

# KIC 008223328

## 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) | $R_p$ ( $R_{\oplus}$ ) | $S_p$ ( $S_{\oplus}$ ) |
|--------------|----------|---------|---------------|--------------|-------------|------------------|-------|-------|-----------------------------|-----------------|------------------------|------------------------|
| 008223328-01 | OBS      | 1767.01 | 35.516198     | 165.930429   | 10921.7     | 2.498            | 806.2 | 747.4 | 0.87                        | 5514            | 16.13                  | 15.24                  |
| 008223328-02 | OBS      | No      | 35.516210     | 135.553283   | 377.9       | 1.839            | 23.6  | 29.2  | 0.87                        | 5514            | 2.98                   | 15.24                  |

## Robovetter Results

| TCE          | Run Type | Disp | Score | N | S | C | E | Comments   |
|--------------|----------|------|-------|---|---|---|---|--|
| 008223328-01 | OBS      | FP   | 0.00  | 0 | 1 | 0 | 0 | MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE |
| 008223328-02 | OBS      | FP   | 0.00  | 1 | 1 | 0 | 0 | IS_SEC_TCE                                       |

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

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

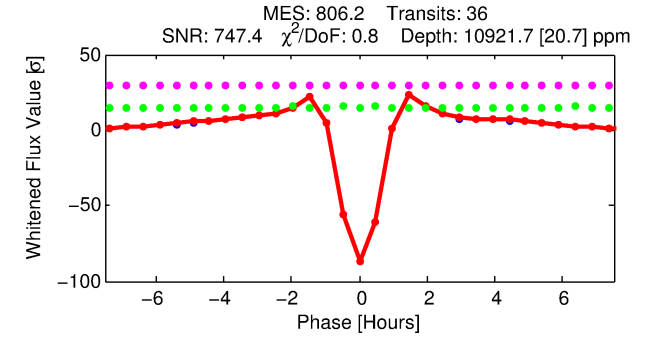
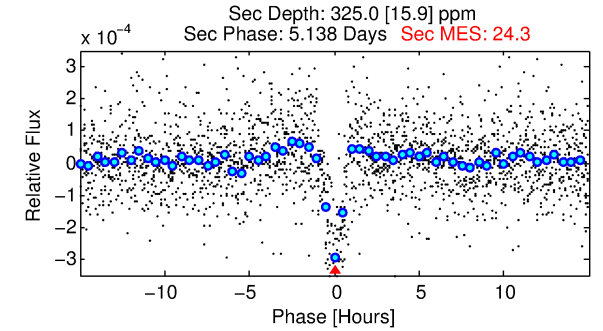
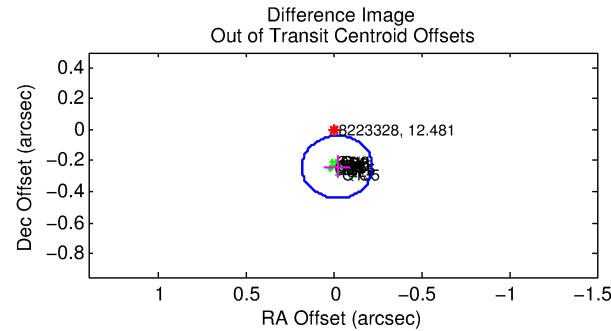
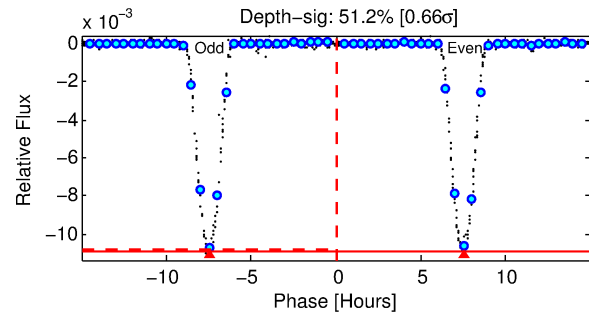
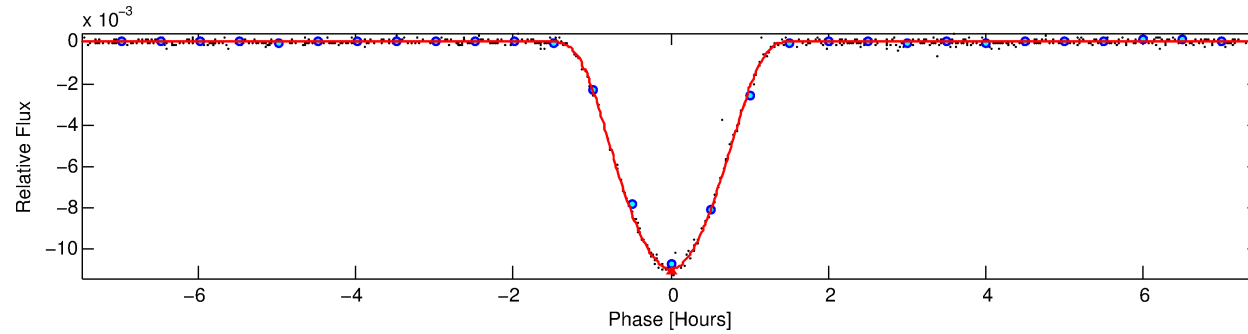
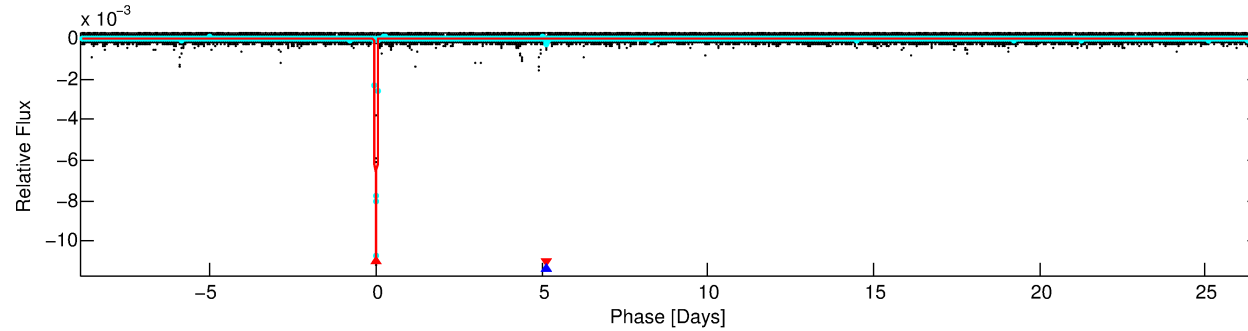
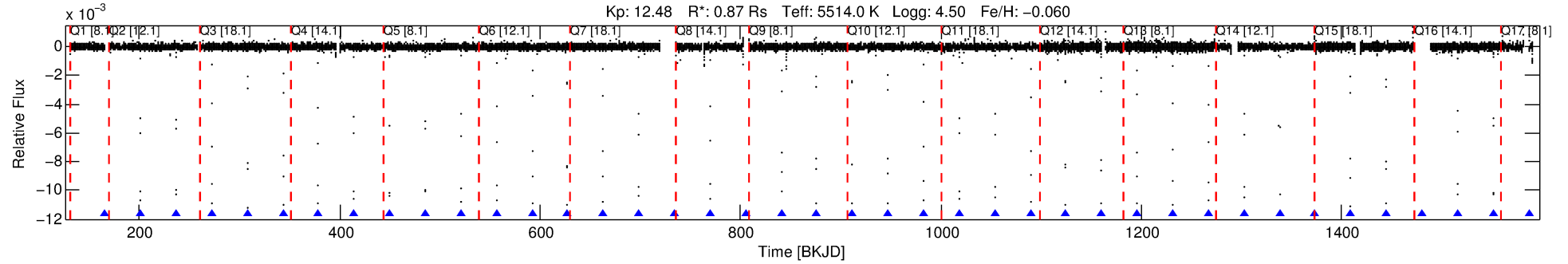
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 008223328-01

No Significant Match Found

# DV One-Page Summary

KIC: 8223328 Candidate: 1 of 2 Period: 35.516 d  
KOI: K01767.01 Corr: 0.995



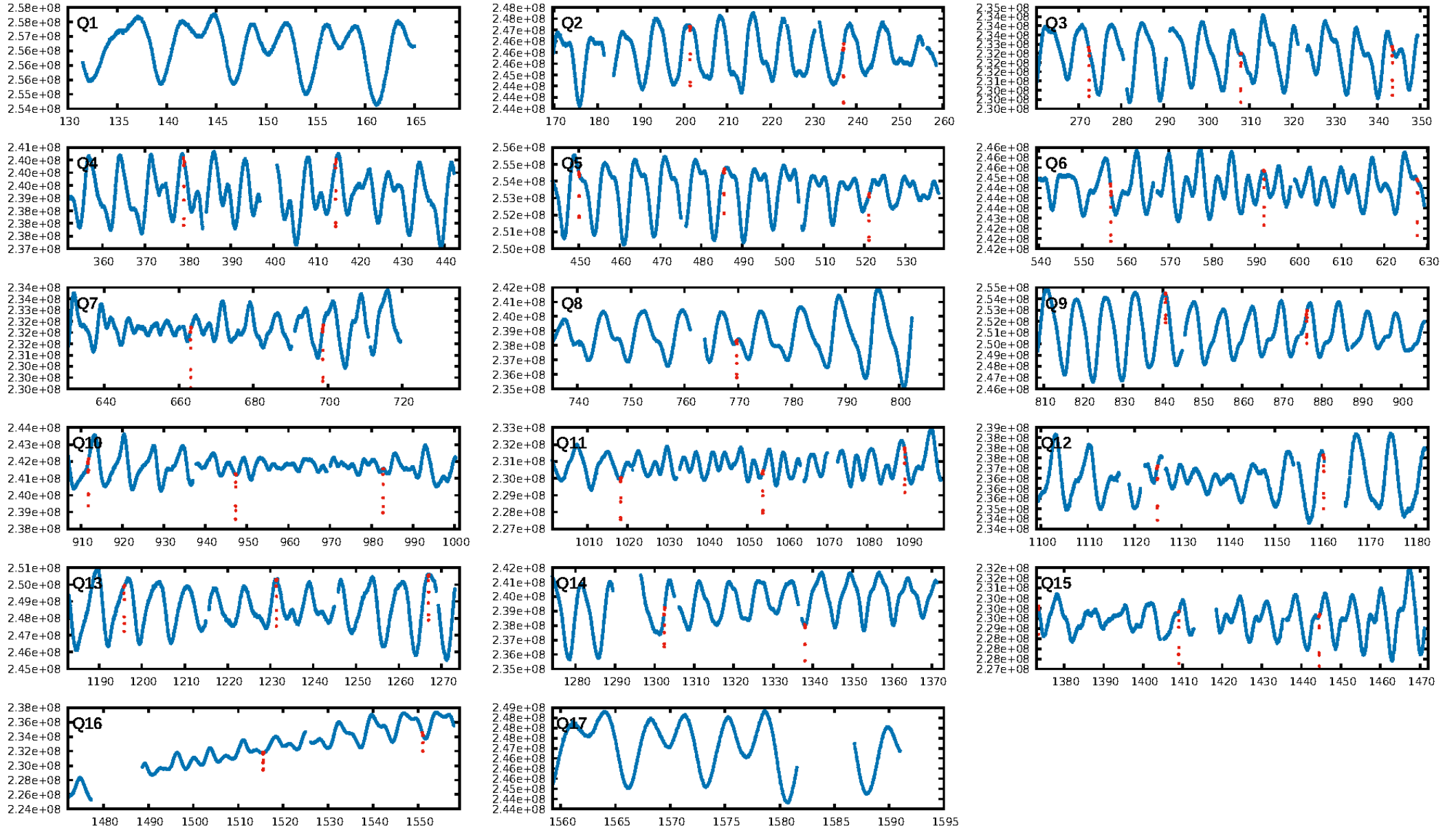
## DV Fit Results:

Period = 35.51620 [0.00000] d  
Epoch = 165.9304 [0.0001] BKJD  
Rp/R\* = 0.1698 [0.0087]  
a/R\* = 67.36 [0.51]  
b = 0.99 [0.01]  
Seff = 15.24 [2.58]  
Teq = 504 [21] K  
Rp = 16.13 [1.99] Re  
a = 0.2031 [0.0208] AU  
Ag = 28.33 [5.52] [4.95 $\sigma$ ]  
Teffp = 1797 [58] K [21.04 $\sigma$ ]

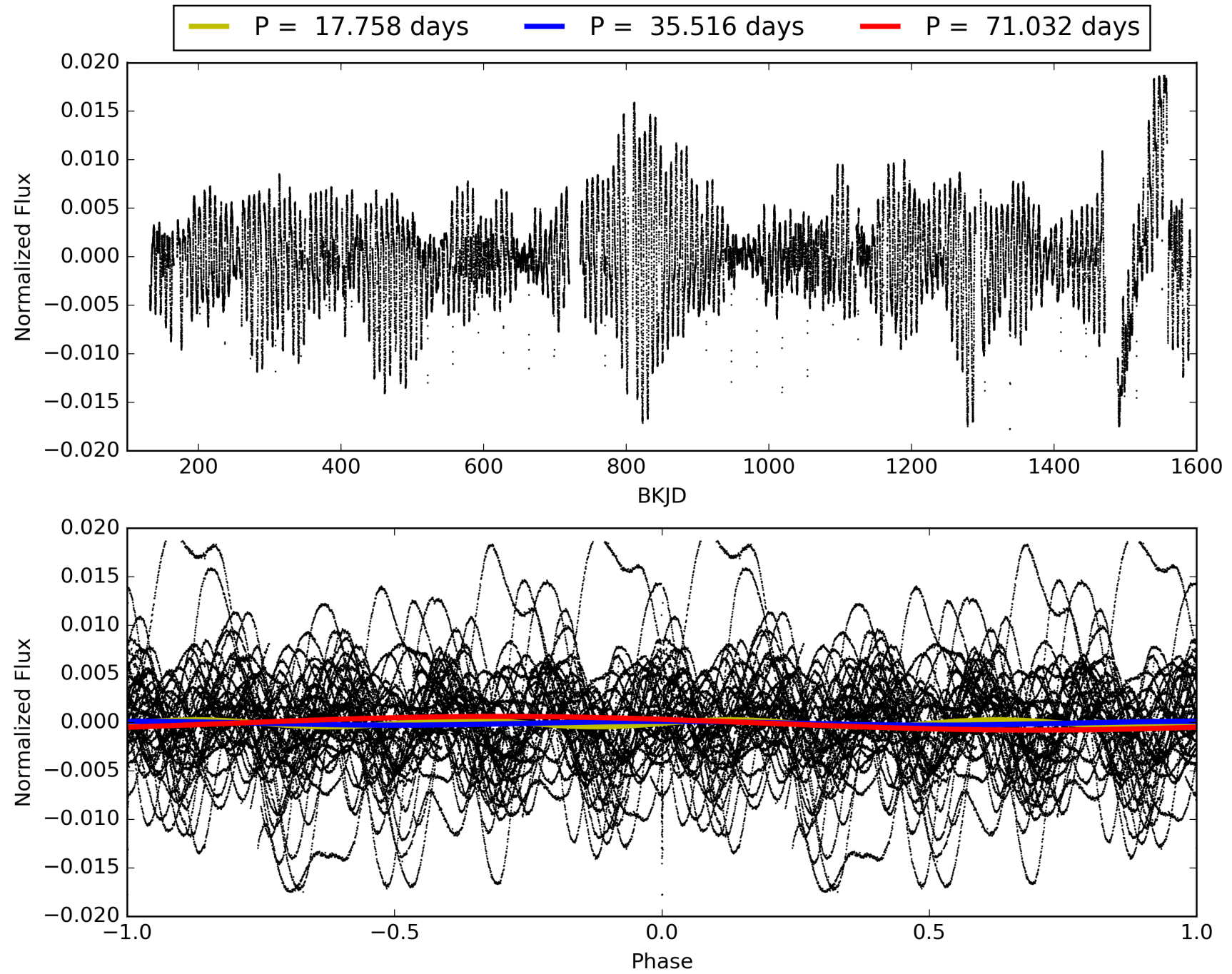
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00 $\sigma$ ]  
ModelChiSquare2-sig: 8.6%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [36/36]  
GhostDiagnostic-chr: 4.384  
Centroid-sig: 0.0%  
Centroid-so: 0.207 arcsec [15.90 $\sigma$ ]  
OotOffset-rm: 0.240 arcsec [3.57 $\sigma$ ]  
KicOffset-rm: 0.313 arcsec [4.61 $\sigma$ ]  
OotOffset-st: 4/4/4/3 [15]  
KicOffset-st: 4/4/4/3 [15]  
DiffImageQuality-fgm: 1.00 [15/15]  
DiffImageOverlap-fno: 1.00 [15/15]

# TCE 008223328-01, PDC Light Curves

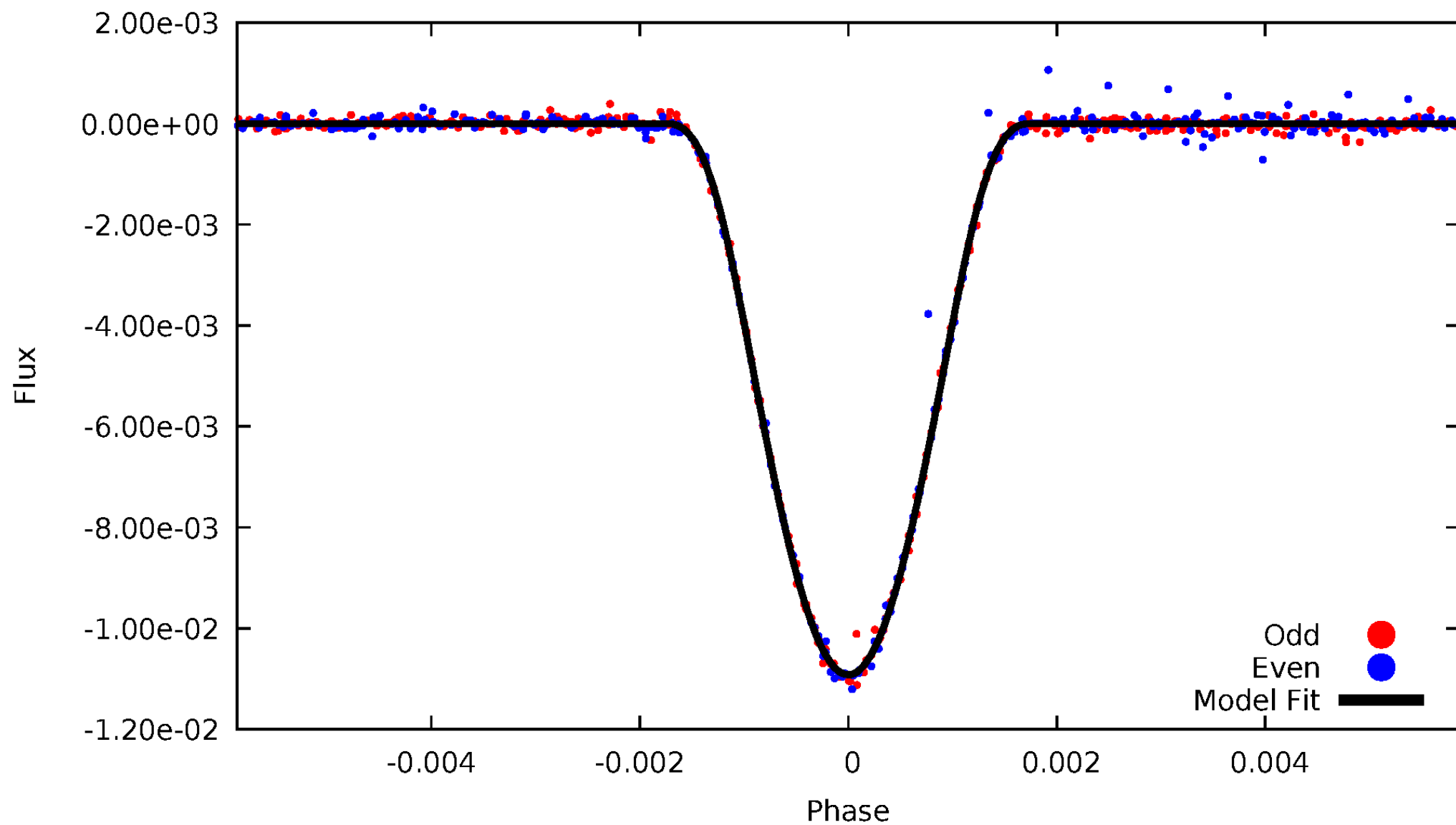


TCE 008223328-01



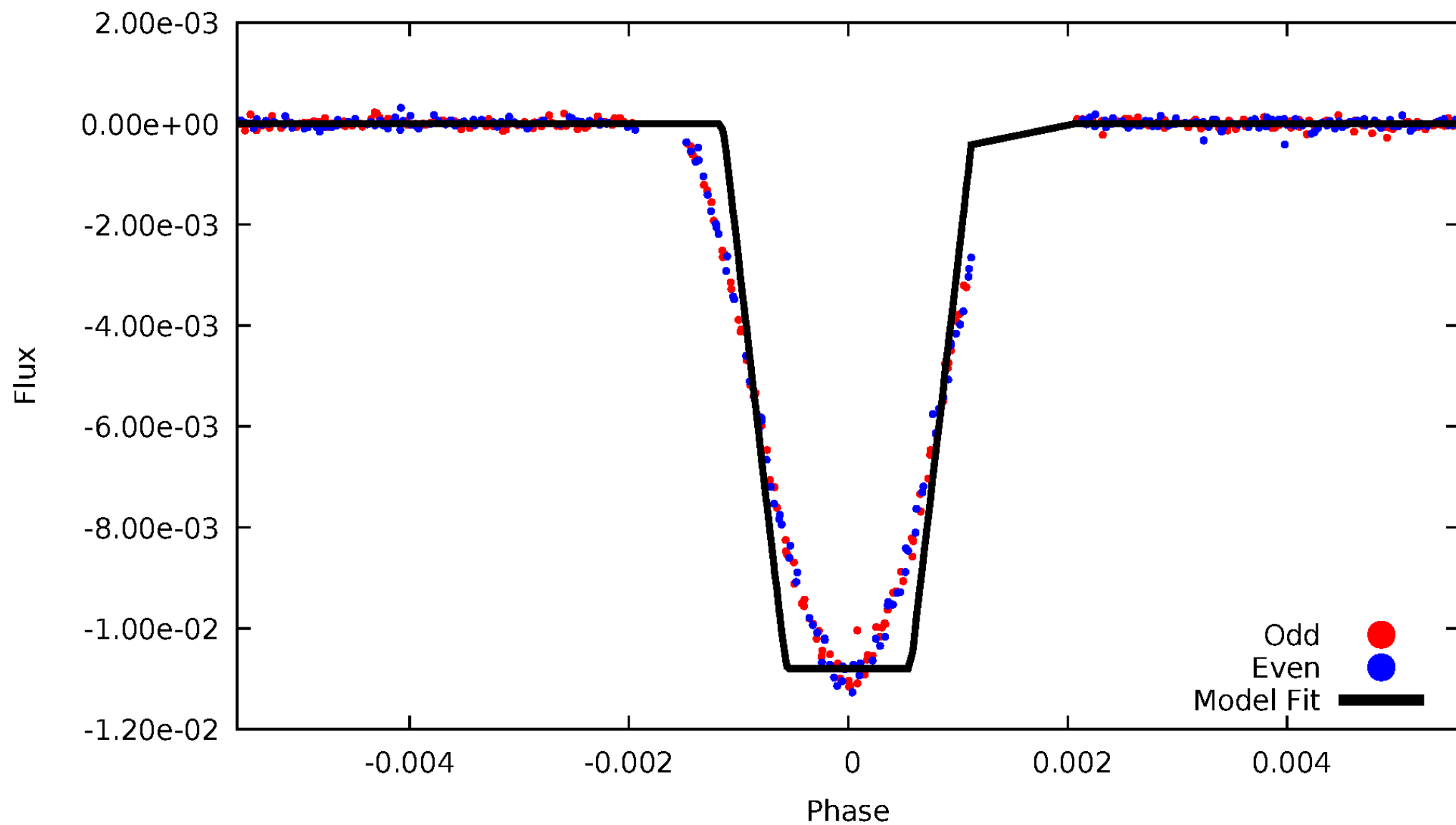
# DV Odd/Even

TCE 008223328-01



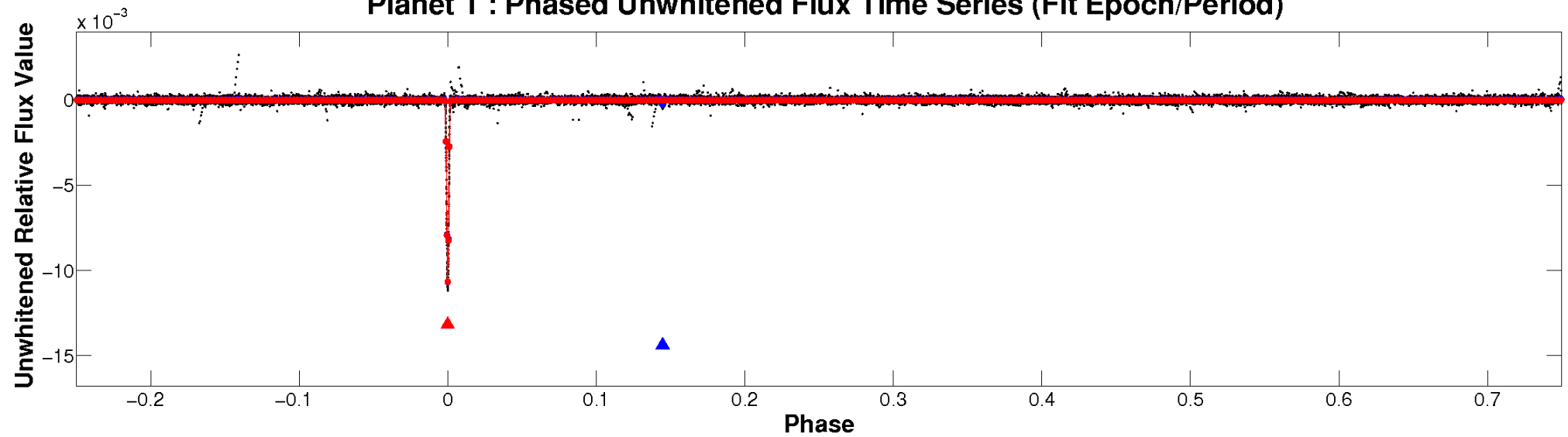
# ALT Odd/Even

TCE 008223328-01

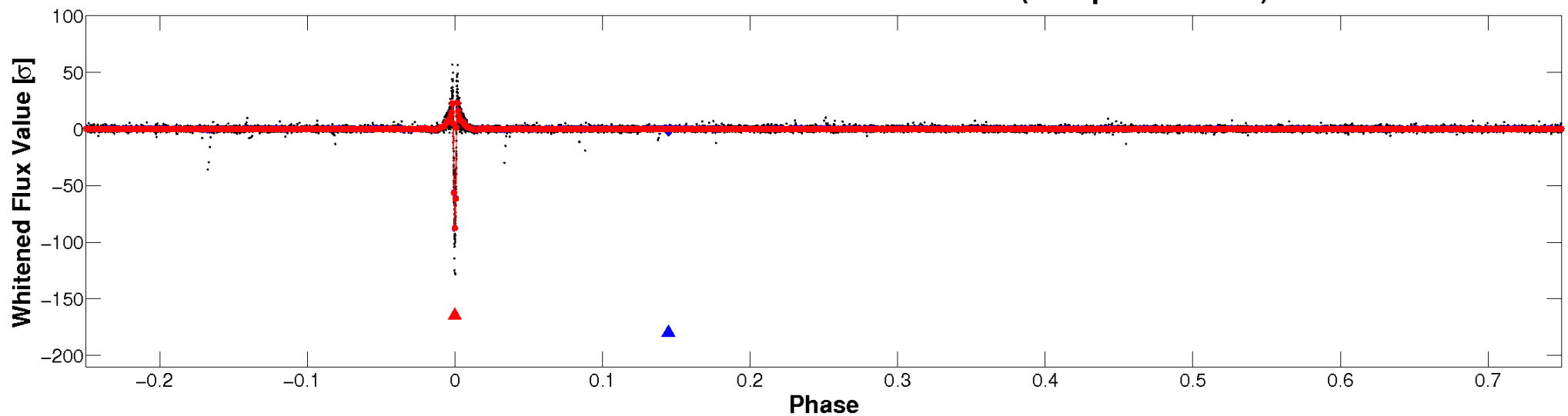


# Non-Whitened Vs. Whitened Light Curve

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

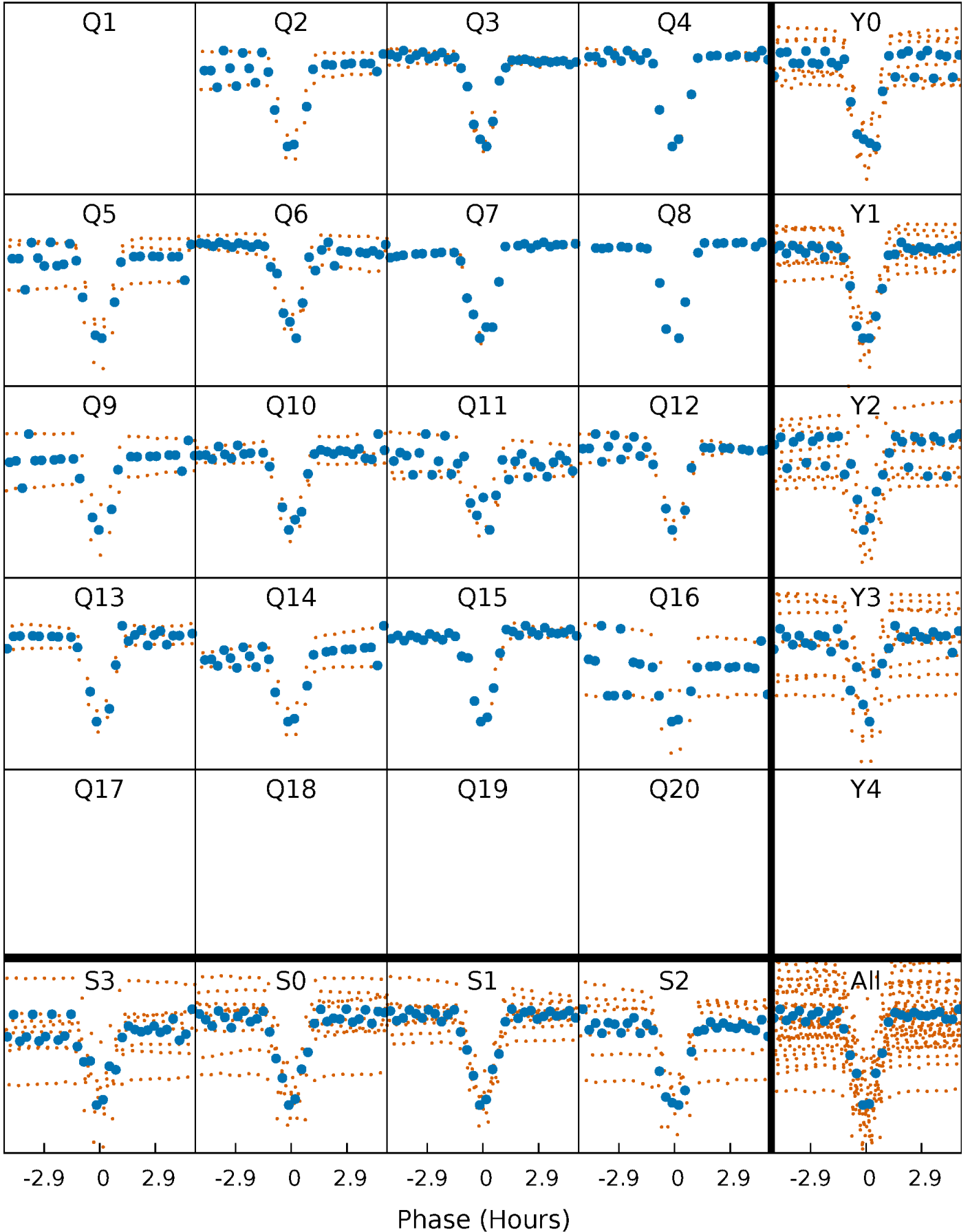


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

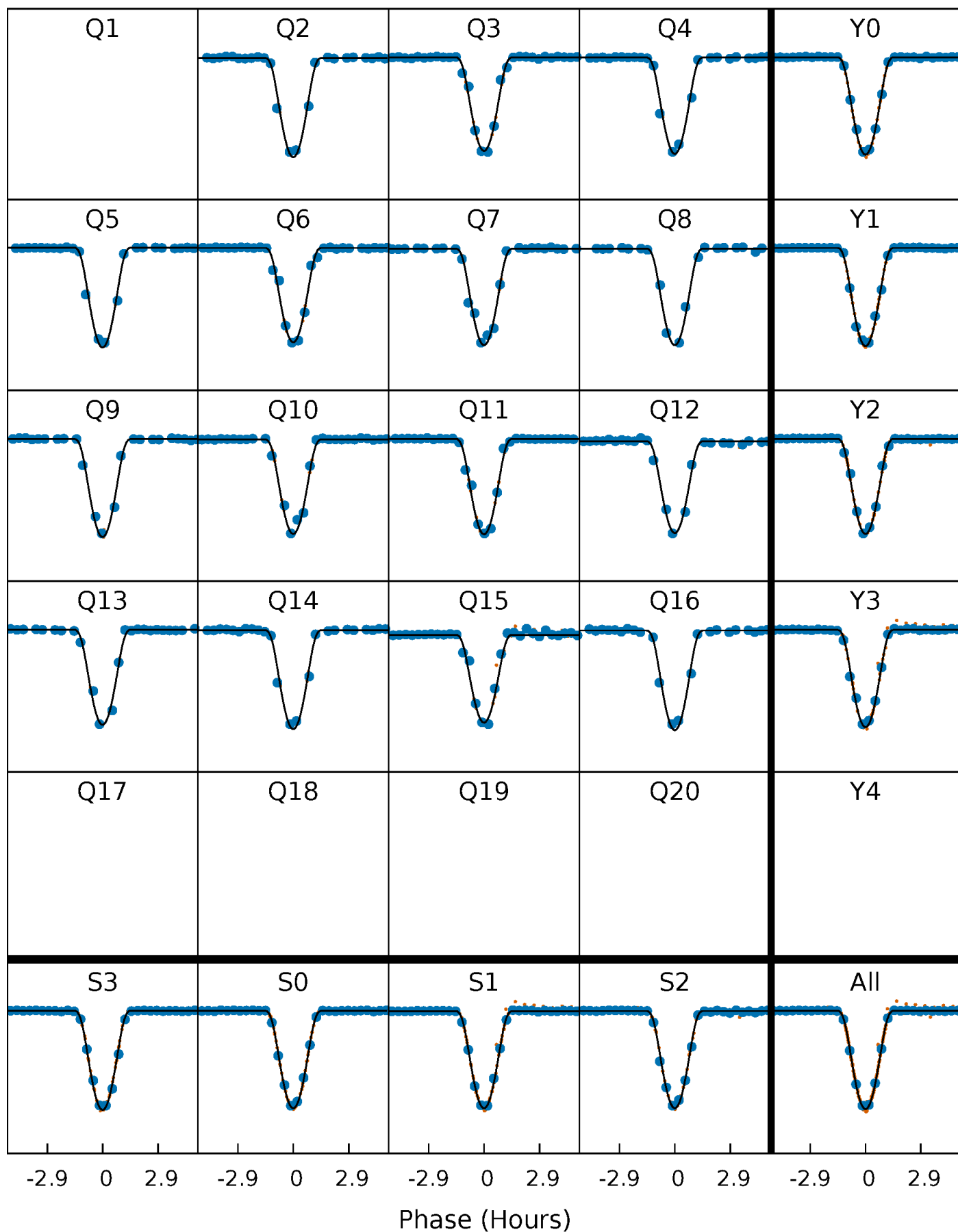
TCE 008223328-01 P= 35.516198 Days  $T_0=165.930429$  (BKJD)





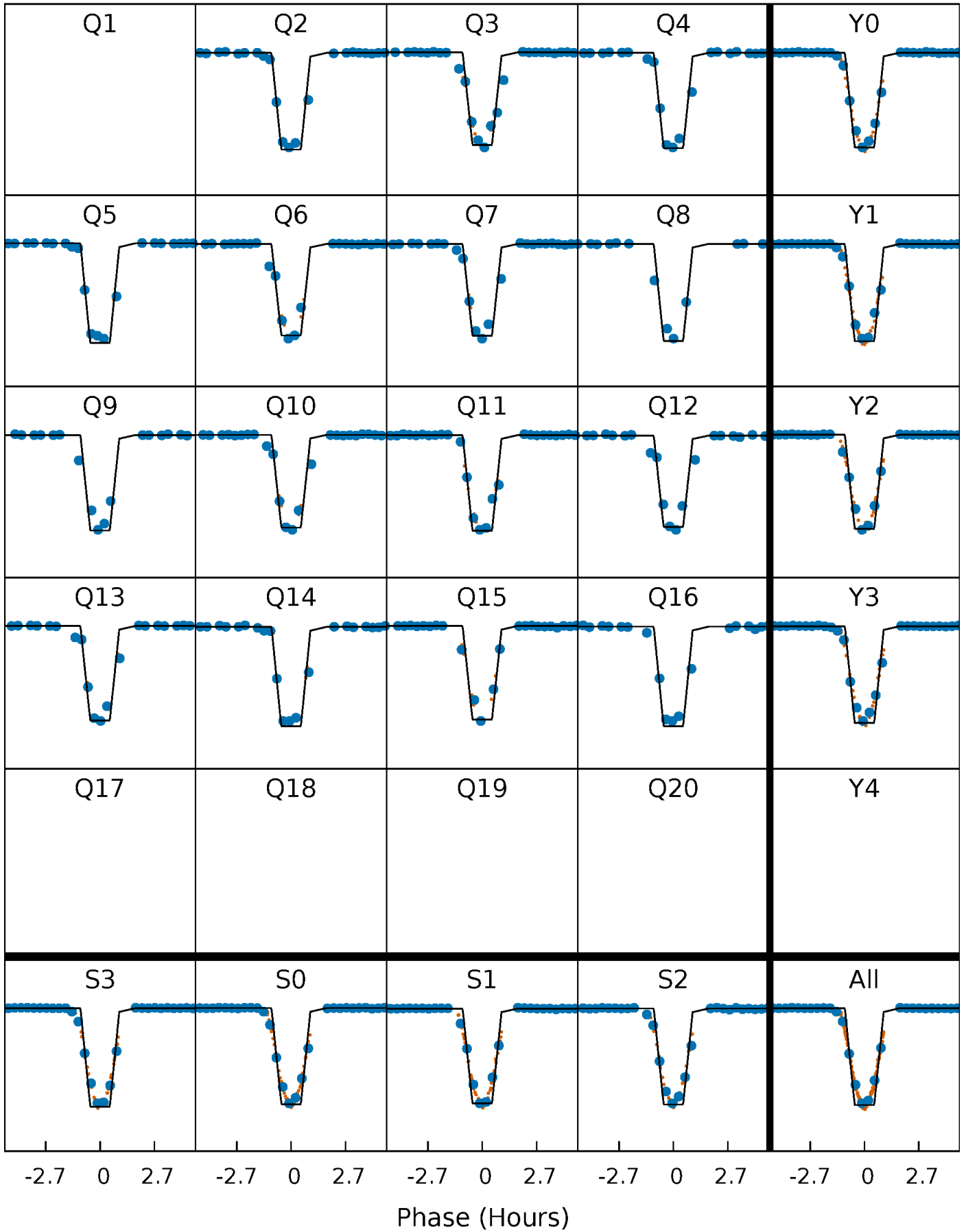
# DV Quarter-Phased Transit Curves

TCE 008223328-01 P= 35.516198 Days  $T_0=165.930429$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

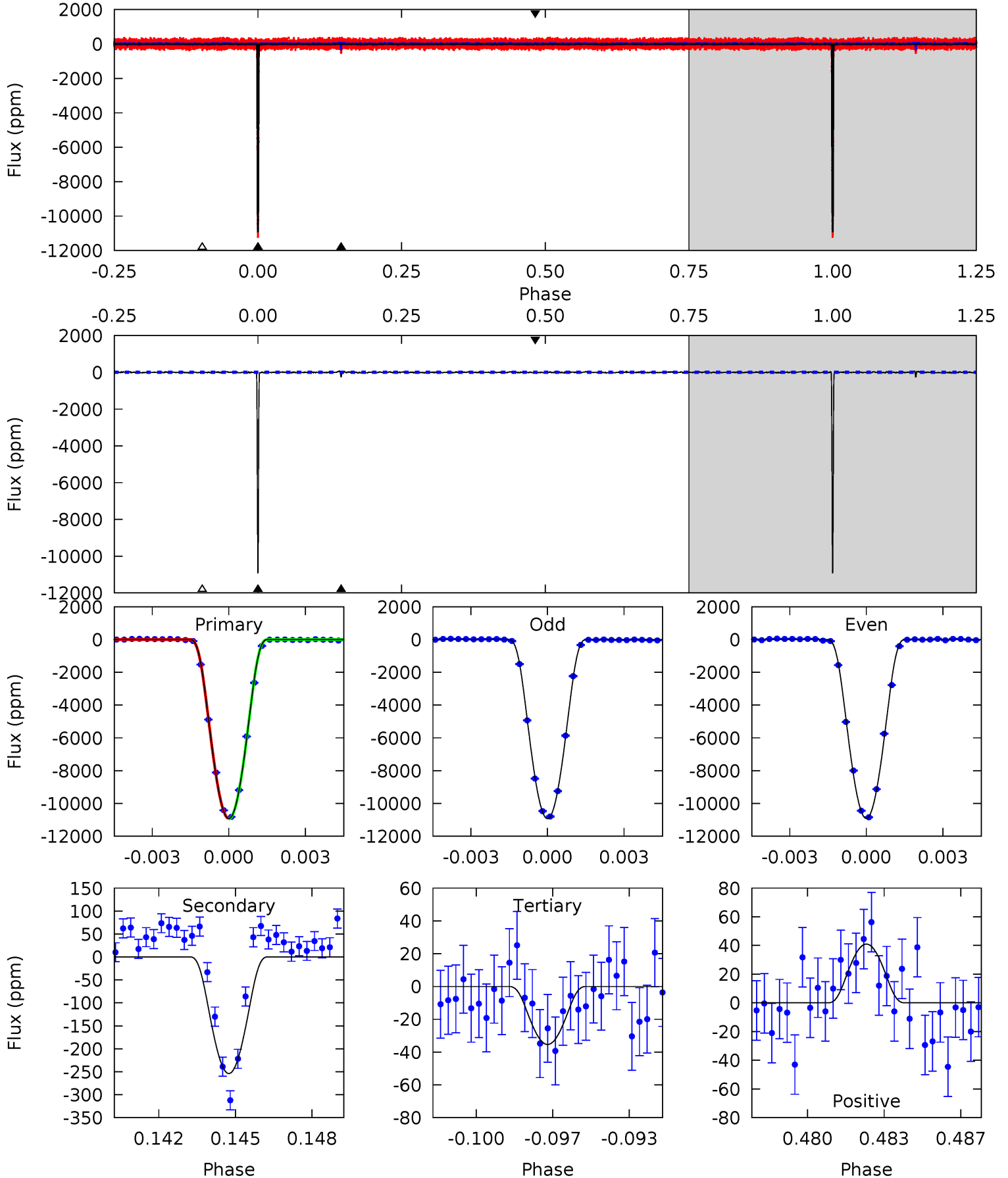
TCE 008223328-01 P= 35.516198 Days  $T_0=165.930412$  (BKJD)



# DV Model-Shift Uniqueness Test

008223328-01, P = 35.516198 Days, E = 130.414231 Days

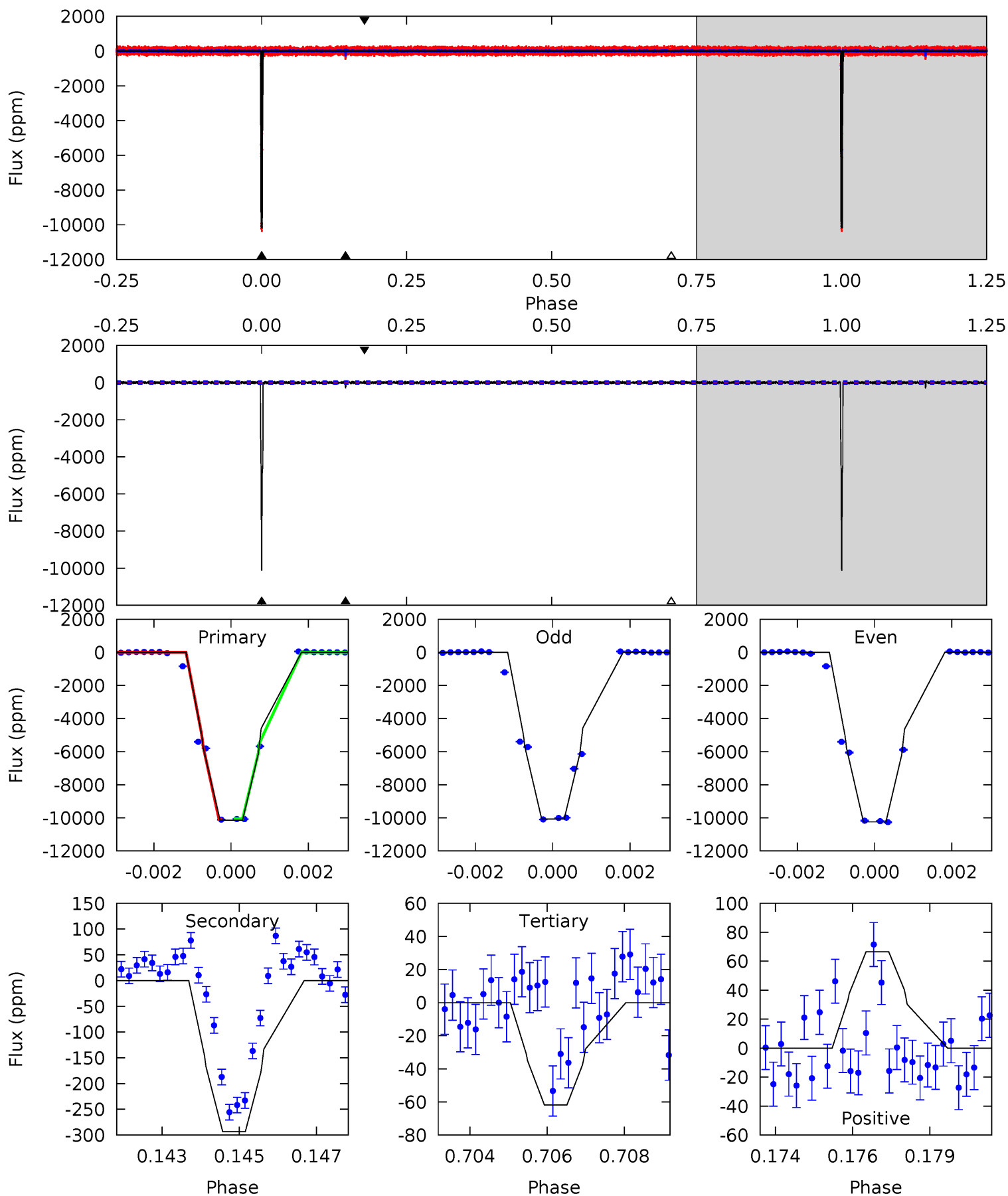
| Pri  | Sec  | Ter  | Pos  | FA <sub>1</sub> | FA <sub>2</sub> | F <sub>Red</sub> | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM  | Shape | TAT  |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 1665 | 38.7 | 5.39 | 6.25 | 5.23            | 2.92            | 2.11             | 1660    | 1659    | 33.3    | 32.4    | 1.61    | 0.99 | 0.01  | 2.99 |



# Alt Model-Shift Uniqueness Test

008223328-01, P = 35.516198 Days, E = 130.414214 Days

| Pri   | Sec  | Ter  | Pos  | FA <sub>1</sub> | FA <sub>2</sub> | F <sub>Red</sub> | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM  | Shape | TAT |
|-------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|-----|
| 740.2 | 21.4 | 4.51 | 4.86 | 5.30            | 3.05            | 1.20             | 735.7   | 735.3   | 16.9    | 16.5    | 6.01    | 0.99 | 0.01  | 0   |



### Stellar Parameters For KIC 008223328

|        | $T_{\text{eff}}(K)$ | $\log(g)$                 | [Fe/H]                     | $R (R_{\odot})$           | $M(M_{\odot})$            | $p_{\star} (\text{g}\cdot\text{cm}^{-3})$ |
|--------|---------------------|---------------------------|----------------------------|---------------------------|---------------------------|---|
|        | $5514^{+74}_{-83}$  | $4.505^{+0.049}_{-0.091}$ | $-0.060^{+0.150}_{-0.150}$ | $0.871^{+0.098}_{-0.053}$ | $0.883^{+0.050}_{-0.050}$ | $1.885^{+0.346}_{-0.505}$                 |
|        | +1%/-2%             | +1%/-2%                   | +250%/-250%                | +11%/-6%                  | +6%/-6%                   | +18%/-27%                                 |
| Source | SPE68               | SPE68                     | SPE68                      | DSEP                      |                           |   |

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

### Secondary Eclipse Parameters for KIC 008223328-01 / KOI 1767.01

| Detrend | Depth (ppm)   | $R_p (R_{\oplus})$      | $T_{\text{max}} (K)$ | $T_{\text{obs}} (K)$ | $A_{\text{obs}}$ |
|---------|---------------|-------------------------|----------------------|----------------------|------------------|
| DV      | $-254 \pm 7$  | $16.35^{+1.19}_{-1.12}$ | $706^{+22}_{-17}$    | $2520^{+42}_{-38}$   | $22^{+3}_{-3}$   |
| Alt.    | $-293 \pm 14$ | $10.00^{+1.02}_{-0.94}$ | $708^{+22}_{-18}$    | $2922^{+81}_{-69}$   | $66^{+15}_{-11}$ |

$T_{\text{max}}$  = Theoretical Maximum Planetary Temperature

$T_{\text{obs}}$  = Observed Planetary Temperature (Assuming  $A=0.3$ )

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

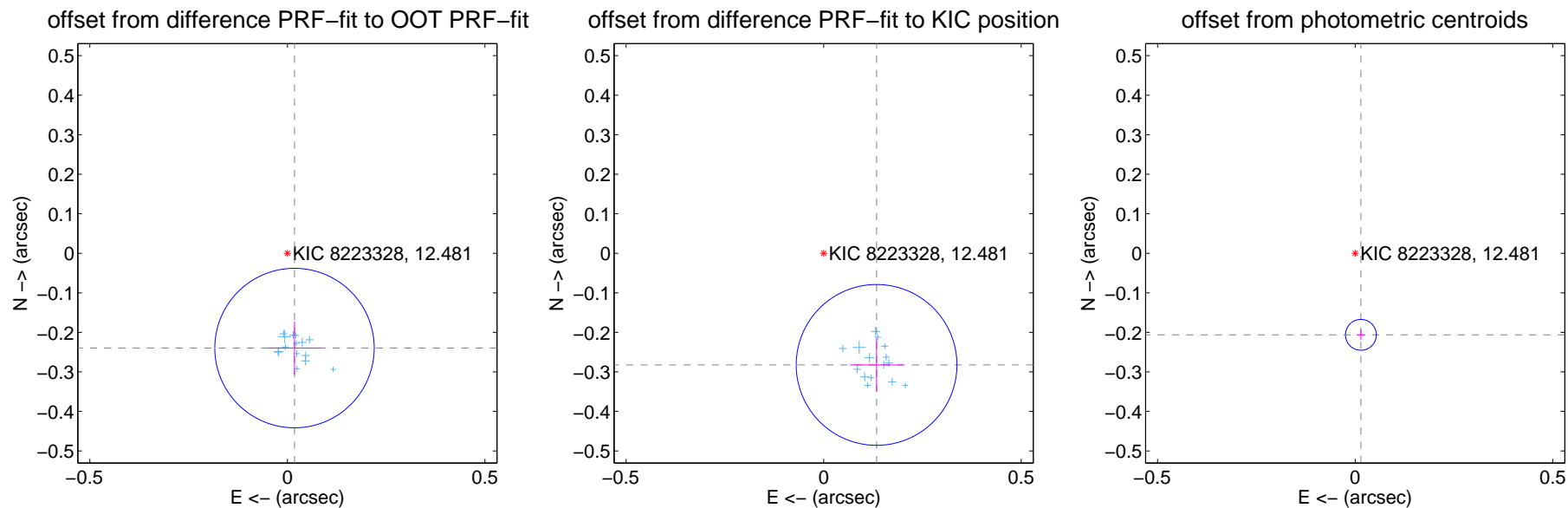
## DV Centroid Data

Supplemental centroid analysis for 008223328-01. Kepler magnitude: 12.48. Transit SNR 747.36

There are 15 quarters with good PRF difference image offsets

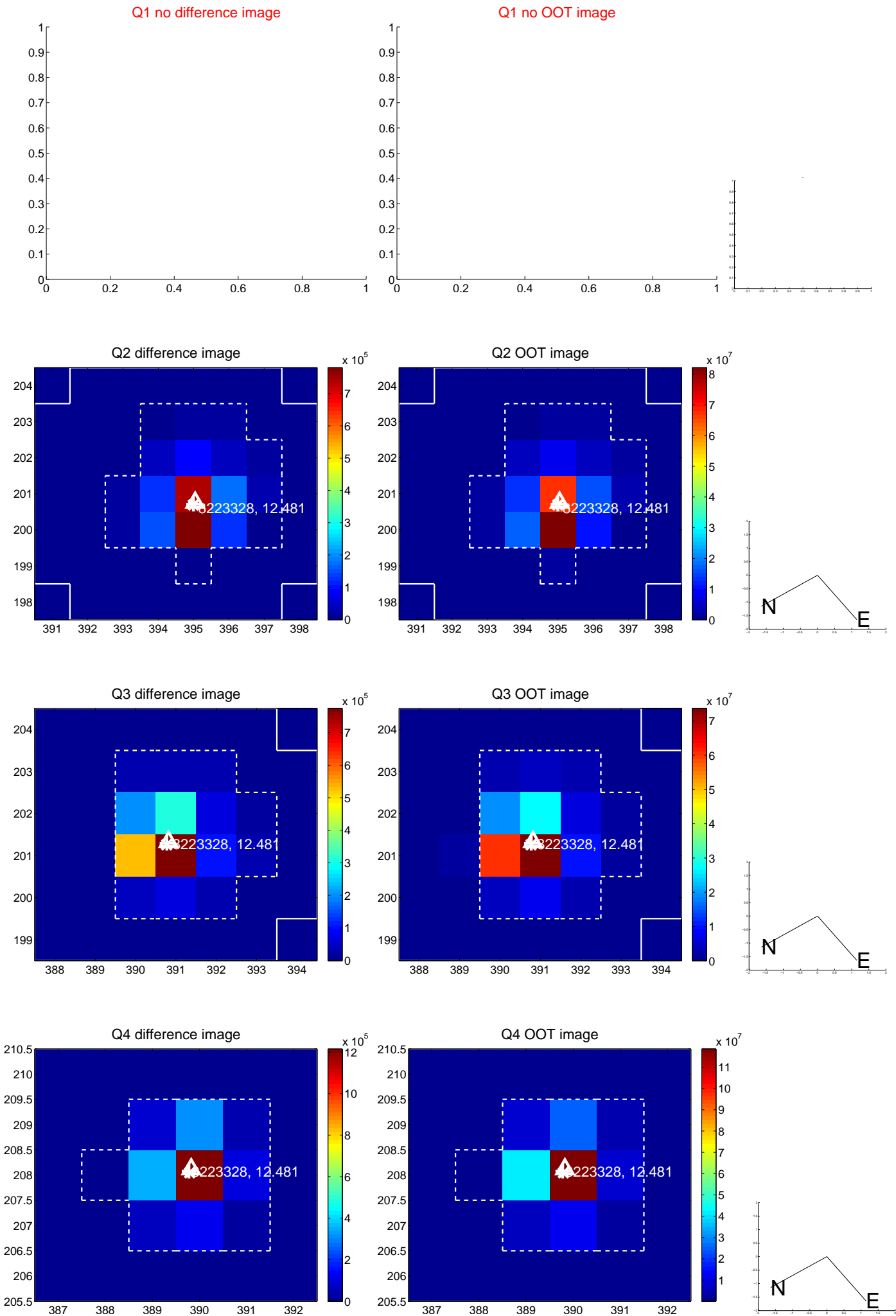
The direct PRF centroid is offset from the target star catalog position by about 0.14 arcsec

|   | Distance in arcsec | Distance / $\sigma$ | $\Delta$ RA        | $\Delta$ Dec       |
|---|--------------------|---------------------|--------------------|--------------------|
| PRF-fit source offset from OOT          | $0.240 \pm 0.067$  | 3.57                | $-0.018 \pm 0.067$ | $-0.240 \pm 0.067$ |
| PRF-fit source offset from KIC position | $0.313 \pm 0.068$  | 4.61                | $-0.134 \pm 0.068$ | $-0.282 \pm 0.068$ |
| photometric centroid source offset      | $0.21 \pm 0.01$    | 15.90               | $-0.01 \pm 0.01$   | $-0.21 \pm 0.01$   |

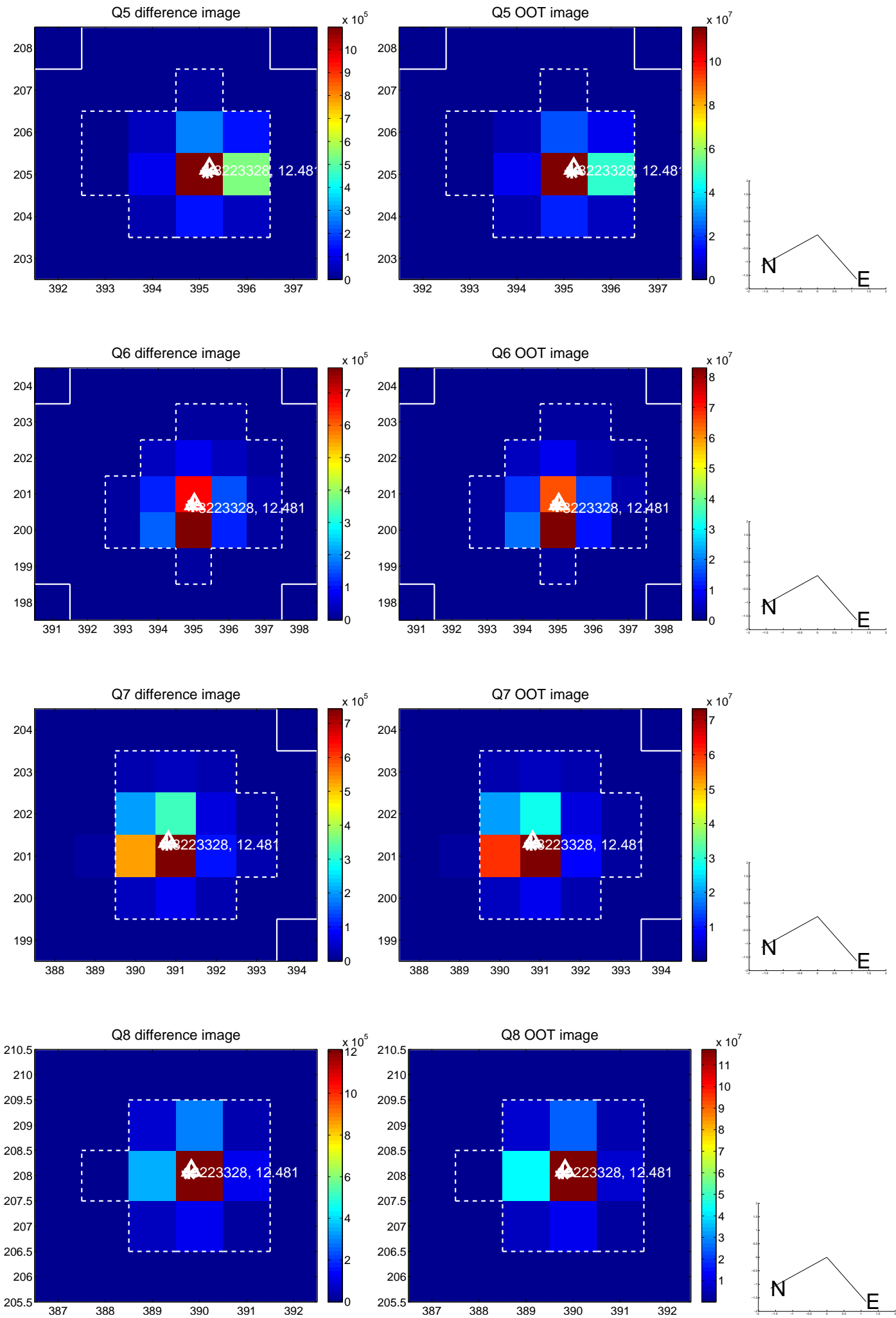


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three- $\sigma$ . Red \*: target star. Blue \*: Other stars. Text next to a star gives its KIC ID and kepmag. KIC IDs > 15,000,000 are from the UKIRT catalog.

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

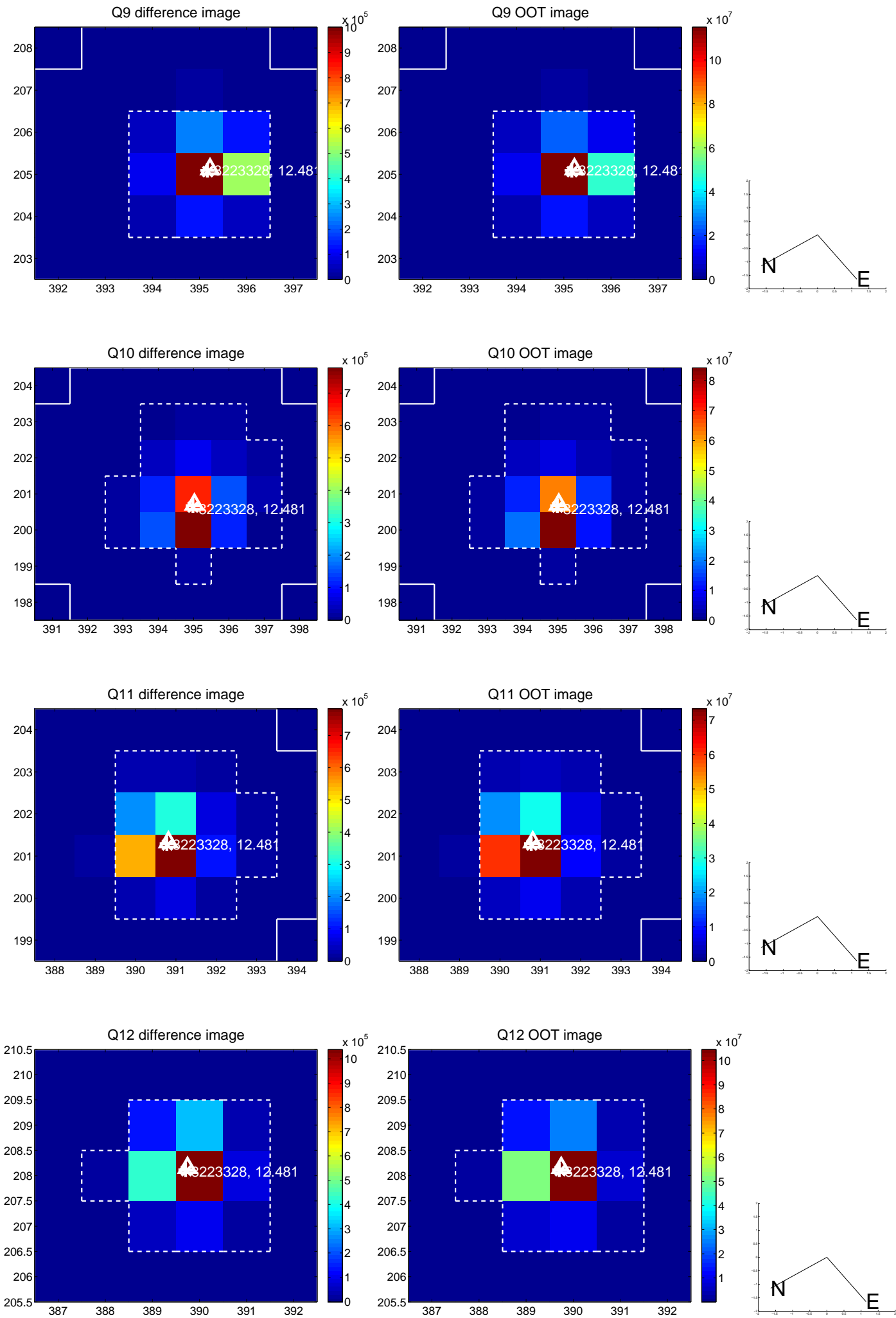


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

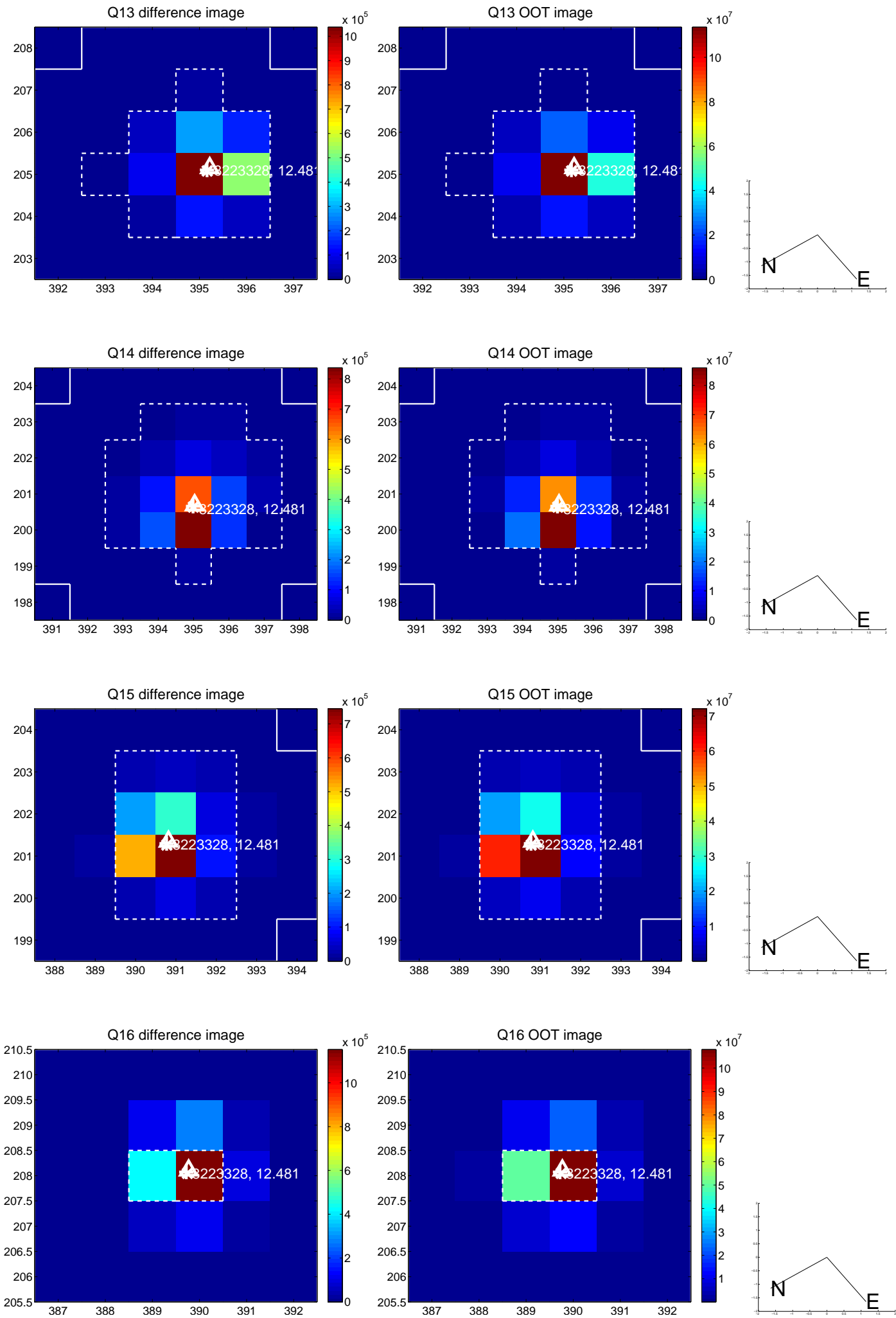




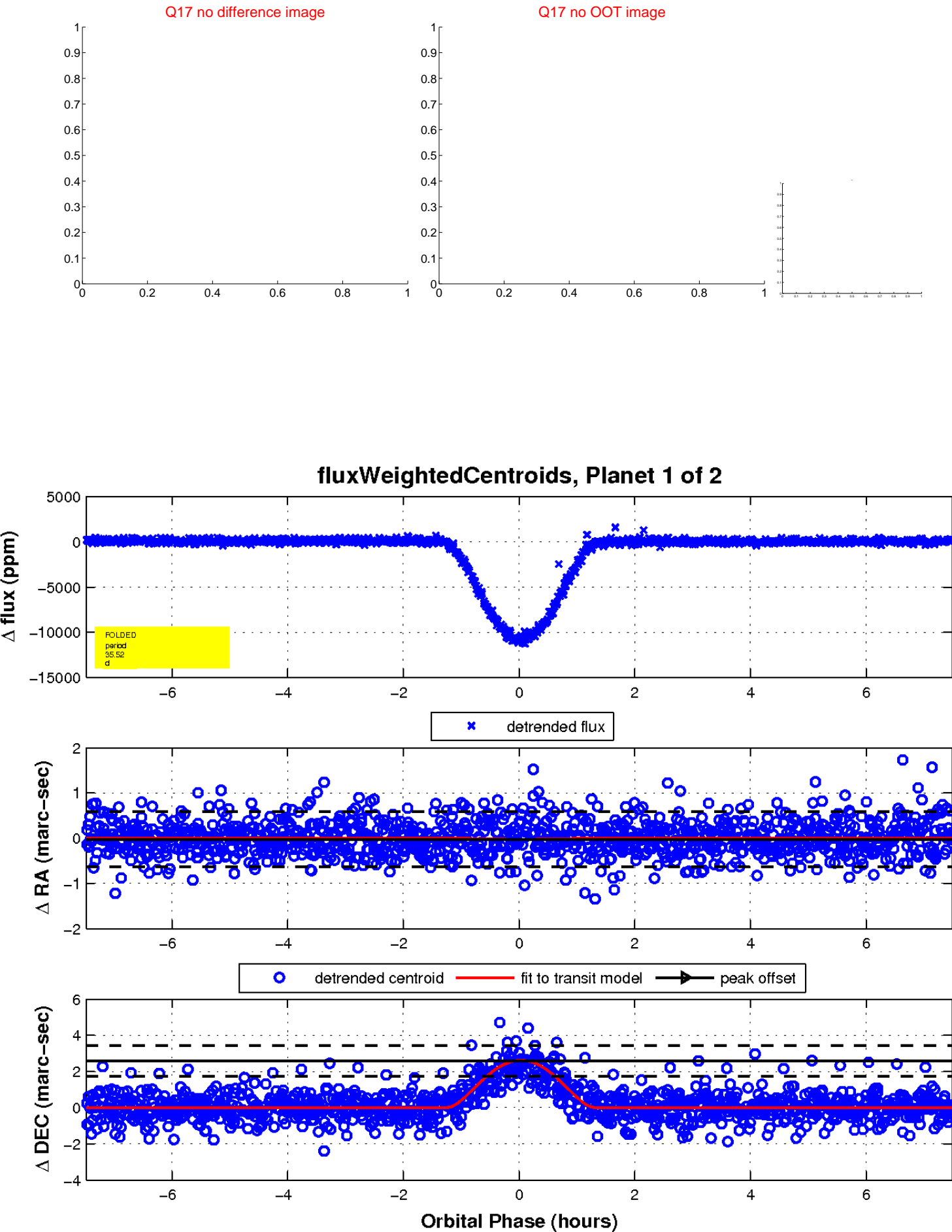
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

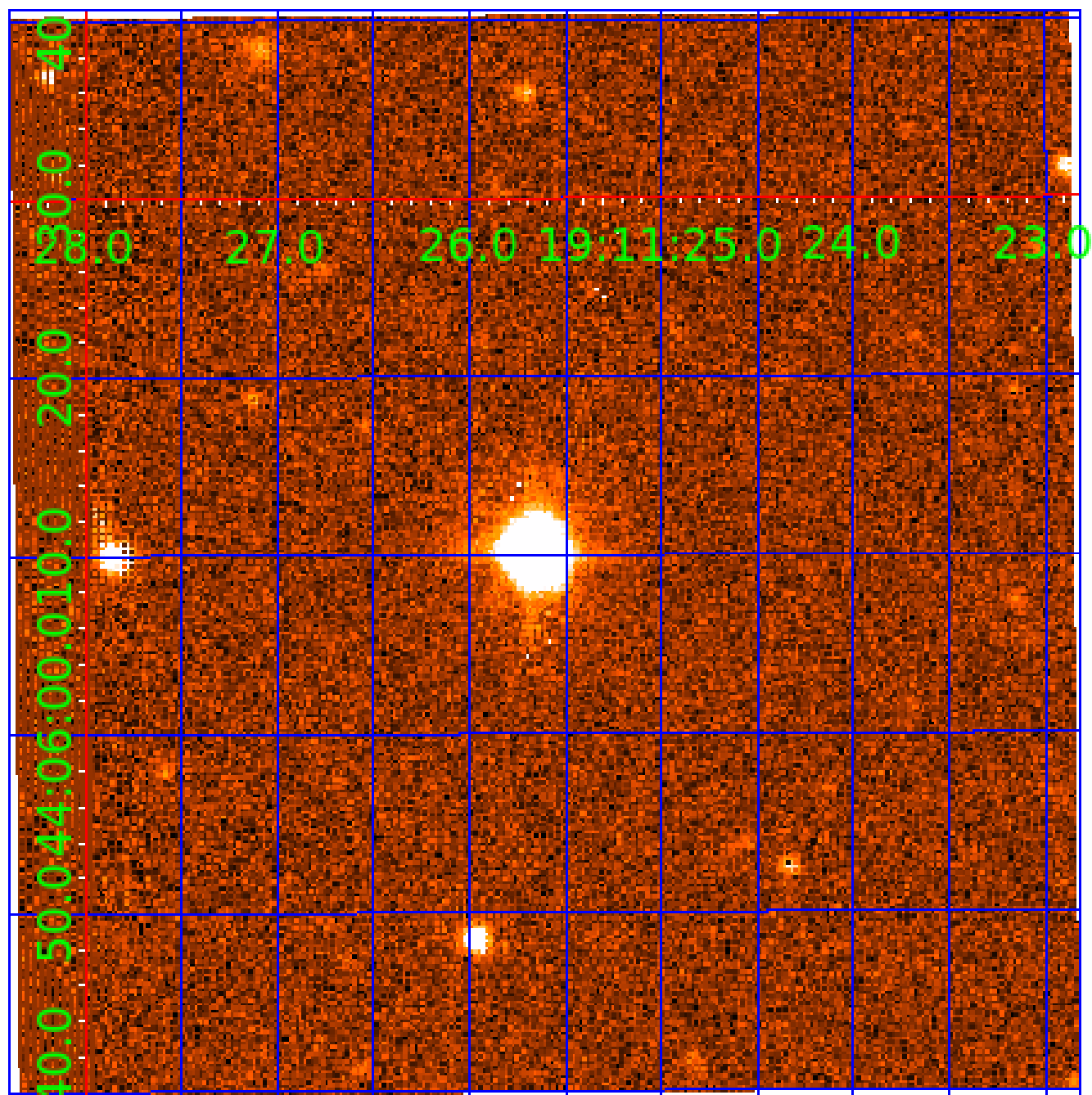


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 008223328

## 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) | $R_p$ ( $R_{\oplus}$ ) | $S_p$ ( $S_{\oplus}$ ) |
|--------------|----------|---------|---------------|--------------|-------------|------------------|-------|-------|-----------------------------|-----------------|------------------------|------------------------|
| 008223328-01 | OBS      | 1767.01 | 35.516198     | 165.930429   | 10921.7     | 2.498            | 806.2 | 747.4 | 0.87                        | 5514            | 16.13                  | 15.24                  |
| 008223328-02 | OBS      | No      | 35.516210     | 135.553283   | 377.9       | 1.839            | 23.6  | 29.2  | 0.87                        | 5514            | 2.98                   | 15.24                  |

## Robovetter Results

| TCE          | Run Type | Disp | Score | N | S | C | E | Comments   |
|--------------|----------|------|-------|---|---|---|---|--|
| 008223328-01 | OBS      | FP   | 0.00  | 0 | 1 | 0 | 0 | MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE |
| 008223328-02 | OBS      | FP   | 0.00  | 1 | 1 | 0 | 0 | IS_SEC_TCE                                       |

**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](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

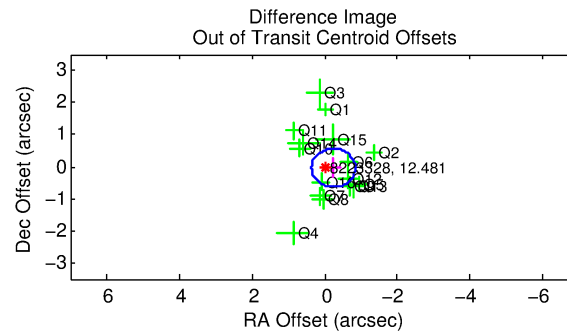
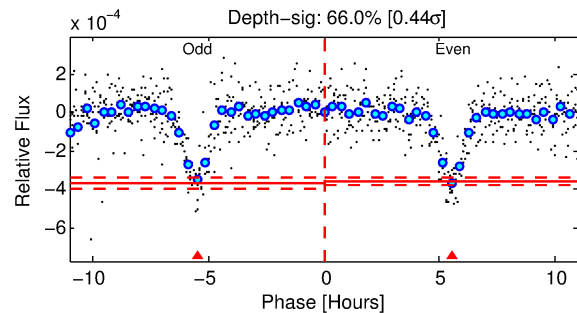
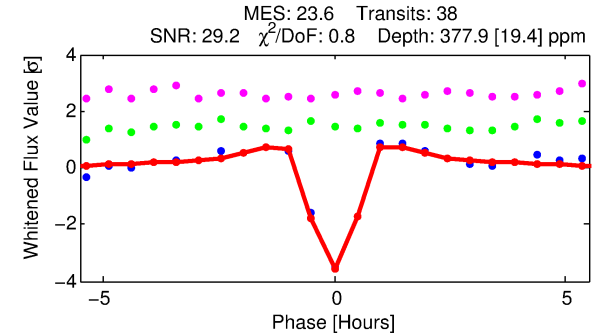
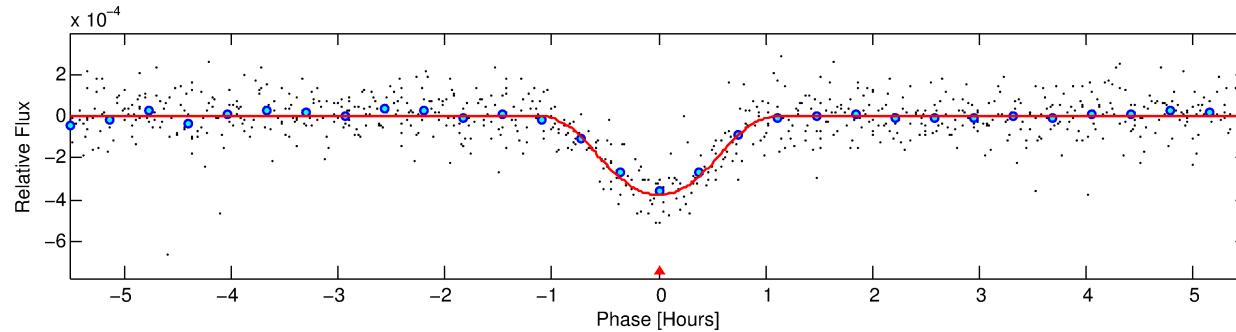
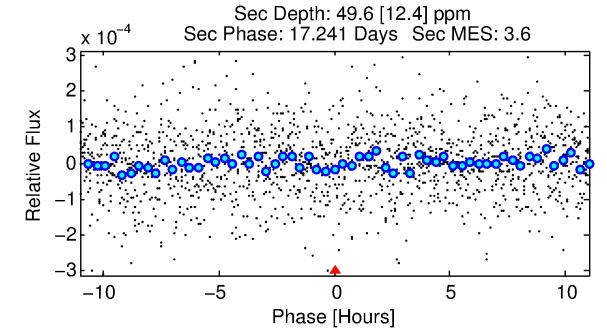
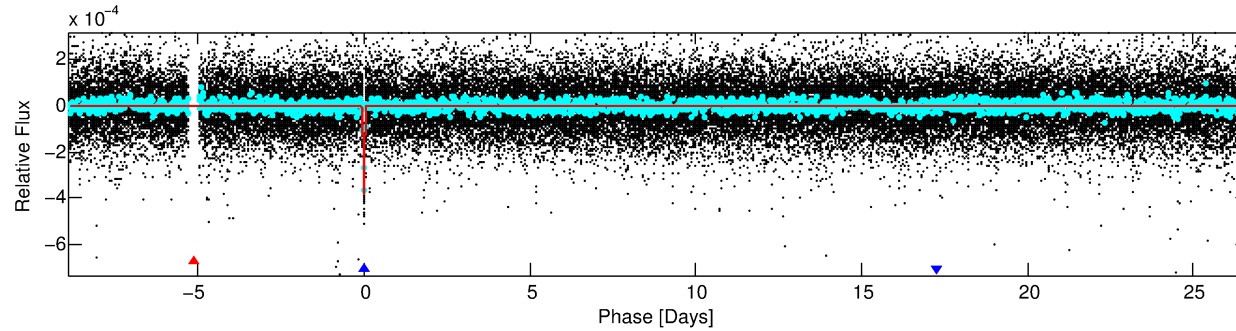
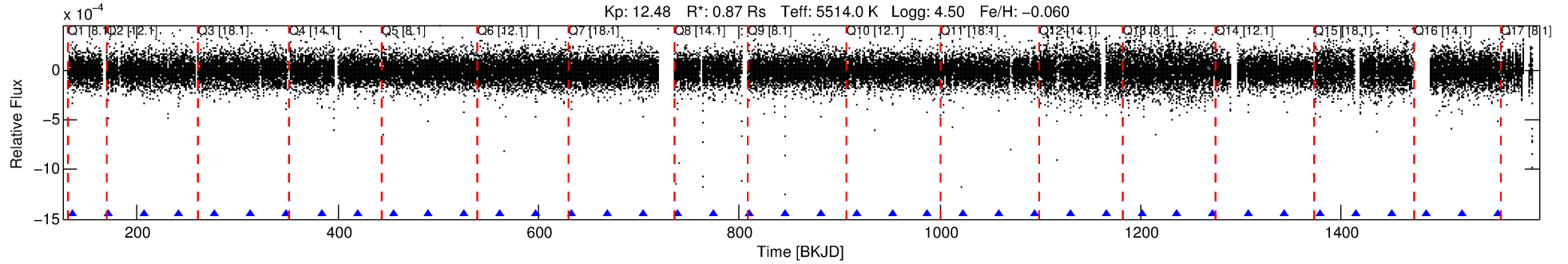
## Ephemeris Match Information For 008223328-02

No Significant Match Found

# DV One-Page Summary

KIC: 8223328 Candidate: 2 of 2 Period: 35.516 d

KOI: K01767 Corr: No Ephemeris Match



## DV Fit Results:

Period = 35.51621 [0.00006] d  
Epoch = 135.5533 [0.0012] BKJD  
Rp/R\* = 0.0314 [0.0281]  
a/R\* = 42.10 [12.89]  
b = 0.99 [0.05]  
Seff = 15.24 [2.58]  
Teq = 504 [21] K  
Rp = 2.98 [2.69] Re  
a = 0.2031 [0.0208] AU  
Ag = 126.78 [230.28] [0.55σ]  
Teffp = 2614 [1183] K [1.78σ]

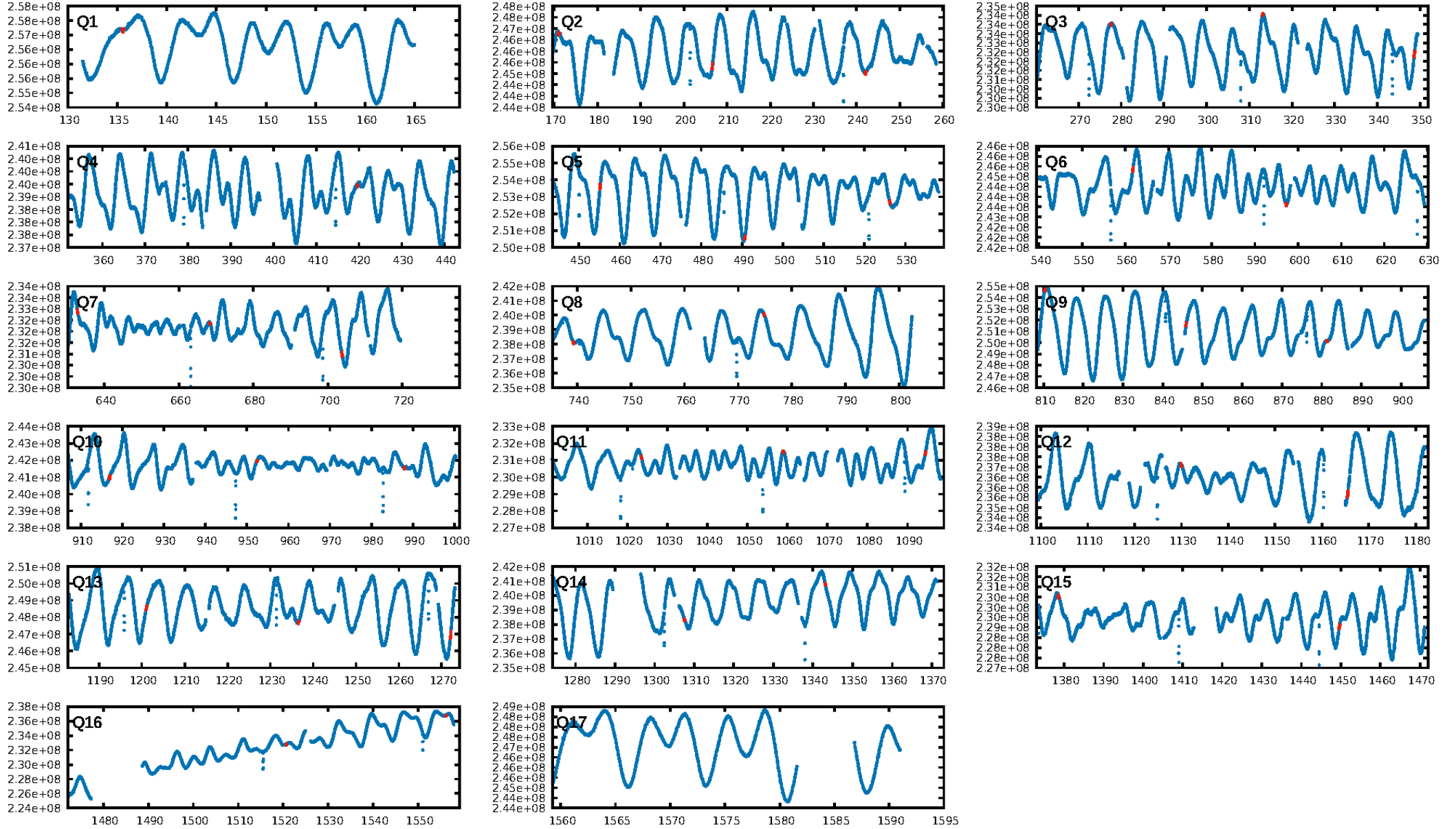
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 92.6%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 1.07e-59  
RollingBand-fgt: 1.00 [37/37]  
GhostDiagnostic-chr: 3.601  
Centroid-sig: 1.9%  
Centroid-so: 0.576 arcsec [1.49σ]  
OotOffset-rm: 0.240 arcsec [1.21σ]  
OotOffset-st: 4/4/4/4 [16]  
KicOffset-rm: 0.358 arcsec [1.82σ]  
KicOffset-st: 4/4/4/4 [16]  
DiffImageQuality-fgm: 1.00 [16/16]  
DiffImageOverlap-fno: 1.00 [16/16]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 05:06:09 Z

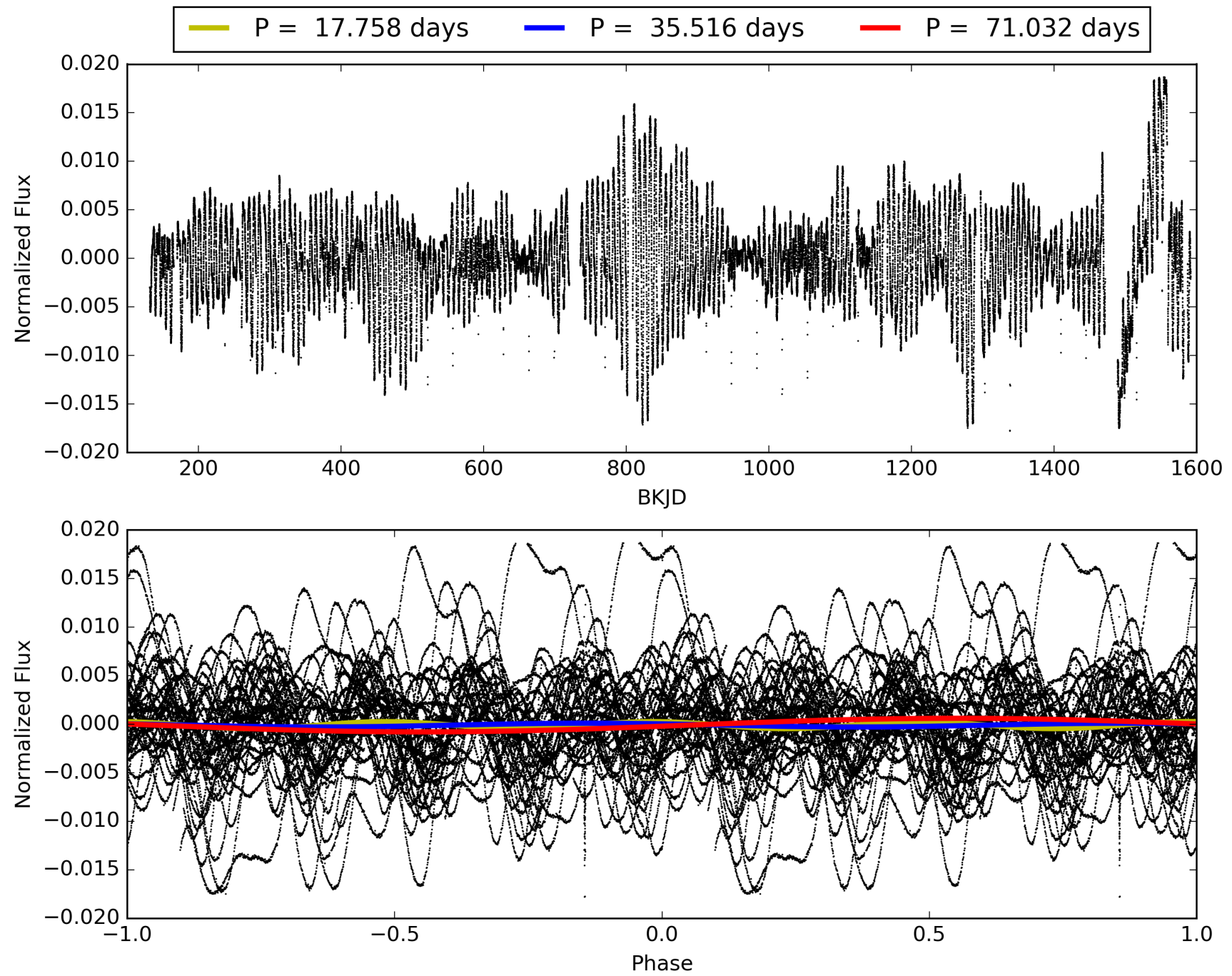
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 008223328-02, PDC Light Curves





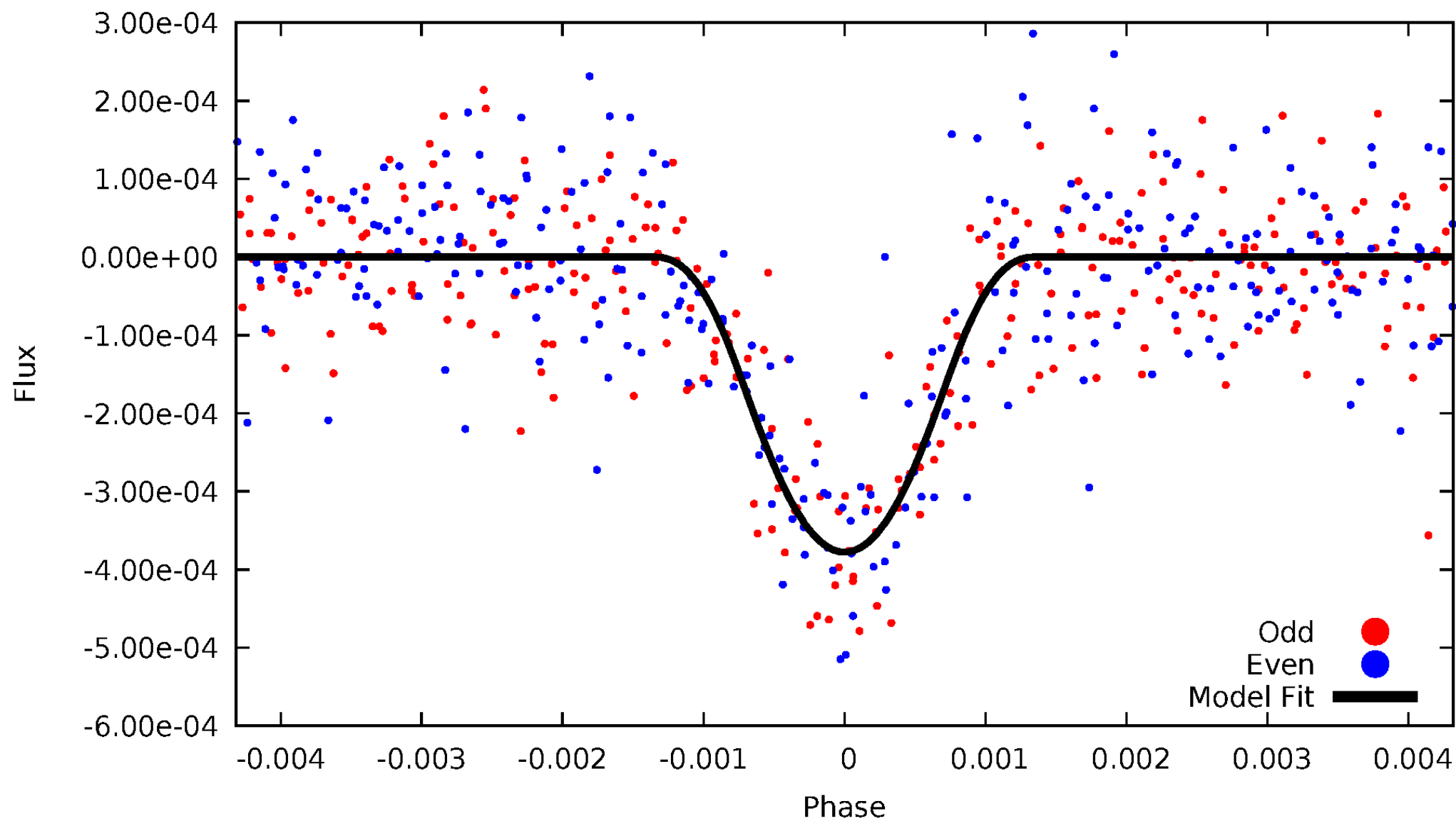
TCE 008223328-02





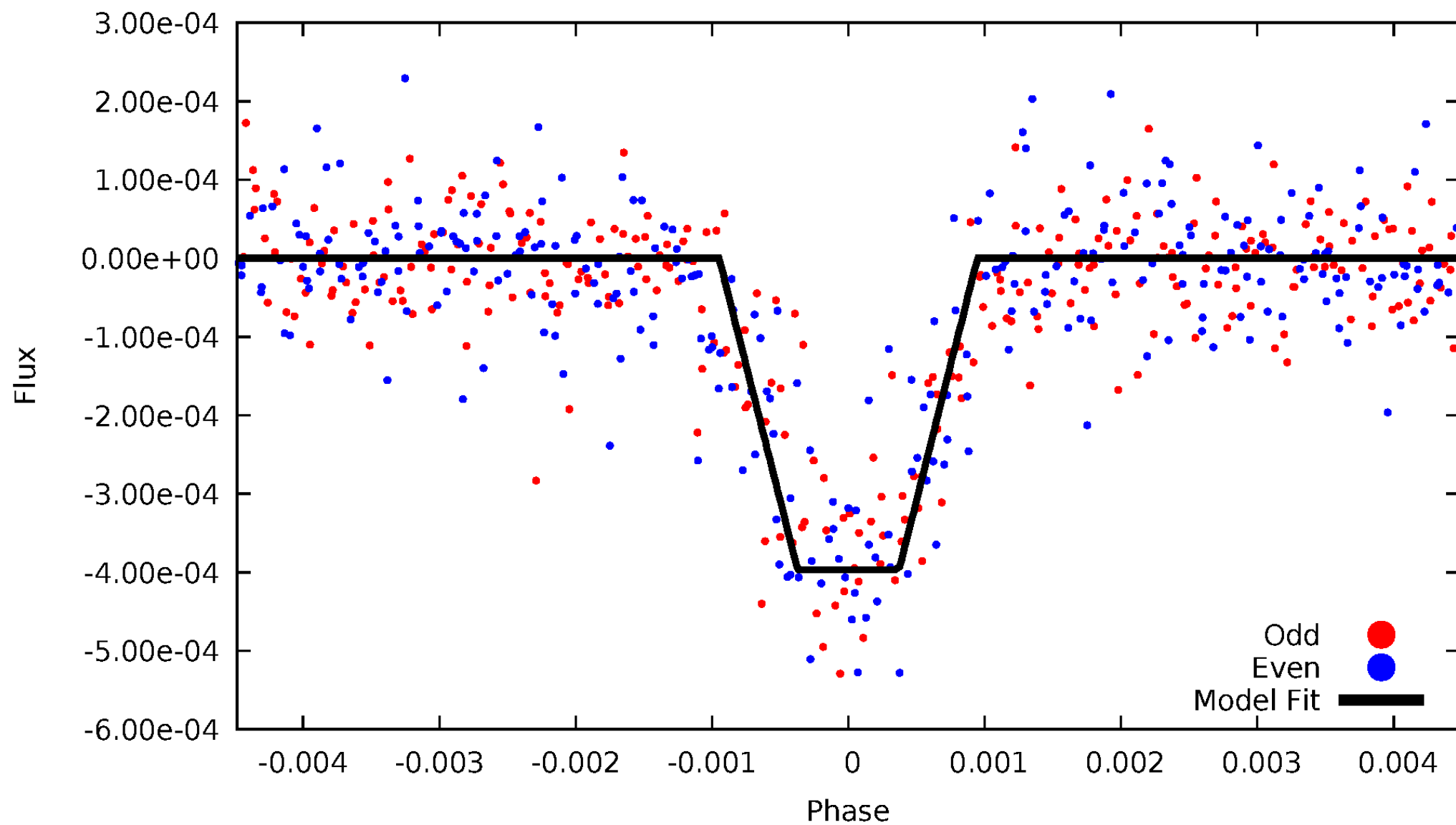
# DV Odd/Even

TCE 008223328-02



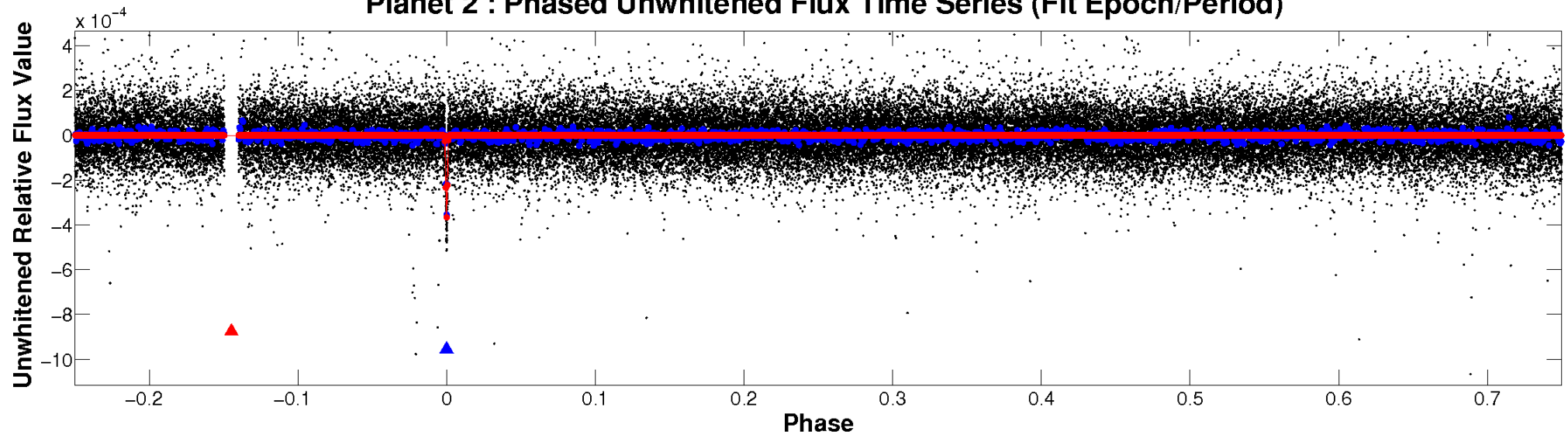
# ALT Odd/Even

TCE 008223328-02

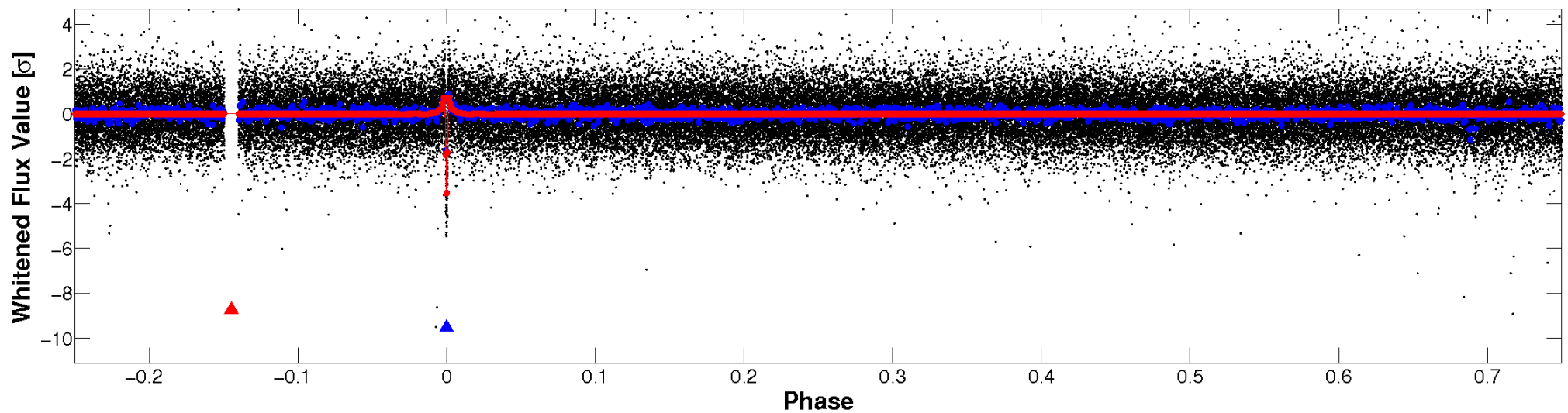


# Non-Whitened Vs. Whitened Light Curve

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

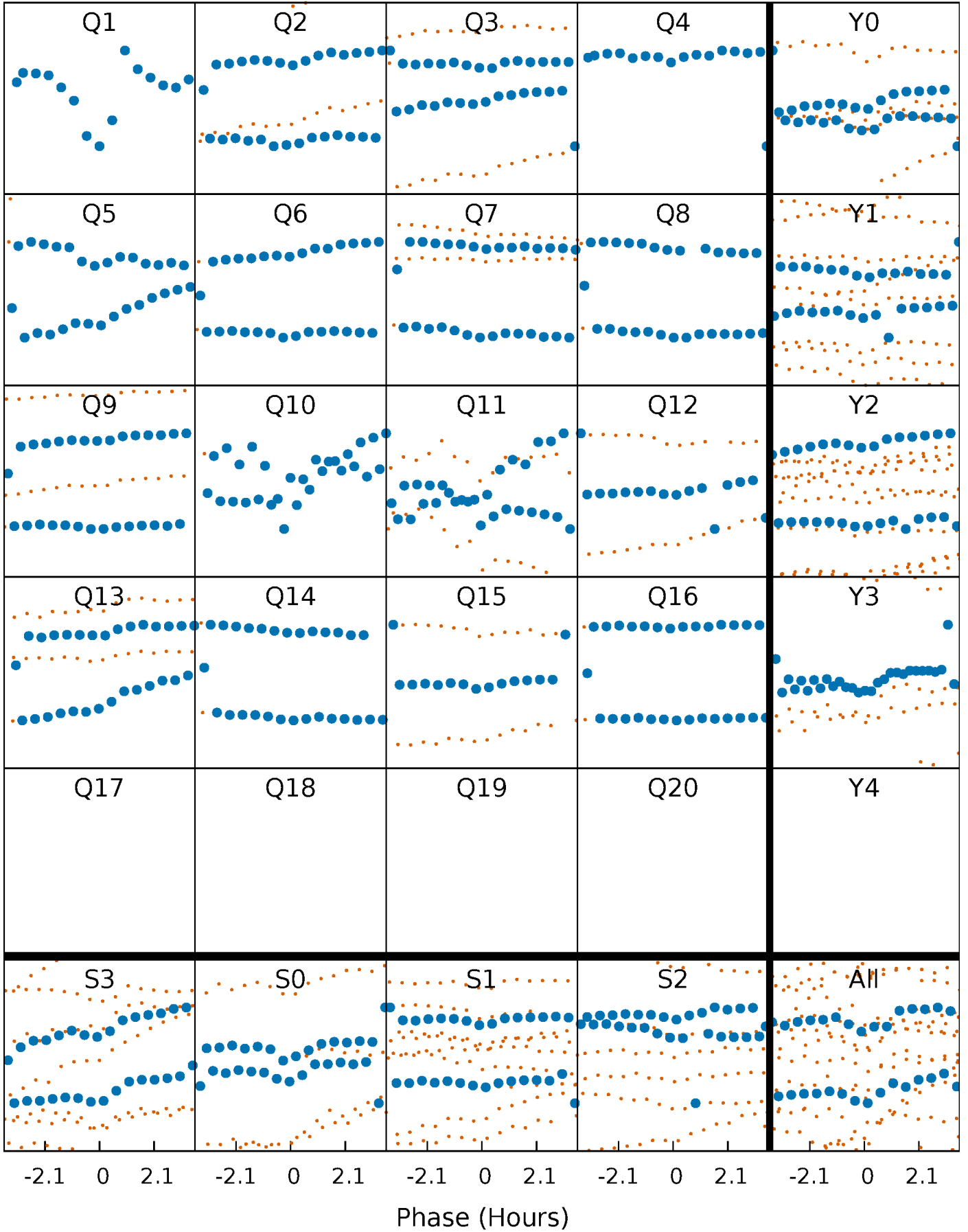


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



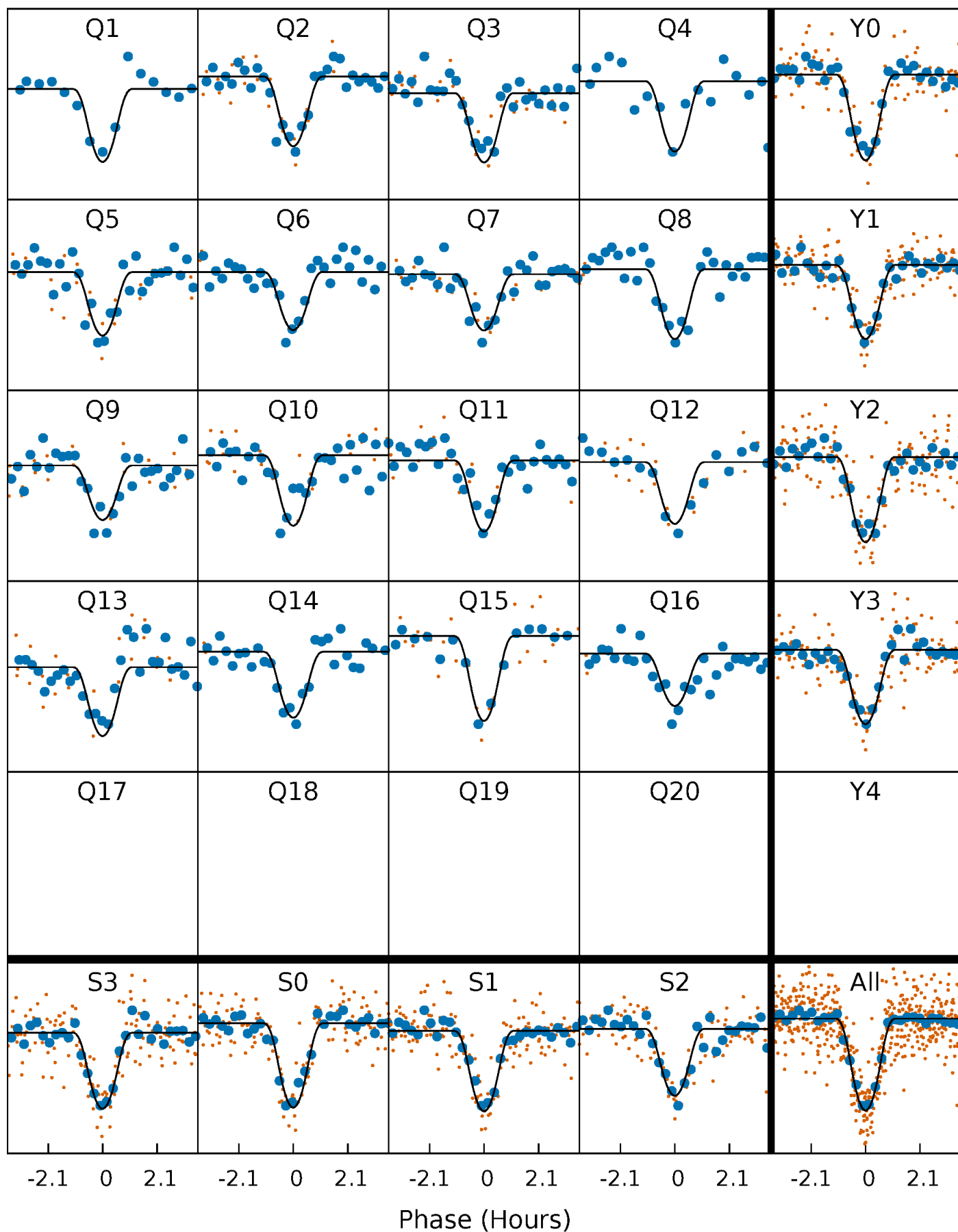
# PDC Quarter-Phased Transit Curves

TCE 008223328-02   P= 35.516210 Days    $T_0=135.553283$  (BKJD)



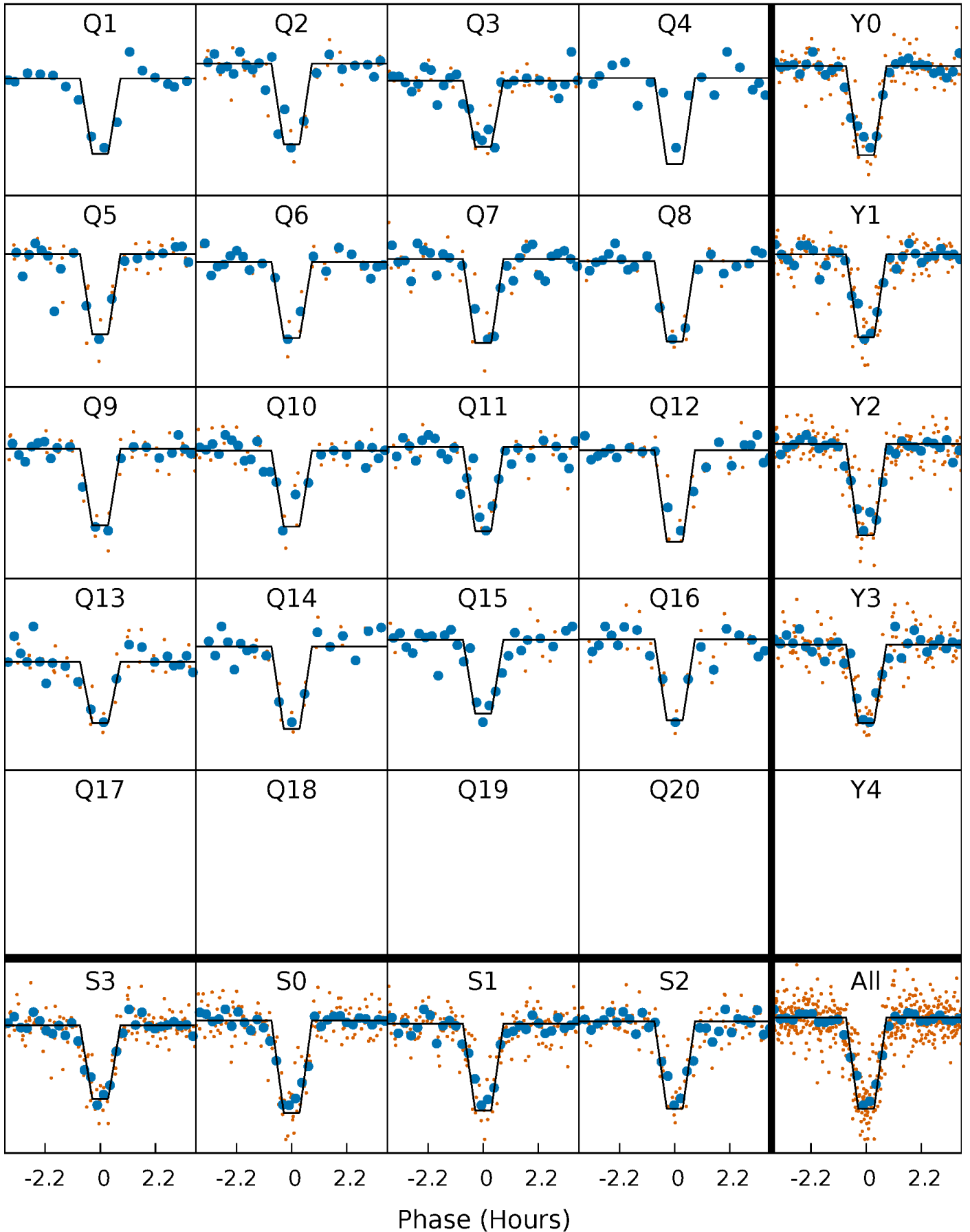
# DV Quarter-Phased Transit Curves

TCE 008223328-02 P= 35.516210 Days  $T_0=135.553283$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

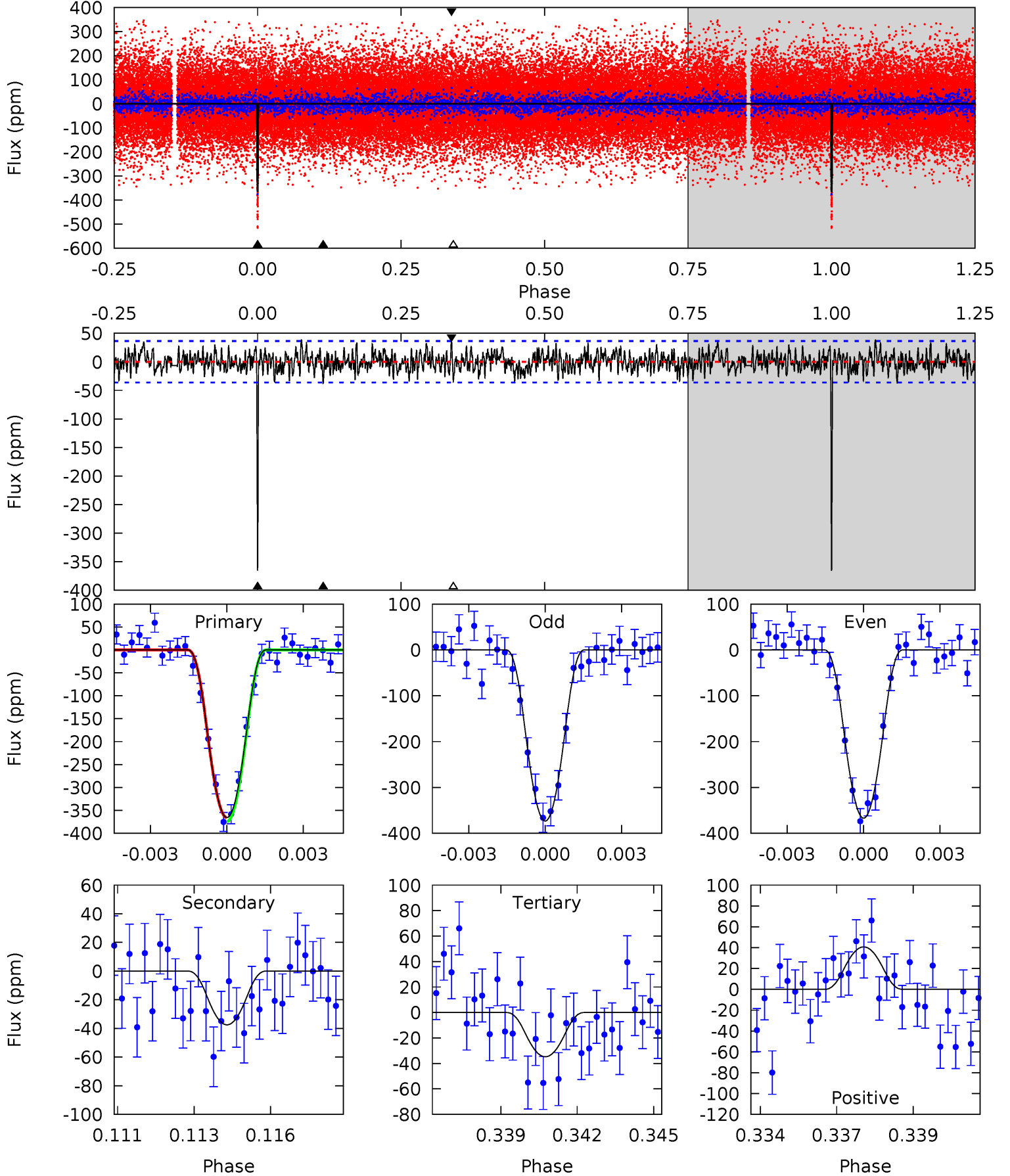
TCE 008223328-02   P= 35.516198 Days    $T_0=135.553148$  (BKJD)



# DV Model-Shift Uniqueness Test

008223328-02,  $P = 35.516210$  Days,  $E = 100.037073$  Days

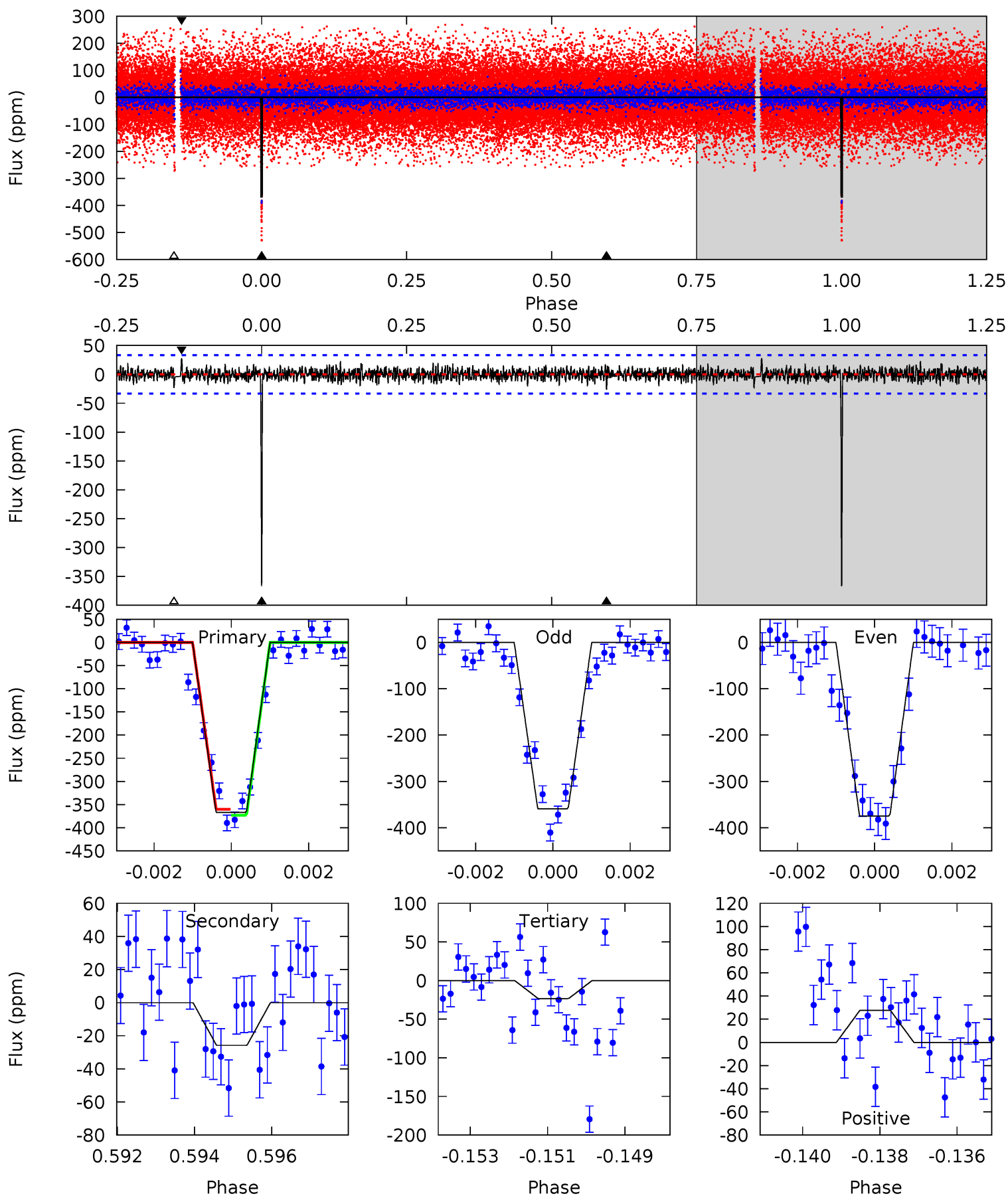
| Pri  | Sec  | Ter  | Pos  | FA <sub>1</sub> | FA <sub>2</sub> | F <sub>Red</sub> | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM  | Shape | TAT  |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 53.1 | 5.44 | 5.05 | 5.91 | 5.28            | 3.01            | 1.89             | 48.1    | 47.2    | 0.40    | -0.47   | 0.45    | 0.99 | 0.10  | 0.62 |



# Alt Model-Shift Uniqueness Test

008223328-02, P = 35.516198 Days, E = 100.036950 Days

| Pri  | Sec  | Ter  | Pos  | FA <sub>1</sub> | FA <sub>2</sub> | F <sub>Red</sub> | Pri-Ter | Pri-Pos | Sec-Ter | Sec-Pos | Odd-Evn | DMM  | Shape | TAT  |
|------|------|------|------|-----------------|-----------------|------------------|---------|---------|---------|---------|---------|------|-------|------|
| 58.6 | 4.13 | 3.72 | 4.42 | 5.34            | 3.11            | 1.06             | 54.9    | 54.2    | 0.40    | -0.29   | 1.21    | 1.00 | 0.07  | 1.03 |





### Stellar Parameters For KIC 008223328

|        | $T_{\text{eff}}(K)$ | $\log(g)$                 | [Fe/H]                     | $R (R_{\odot})$           | $M(M_{\odot})$            | $p_{\star} (g \cdot \text{cm}^{-3})$ |
|--------|---------------------|---------------------------|----------------------------|---------------------------|---------------------------|--------------------------------------|
|        | $5514^{+74}_{-83}$  | $4.505^{+0.049}_{-0.091}$ | $-0.060^{+0.150}_{-0.150}$ | $0.871^{+0.098}_{-0.053}$ | $0.883^{+0.050}_{-0.050}$ | $1.885^{+0.346}_{-0.505}$            |
|        | +1%/-2%             | +1%/-2%                   | +250%/-250%                | +11%/-6%                  | +6%/-6%                   | +18%/-27%                            |
| Source | SPE68               | SPE68                     | SPE68                      | DSEP                      |                           |                                      |

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

### Secondary Eclipse Parameters for KIC 008223328-02 / KOI

| Detrend | Depth (ppm) | $R_p (R_{\oplus})$     | $T_{max} (K)$     | $T_{obs} (K)$         | $A_{obs}$         |
|---------|-------------|------------------------|-------------------|-----------------------|-------------------|
| DV      | $-37 \pm 7$ | $3.38^{+2.23}_{-2.05}$ | $707^{+22}_{-18}$ | $2967^{+1001}_{-398}$ | $73^{+425}_{-48}$ |
| Alt.    | $-26 \pm 6$ | $2.70^{+2.25}_{-1.81}$ | $705^{+24}_{-17}$ | $3025^{+1294}_{-473}$ | $83^{+715}_{-60}$ |

$T_{max}$  = 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  $A_{obs} \gg 1.0$

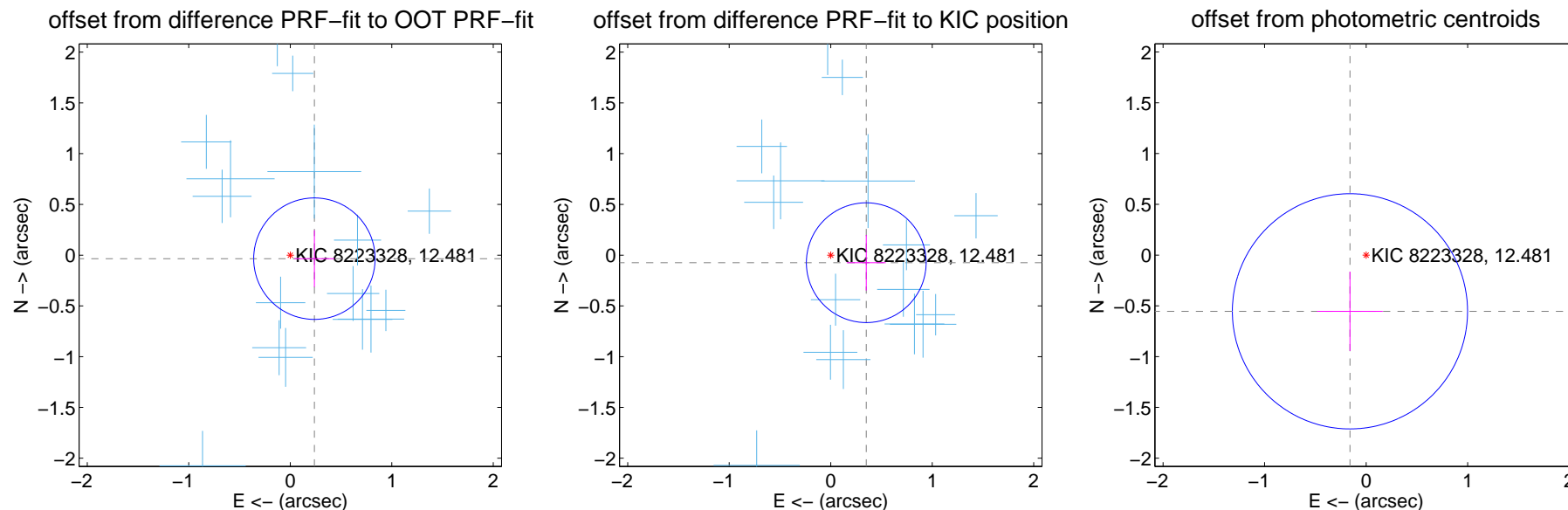
## DV Centroid Data

Supplemental centroid analysis for 008223328-02. Kepler magnitude: 12.48. Transit SNR 29.22

There are 16 quarters with good PRF difference image offsets

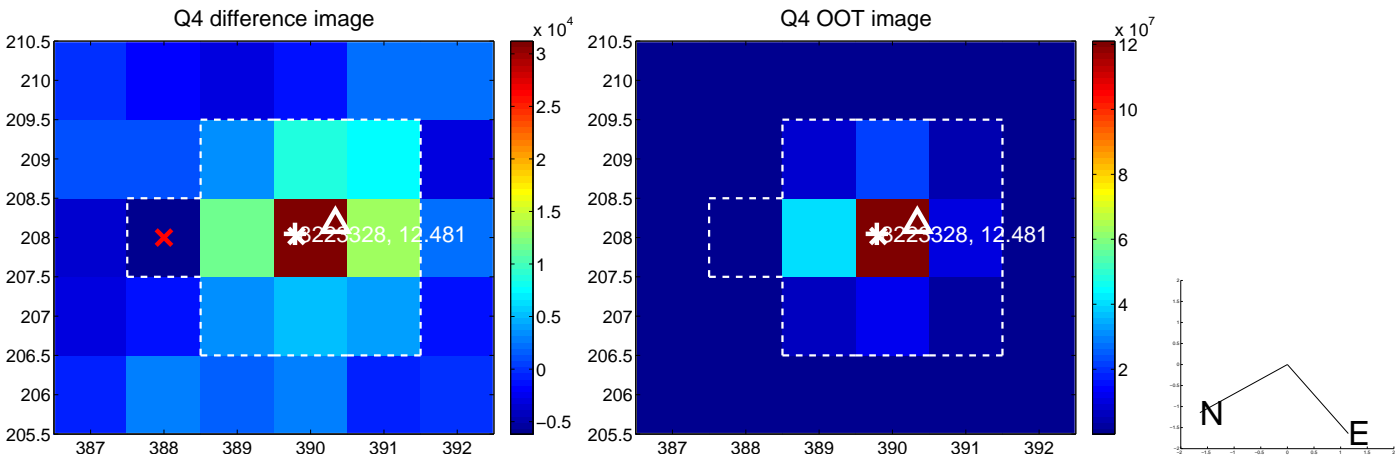
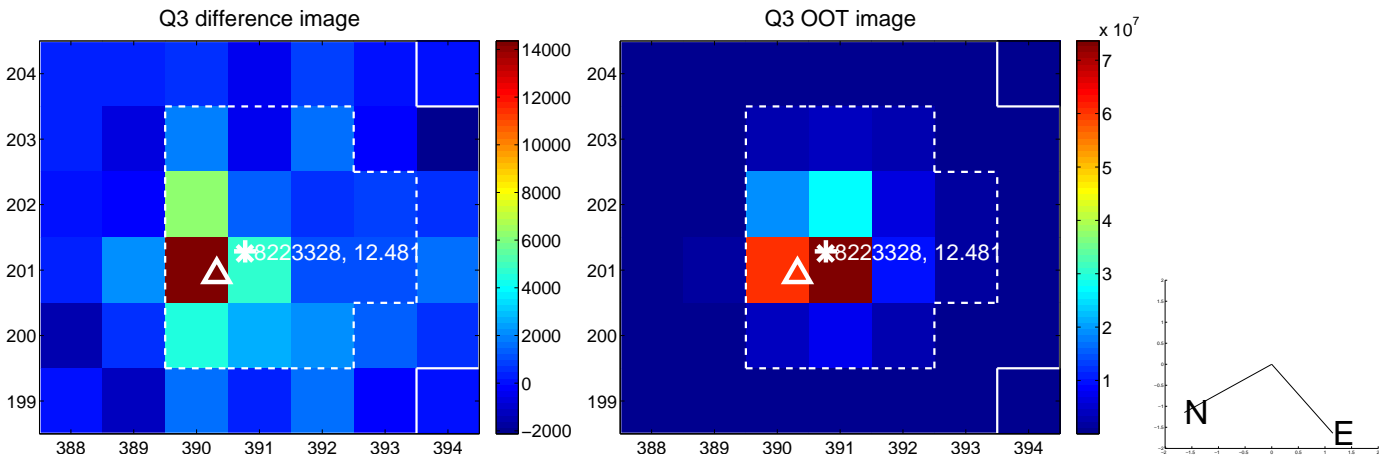
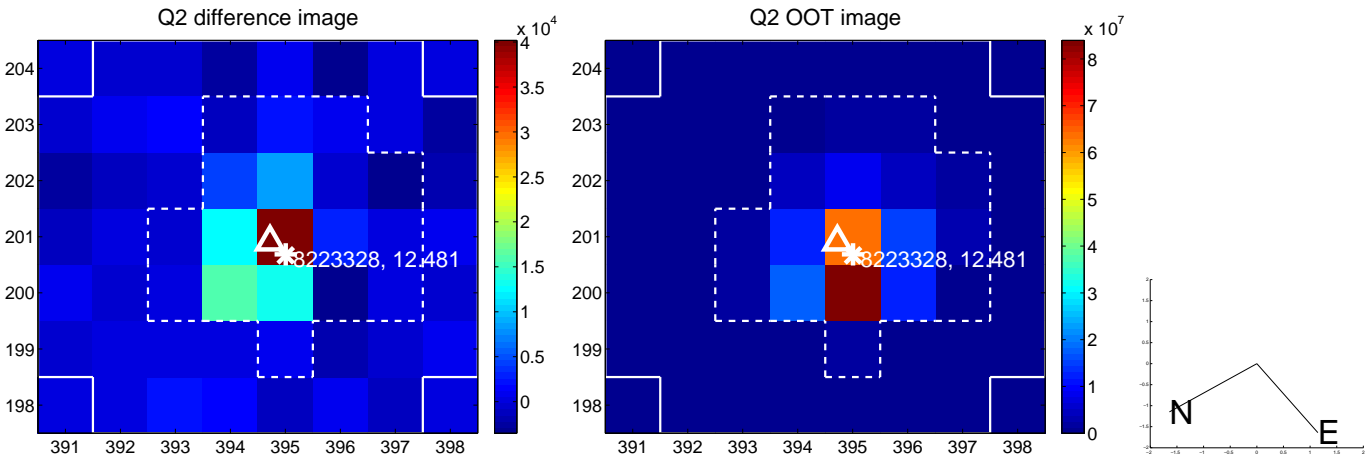
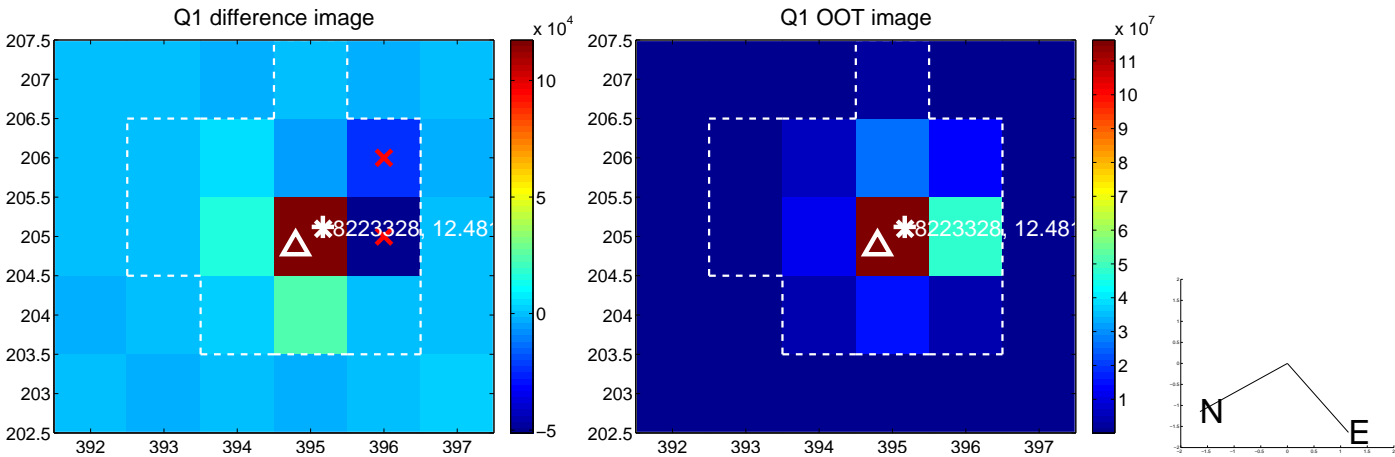
The direct PRF centroid is offset from the target star catalog position by about 0.15 arcsec

|   | Distance in arcsec | Distance / $\sigma$ | $\Delta$ RA        | $\Delta$ Dec       |
|---|--------------------|---------------------|--------------------|--------------------|
| PRF-fit source offset from OOT          | $0.240 \pm 0.199$  | 1.21                | $-0.238 \pm 0.197$ | $-0.035 \pm 0.279$ |
| PRF-fit source offset from KIC position | $0.358 \pm 0.197$  | 1.82                | $-0.350 \pm 0.192$ | $-0.074 \pm 0.274$ |
| photometric centroid source offset      | $0.58 \pm 0.39$    | 1.49                | $0.16 \pm 0.32$    | $-0.55 \pm 0.39$   |

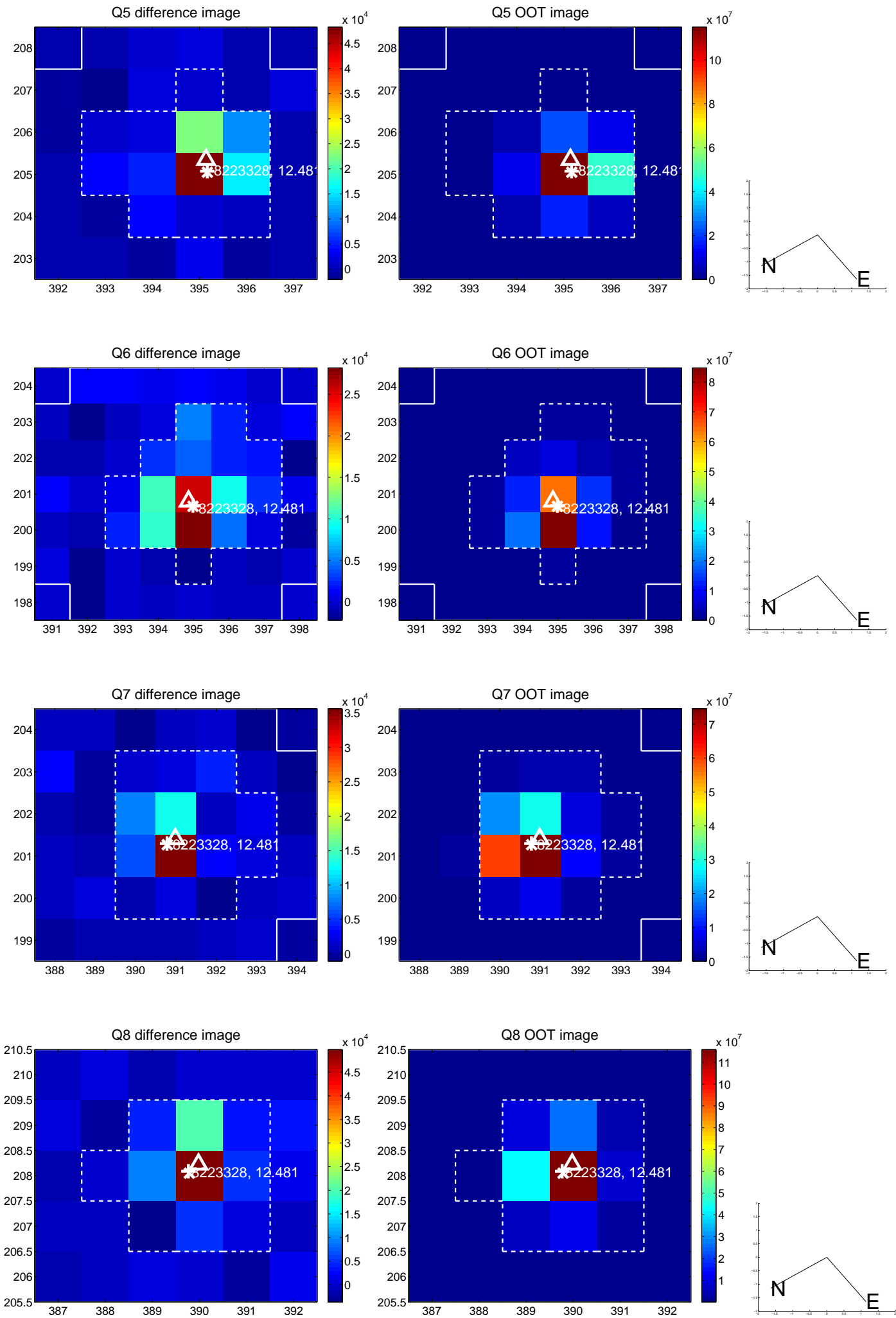


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three- $\sigma$ . Red \*: target star. Blue \*: Other stars. Text next to a star gives its KIC ID and kepmag. KIC IDs > 15,000,000 are from the UKIRT catalog.

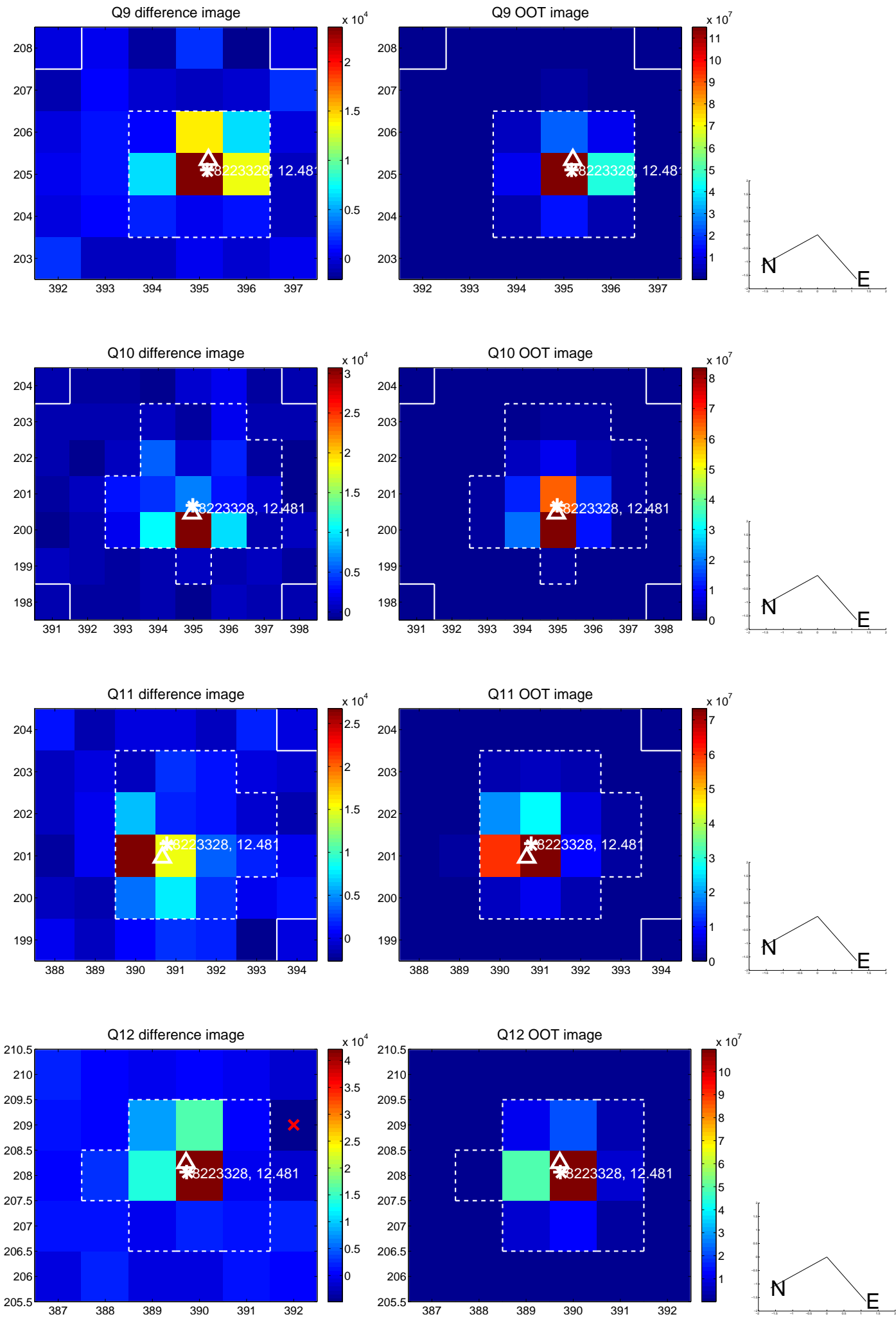
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



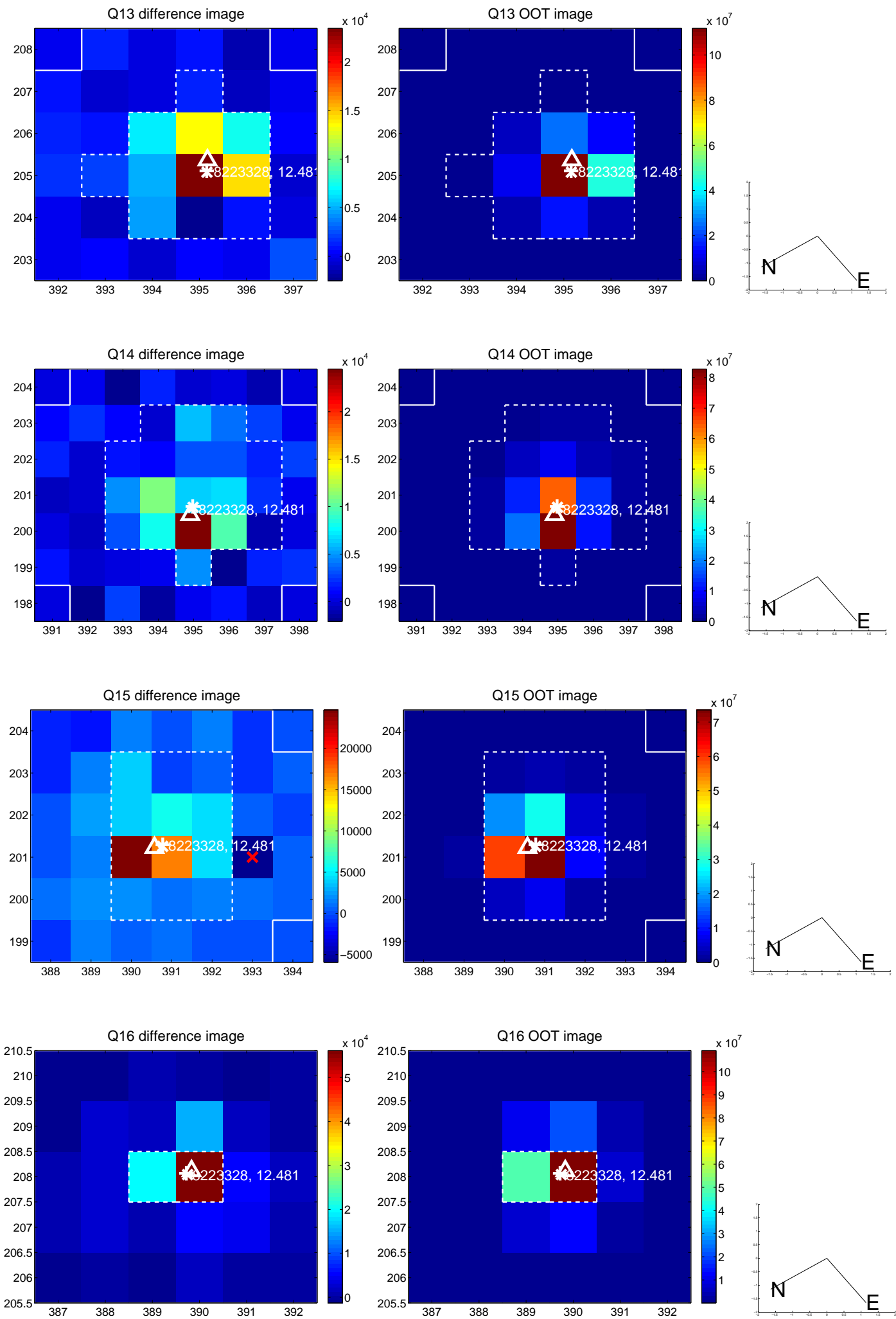
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



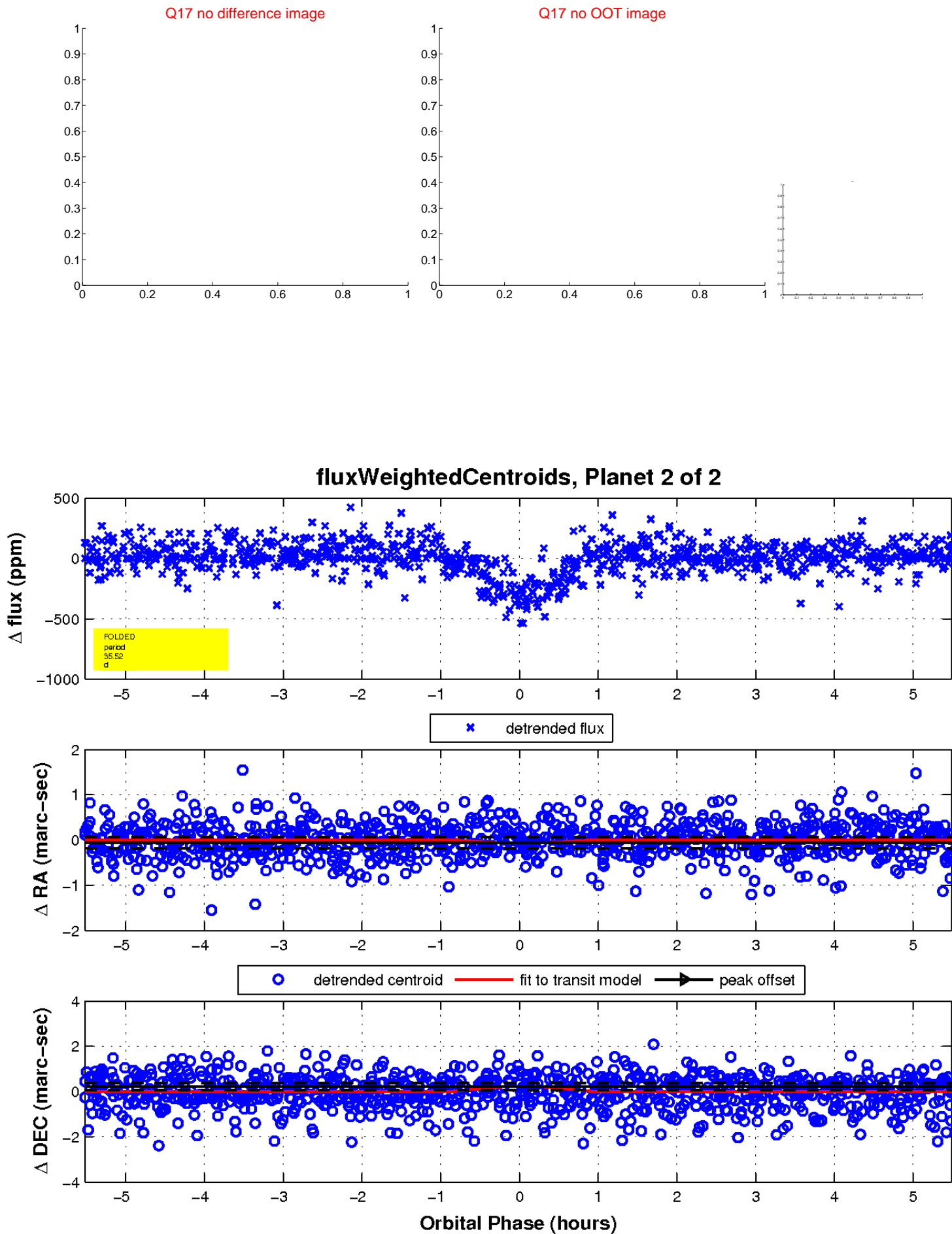
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



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



UKIRT Image

Declination

