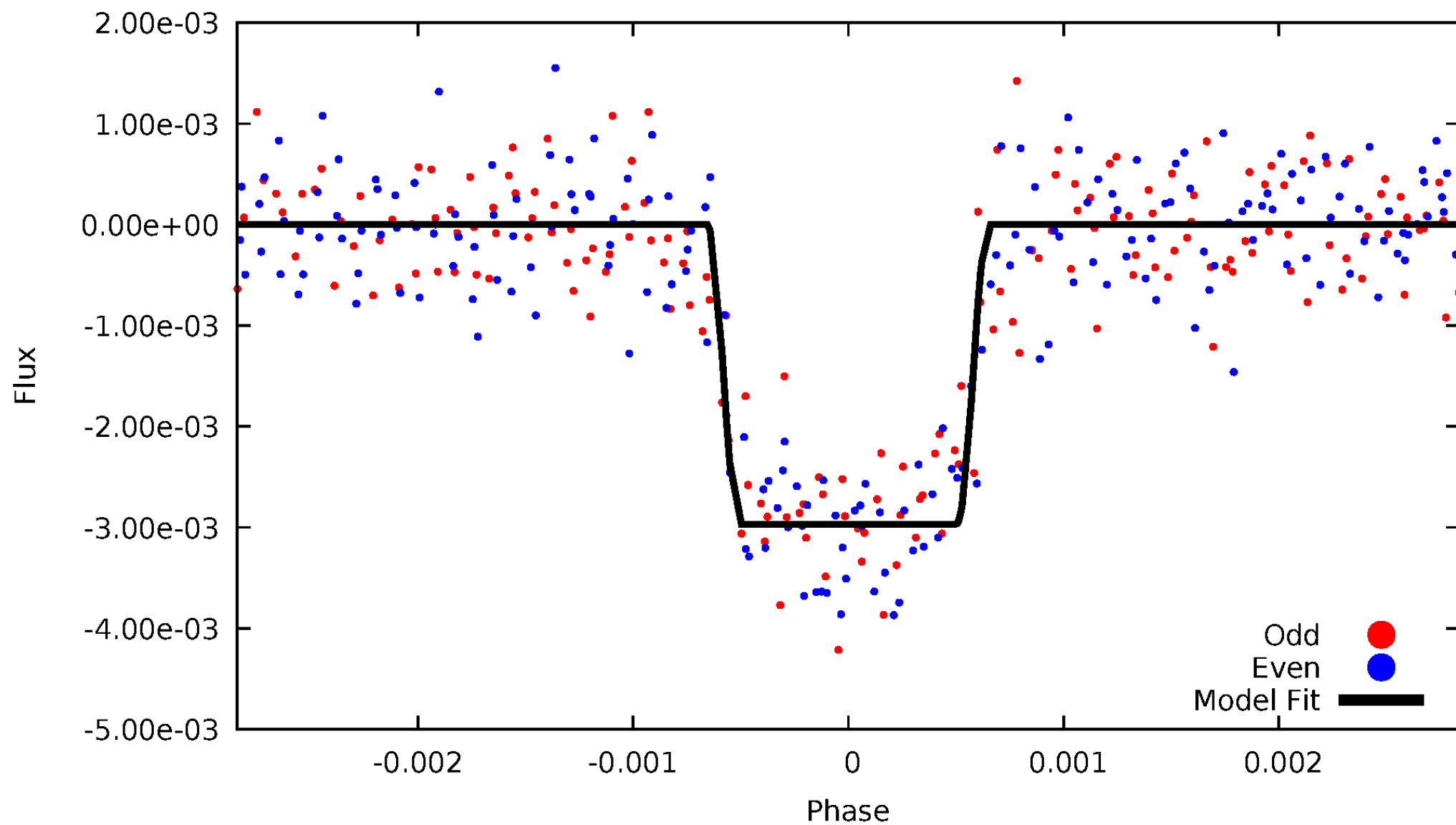
DV Odd/Even

TCE 007373451-02



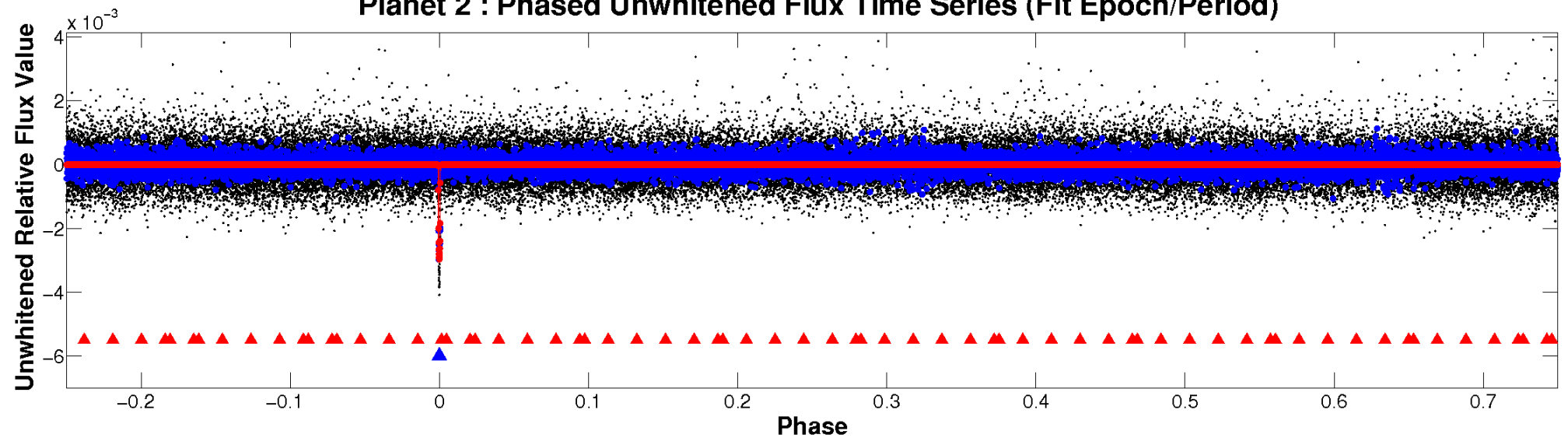
ALT Odd/Even

TCE 007373451-02

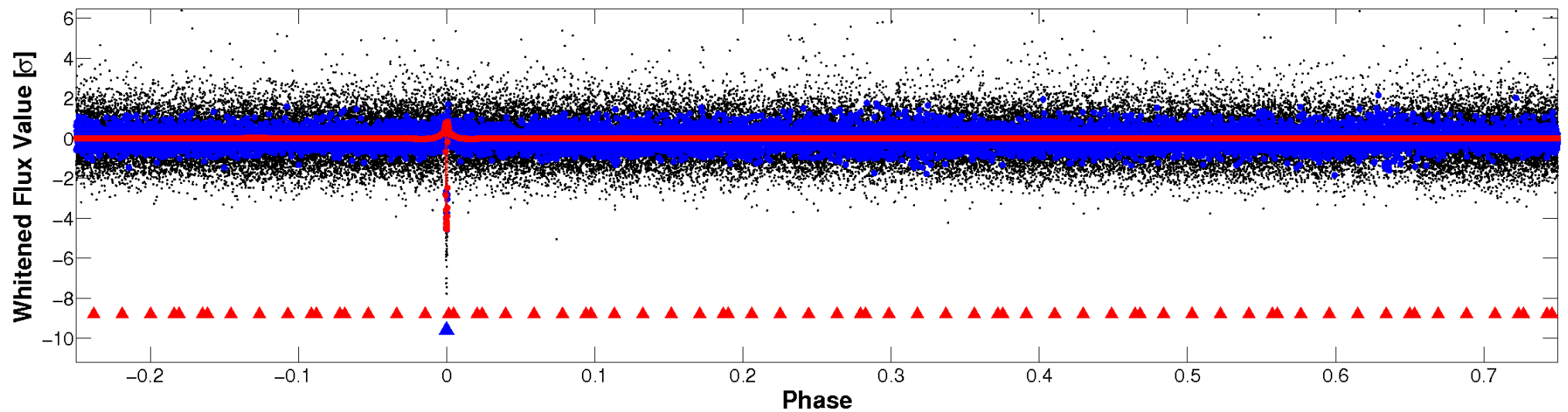


Non-Whitened Vs. Whitened Light Curve

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

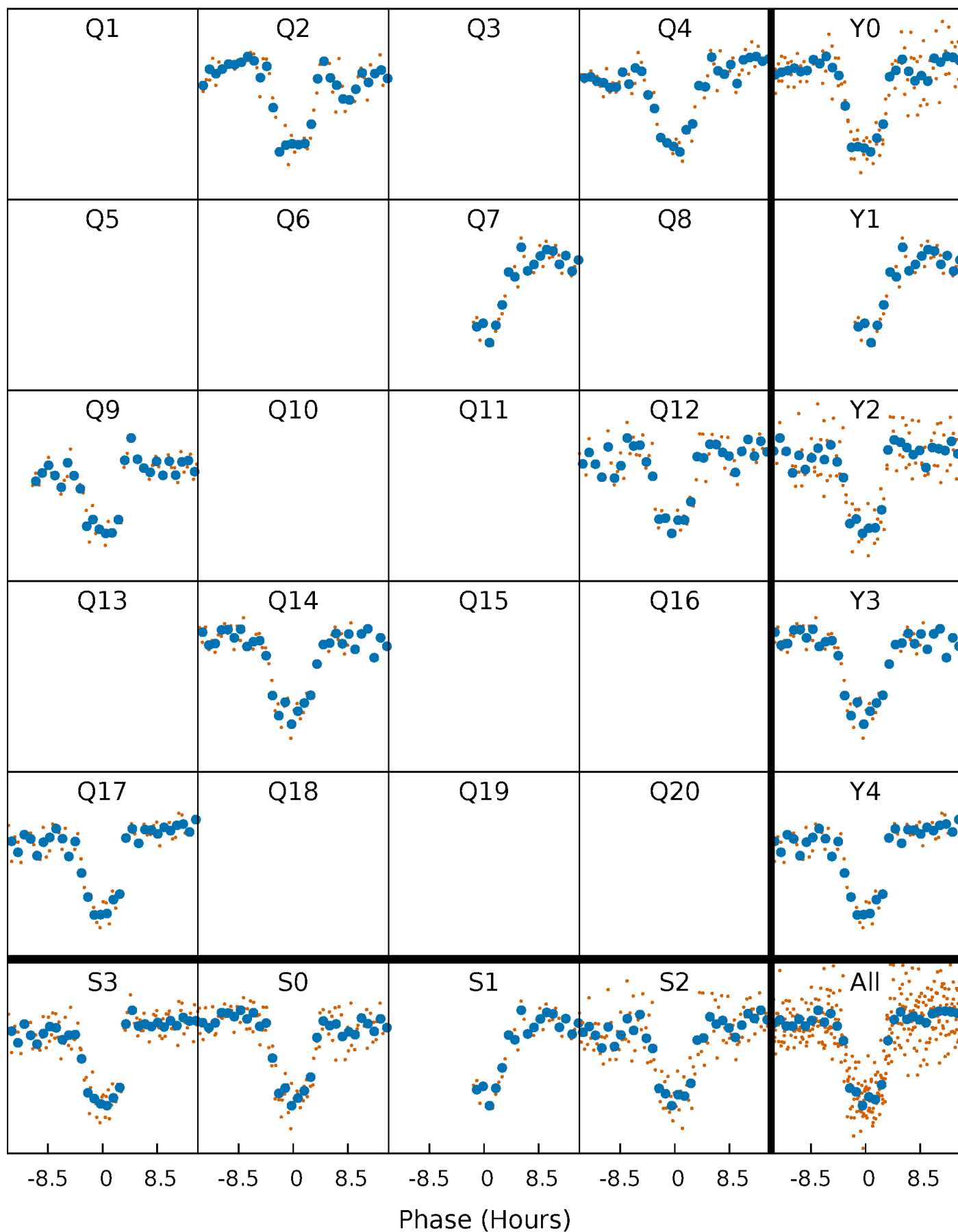


Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



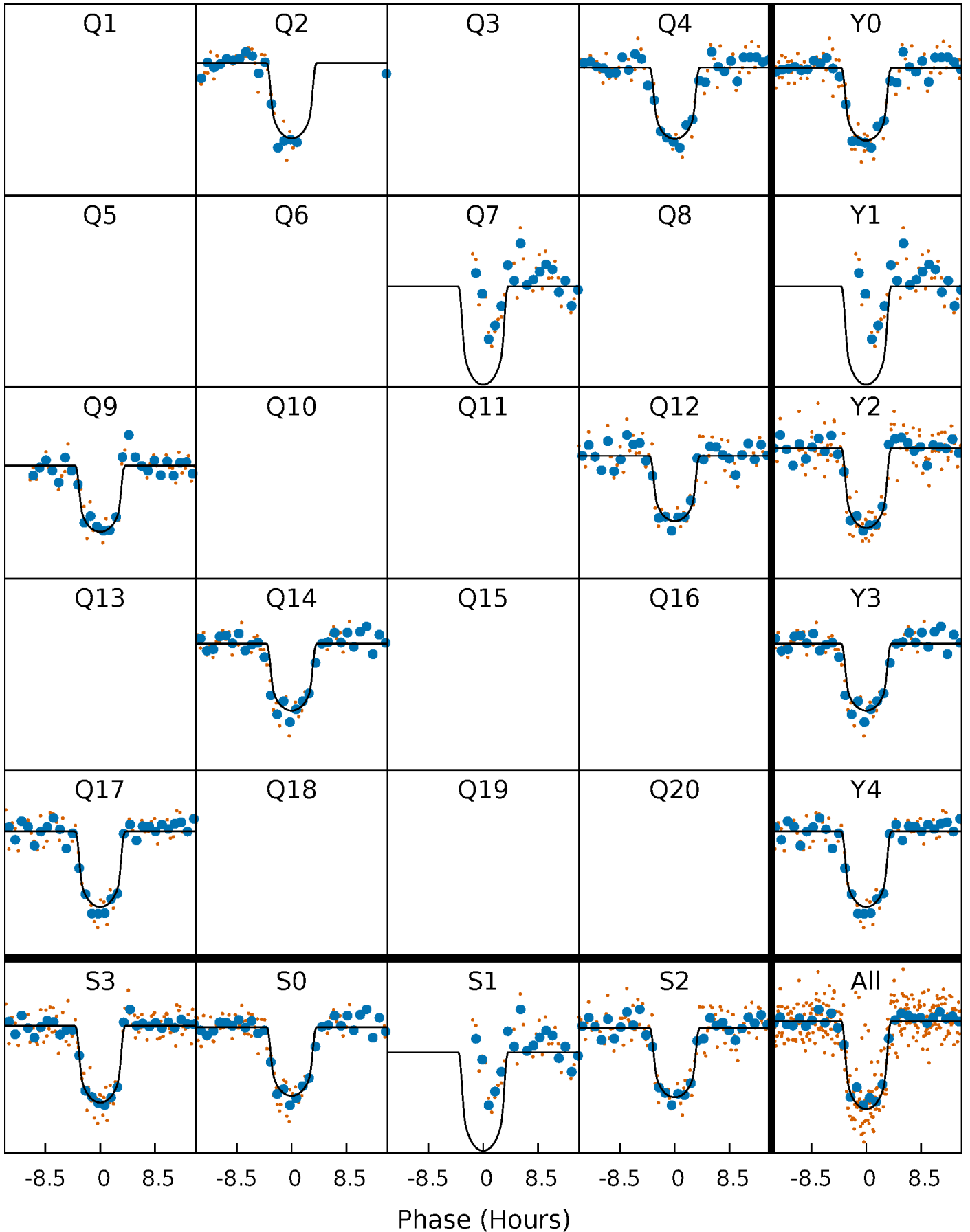
PDC Quarter-Phased Transit Curves

TCE 007373451-02 P=226.891542 Days $T_0=207.354457$ (BKJD)



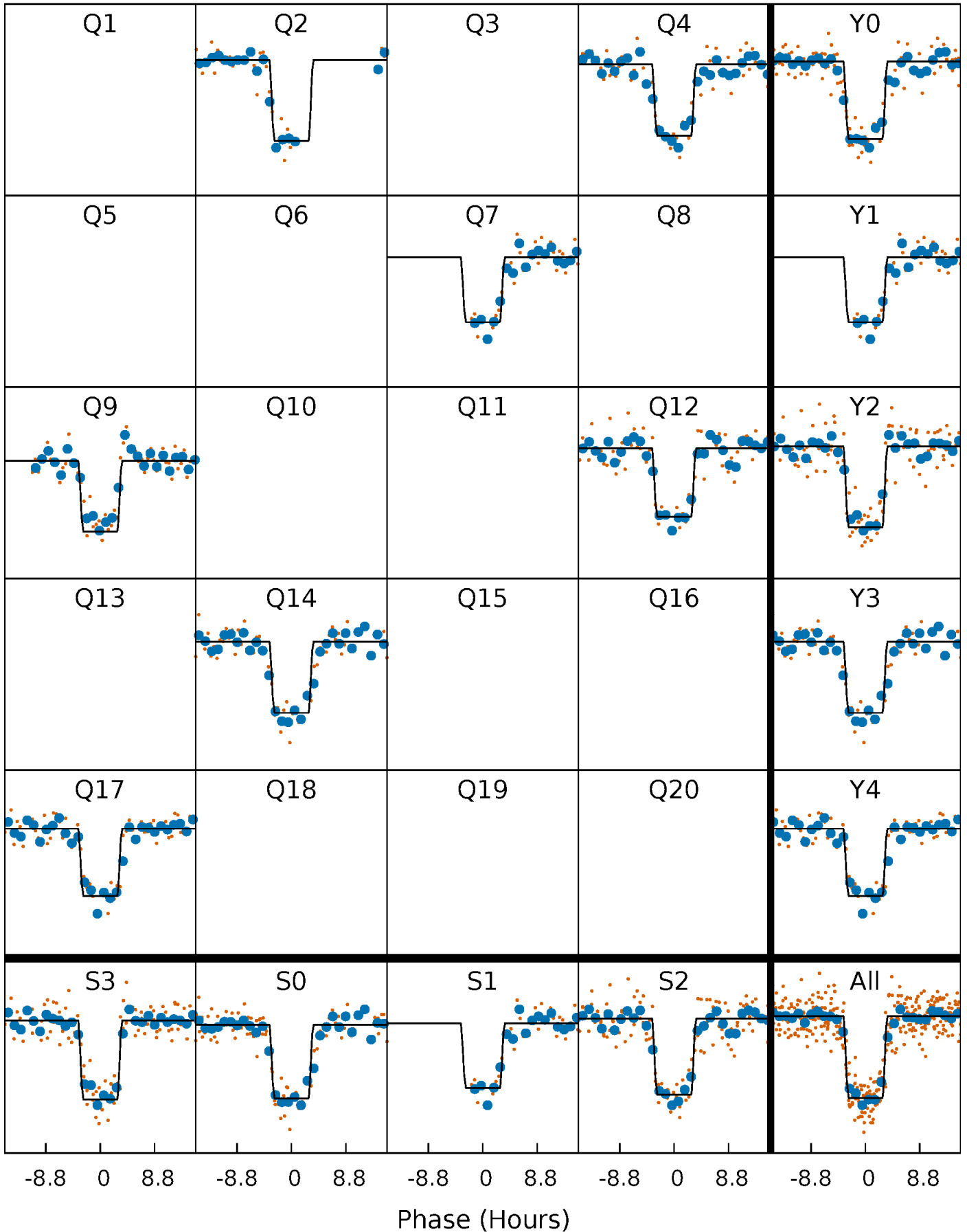
DV Quarter-Phased Transit Curves

TCE 007373451-02 $P=226.891542$ Days $T_0=207.354457$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

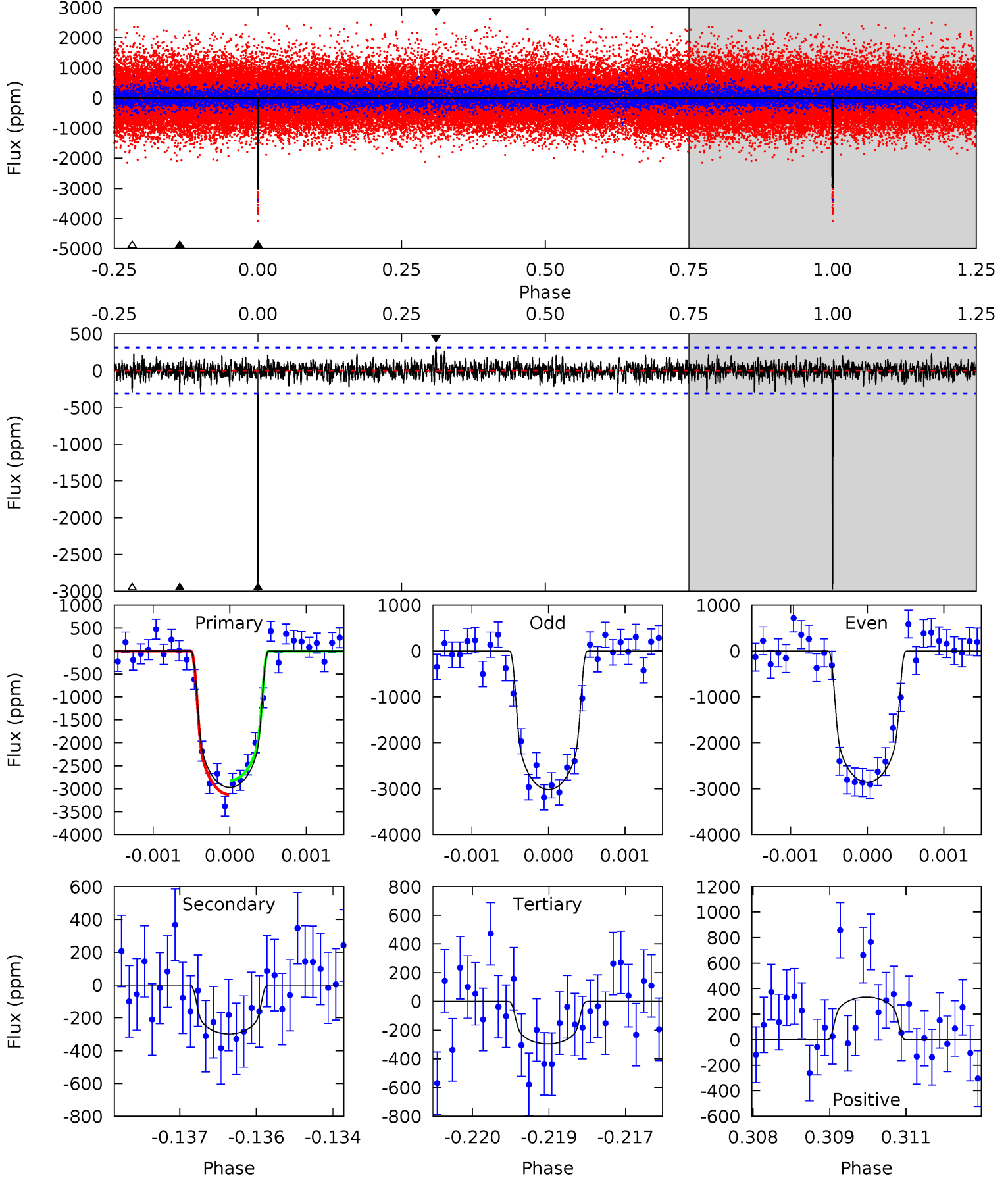
TCE 007373451-02 $P=226.887439$ Days $T_0=207.369846$ (BKJD)



DV Model-Shift Uniqueness Test

007373451-02, P = 226.891542 Days, E = 207.354457 Days

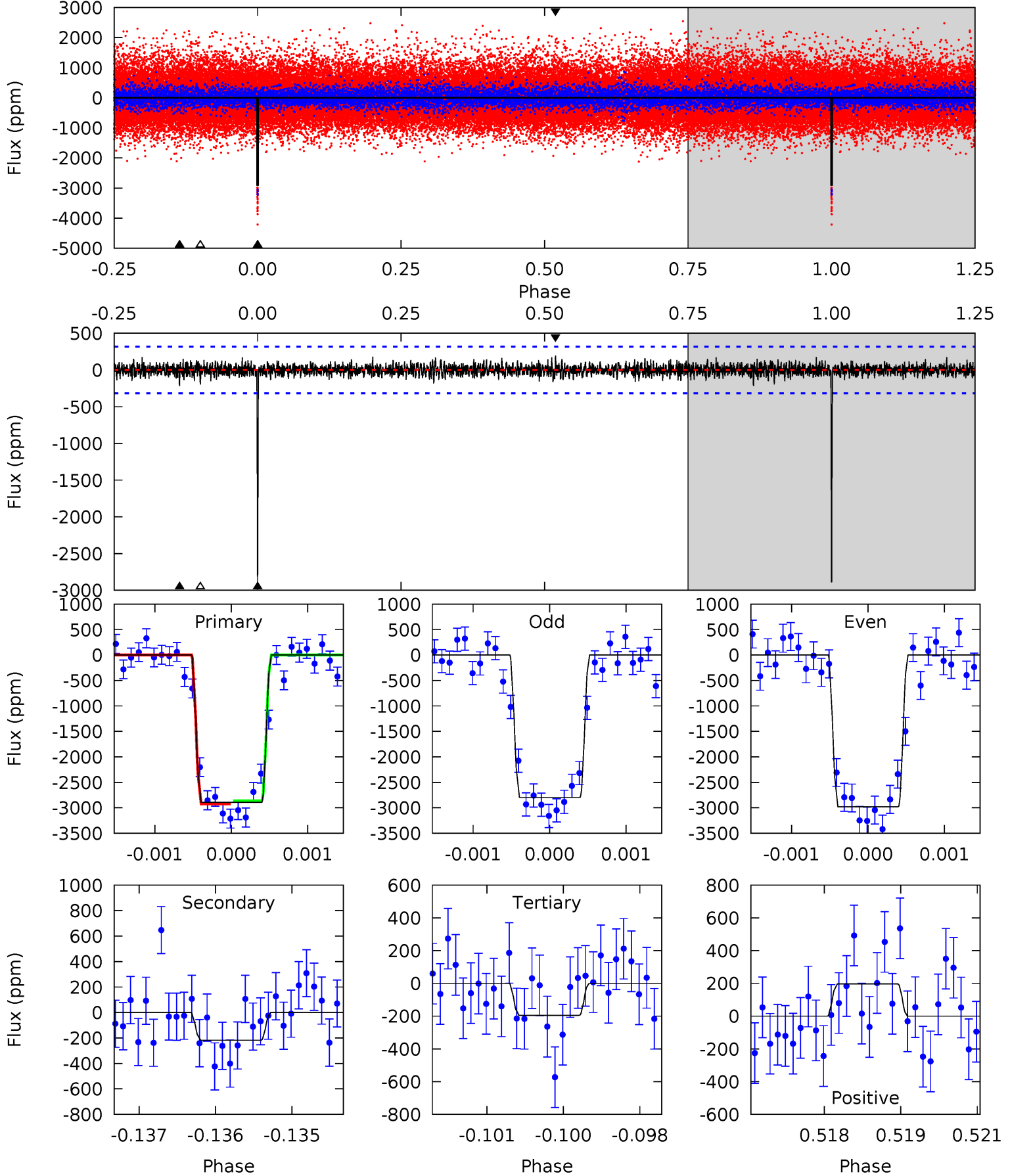
| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 51.1 | 5.13 | 5.09 | 5.75 | 5.39 | 3.19 | 1.27 | 46.1 | 45.4 | 0.04 | -0.62 | 1.38 | 0.89 | 0.10 | 2.66 |



Alt Model-Shift Uniqueness Test

007373451-02, P = 226.887439 Days, E = 207.369846 Days

| Pri | Sec | Ter | Pos | FA ₁ | FA ₂ | F _{Red} | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM | Shape | TAT |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 49.3 | 3.70 | 3.31 | 3.35 | 5.41 | 3.22 | 0.88 | 46.0 | 45.9 | 0.39 | 0.35 | 1.56 | 0.98 | 0.06 | 0.52 |



Stellar Parameters For KIC 007373451

| | $T_{\text{eff}}(K)$ | $\log(g)$ | [Fe/H] | $R (R_{\odot})$ | $M(M_{\odot})$ | $p_{\star} (\text{g}\cdot\text{cm}^{-3})$ |
|--------|----------------------|---------------------------|----------------------------|---------------------------|---------------------------|---|
| | 5067^{+102}_{-102} | $4.585^{+0.024}_{-0.048}$ | $-0.080^{+0.150}_{-0.150}$ | $0.750^{+0.052}_{-0.033}$ | $0.789^{+0.044}_{-0.044}$ | $2.633^{+0.269}_{-0.435}$ |
| | +2%/-2% | +1%/-1% | +188%/-188% | +7%/-4% | +6%/-6% | +10%/-17% |
| Source | SPE58 | SPE58 | SPE58 | DSEP | | |

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

Secondary Eclipse Parameters for KIC 007373451-02 / KOI 0881.02

| Detrend | Depth (ppm) | $R_p (R_{\oplus})$ | $T_{max} (K)$ | $T_{obs} (K)$ | A_{obs} |
|---------|---------------|------------------------|-----------------|----------------------|-----------------------|
| DV | -298 ± 58 | $4.46^{+0.35}_{-0.36}$ | 331^{+9}_{-8} | 3361^{+137}_{-136} | 3724^{+1001}_{-867} |
| Alt. | -217 ± 59 | $4.50^{+0.40}_{-0.37}$ | 331^{+9}_{-9} | 3191^{+151}_{-166} | 2661^{+904}_{-819} |

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 $A_{obs} \gg 1.0$

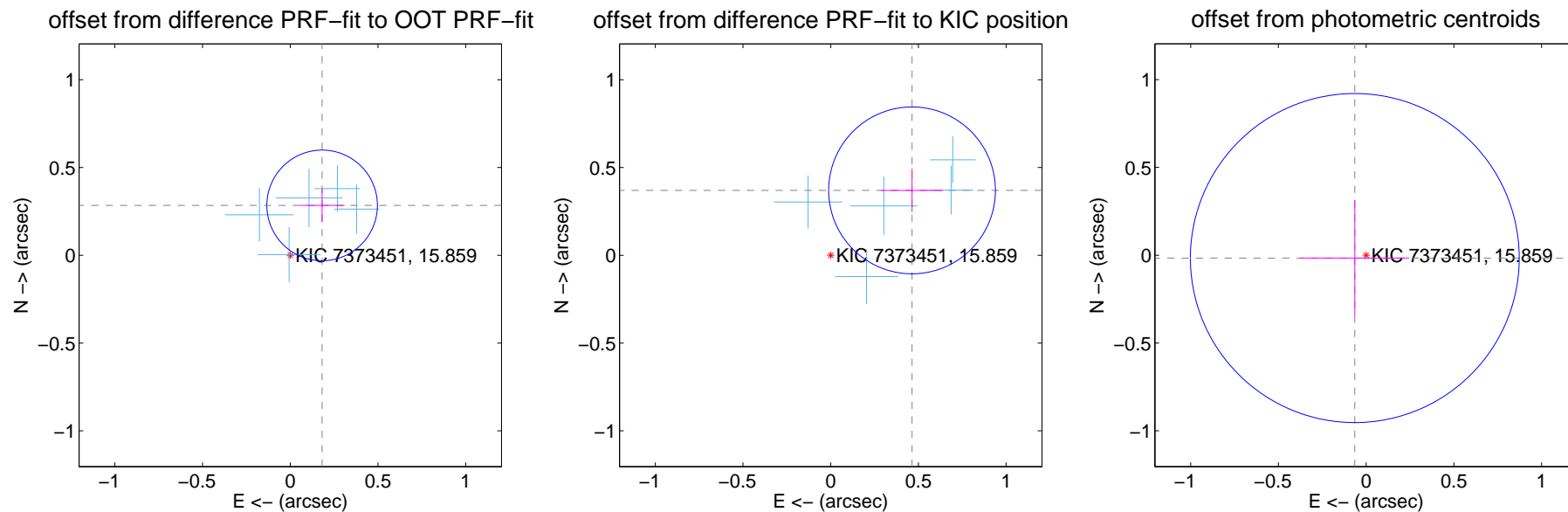
DV Centroid Data

Supplemental centroid analysis for 007373451-02. Kepler magnitude: 15.86. Transit SNR 35.64

There are 5 quarters with good PRF difference image offsets

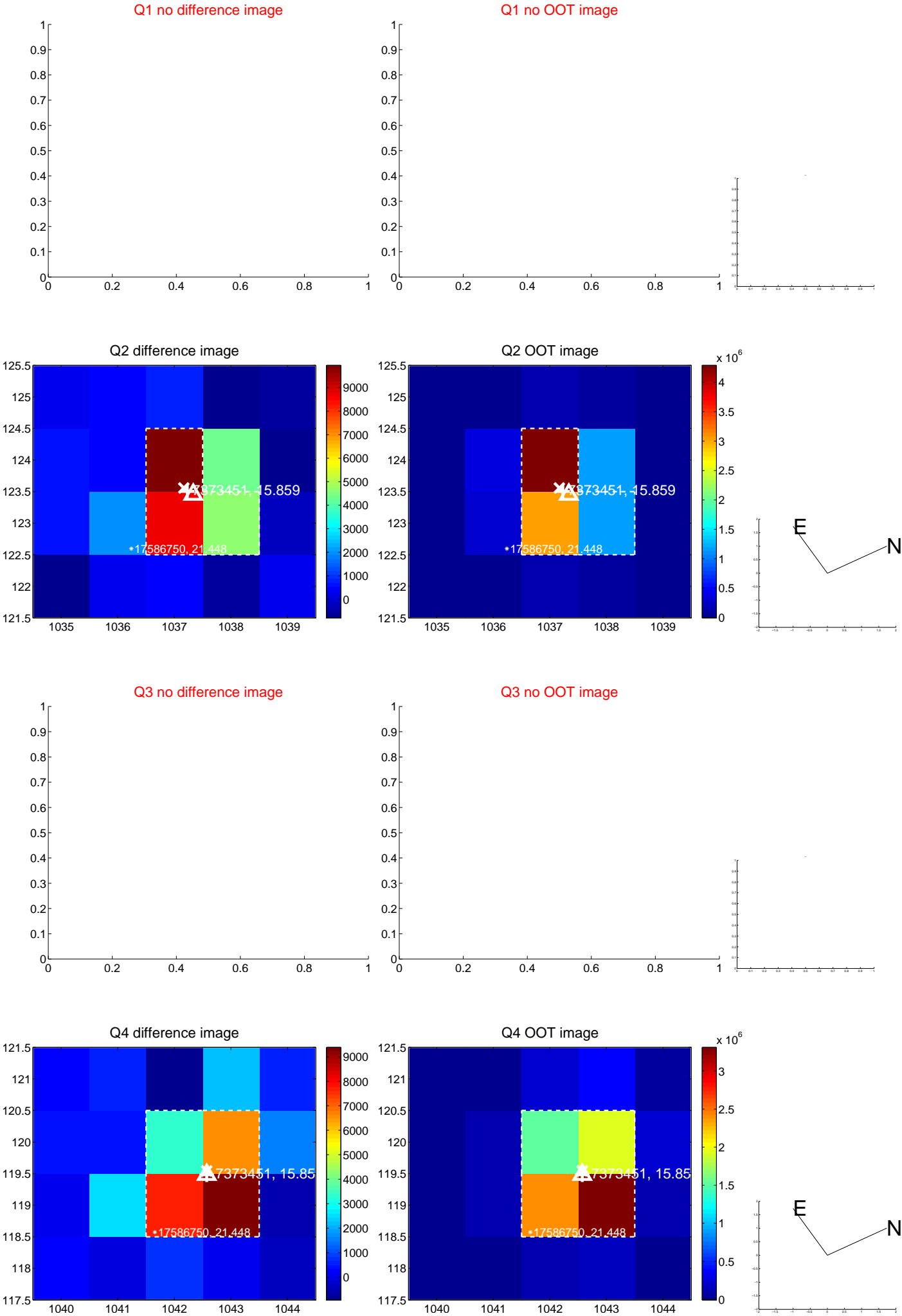
The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

| | Distance in arcsec | Distance / σ | Δ RA | Δ Dec |
|---|--------------------|---------------------|--------------------|-------------------|
| PRF-fit source offset from OOT | 0.337 ± 0.105 | 3.21 | -0.182 ± 0.127 | 0.284 ± 0.094 |
| PRF-fit source offset from KIC position | 0.593 ± 0.158 | 3.74 | -0.464 ± 0.177 | 0.370 ± 0.124 |
| photometric centroid source offset | 0.07 ± 0.31 | 0.21 | 0.06 ± 0.31 | -0.02 ± 0.33 |



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.

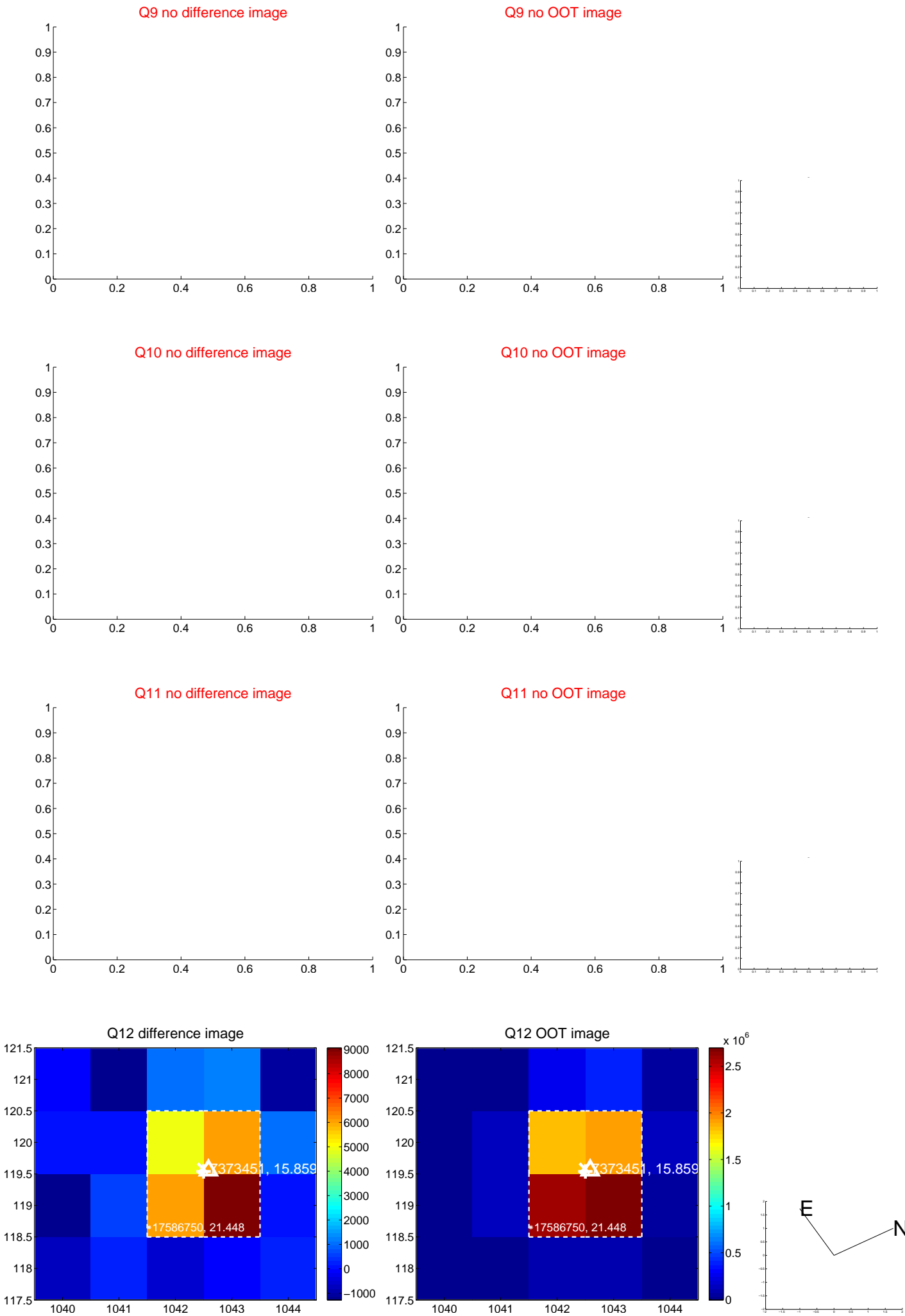
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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

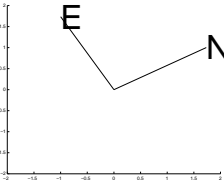
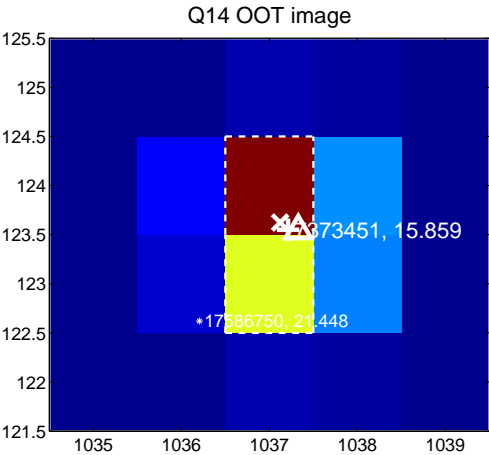
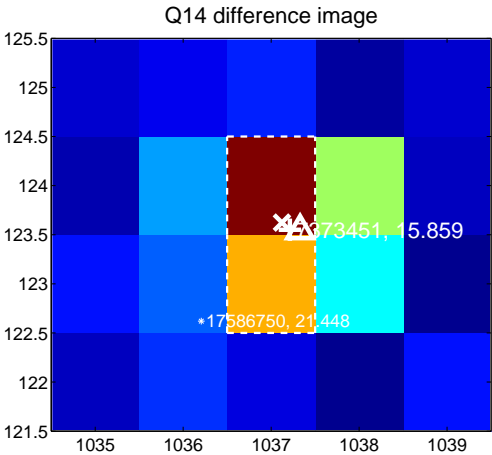


white ×: KIC target position; +: OOT centroid; △: difference centroid. red ×: large negative pixel value.

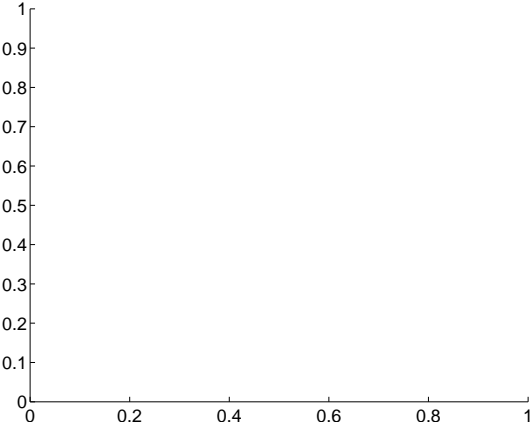
Q13 no difference image



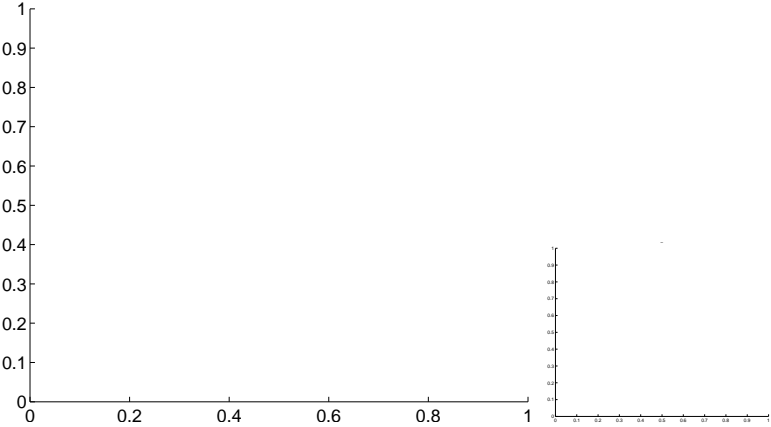
Q13 no OOT image



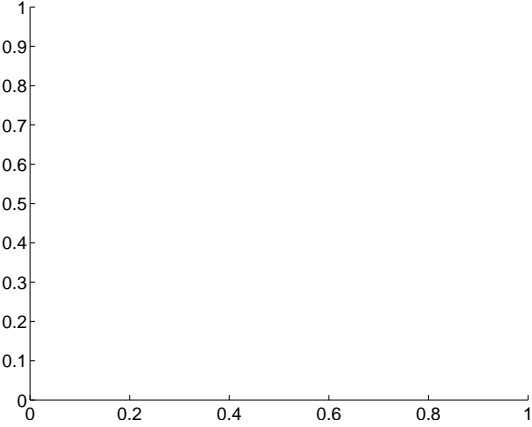
Q15 no difference image



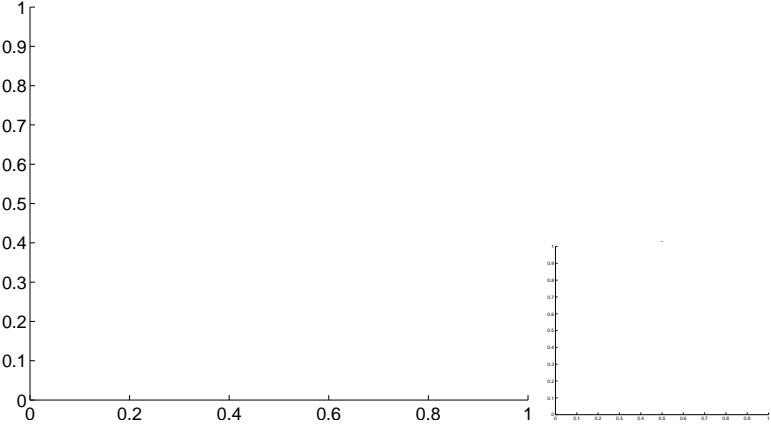
Q15 no OOT image



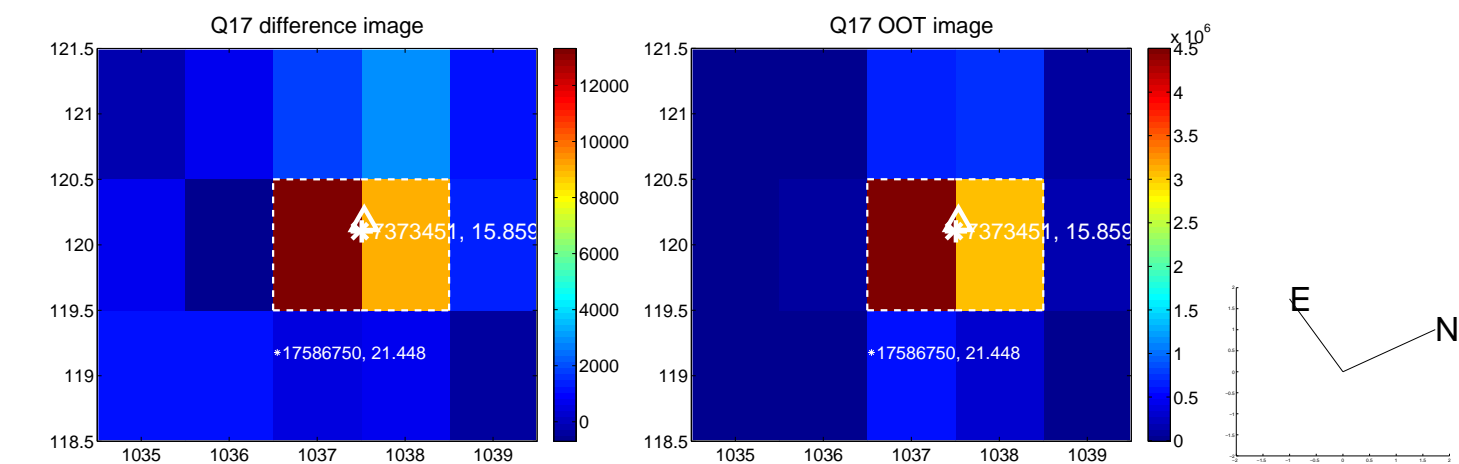
Q16 no difference image



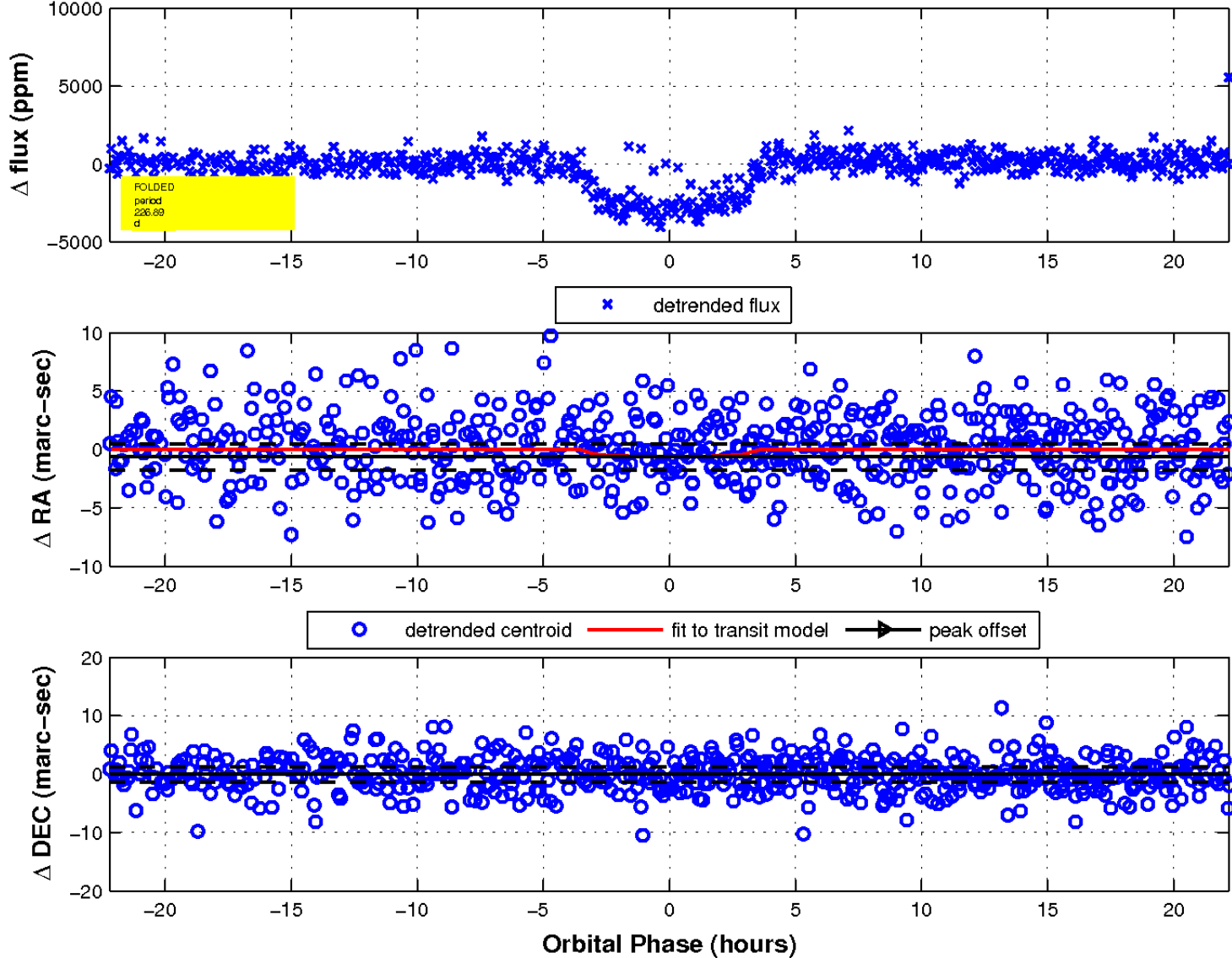
Q16 no OOT image



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

