Data Validation (DV) Report
for TESS ID 393414358
Sectors 7 - 7

This Data Validation Report was produced in the
TESS Science Processing Operations Center (SPOC) Pipeline
at NASA Ames Research Center

23-Feb-2019 02:03:18 Z

Contents

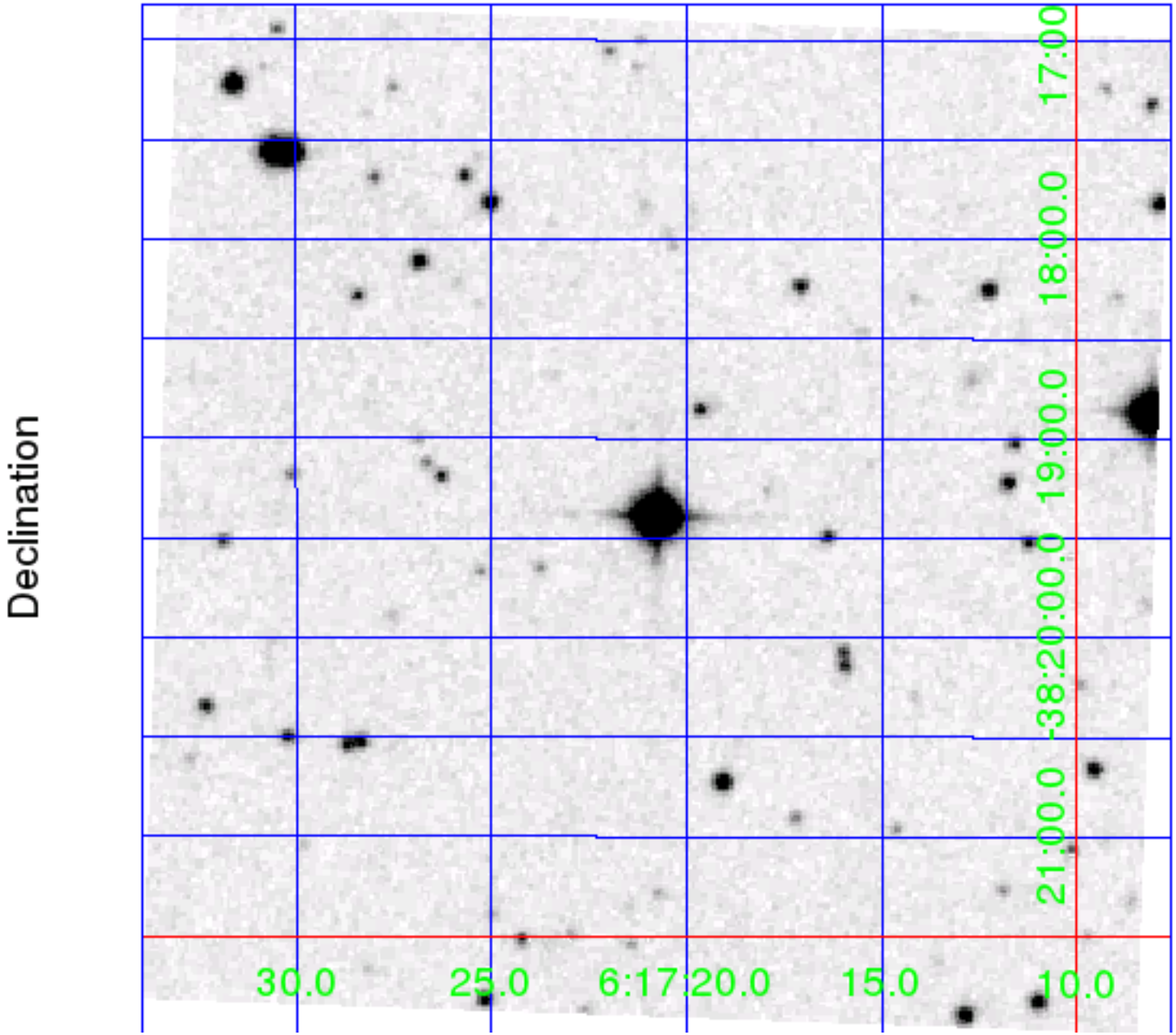
1 Summary

Target Properties	Value	Uncertainty	Units	Provenance
Catalog ID	393414358			
TOI ID	-			
TESS Name	-			
RA	94.33643100	0	degrees	TIC7
Dec	-38.32325700	0	degrees	TIC7
Magnitude	10.417	0.018		TIC7
Radius	1.880	0.000	Solar radii	TIC7
Effective Temperature	5570	0	Kelvin	TIC7
log(g)	4.011	0	cm/sec^2	TIC7
[M/H]	0.280	0.05	Solar metallicity	TIC7
Stellar Density	0.199	0.000	Solar density	TIC7-Derived
Limb Darkening Coefficient 1	0.70133			
Limb Darkening Coefficient 2	-0.44219			
Limb Darkening Coefficient 3	0.83746			
Limb Darkening Coefficient 4	-0.39004			
Number of Planet Candidates	1			
TOI Model	-			
TESS Names Model	-			
External TCE Model	-			
Software Revision	spoc-3.3.57-20190215			
Date Report Generated	23-Feb-2019 02:03:18 Z			

Sector	Target Table	Camera/ CCD	Crowding Metric	Flux Fraction
7	145	3:2	0.9981	0.8775

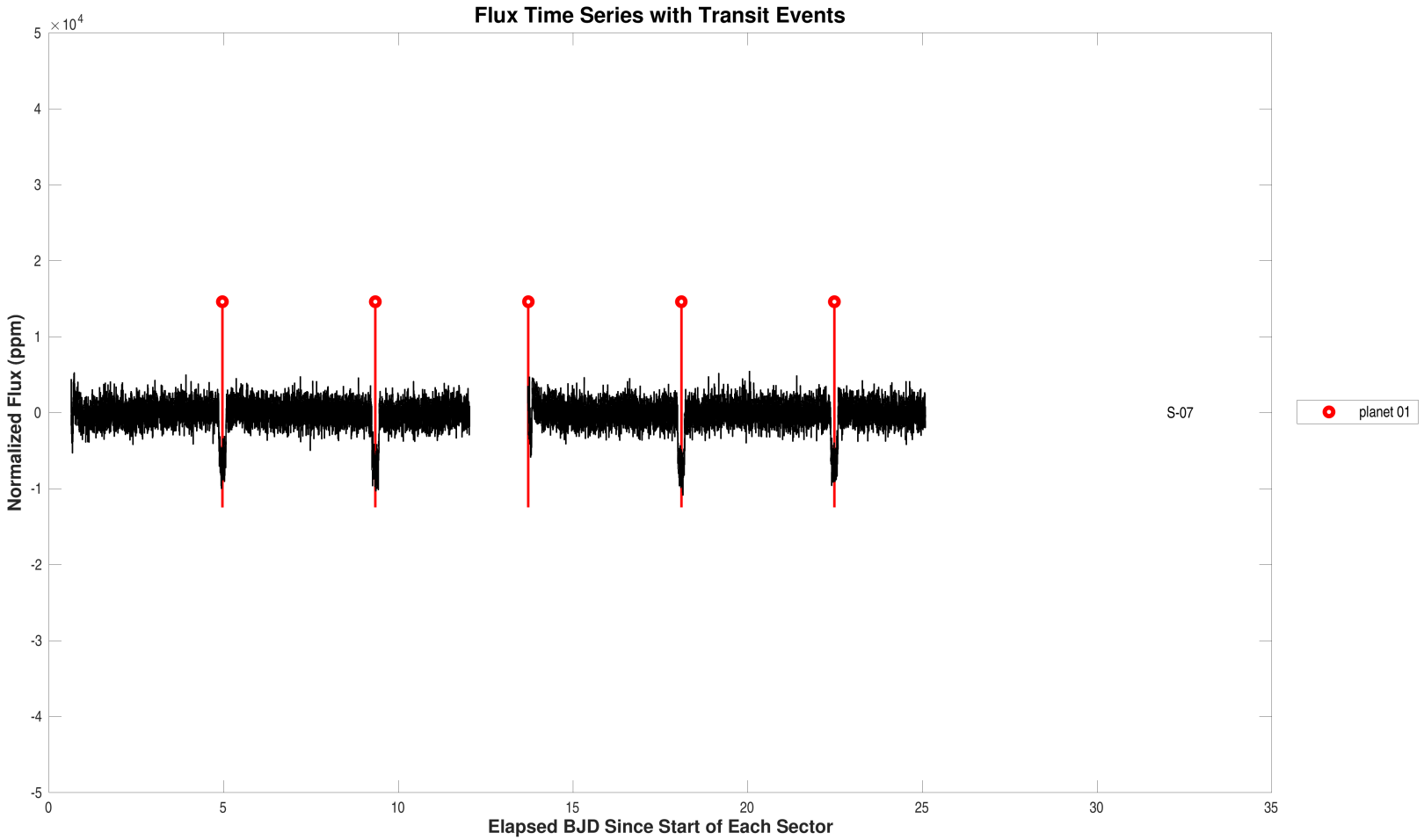
Planet Candidate	TOI ID	TESS Name	TOI Correlation	Period (days)	Period Ratio	Epoch (BTJD)	Semi-major Axis (AU)	Radius (Re)	Seff	Teq (K)	False Alarm	Suspected EB
1	-	-	-	4.379	1.00	1495.964	0.06	15.5	921.7	1405	0.00e+00	false

2 Survey Image

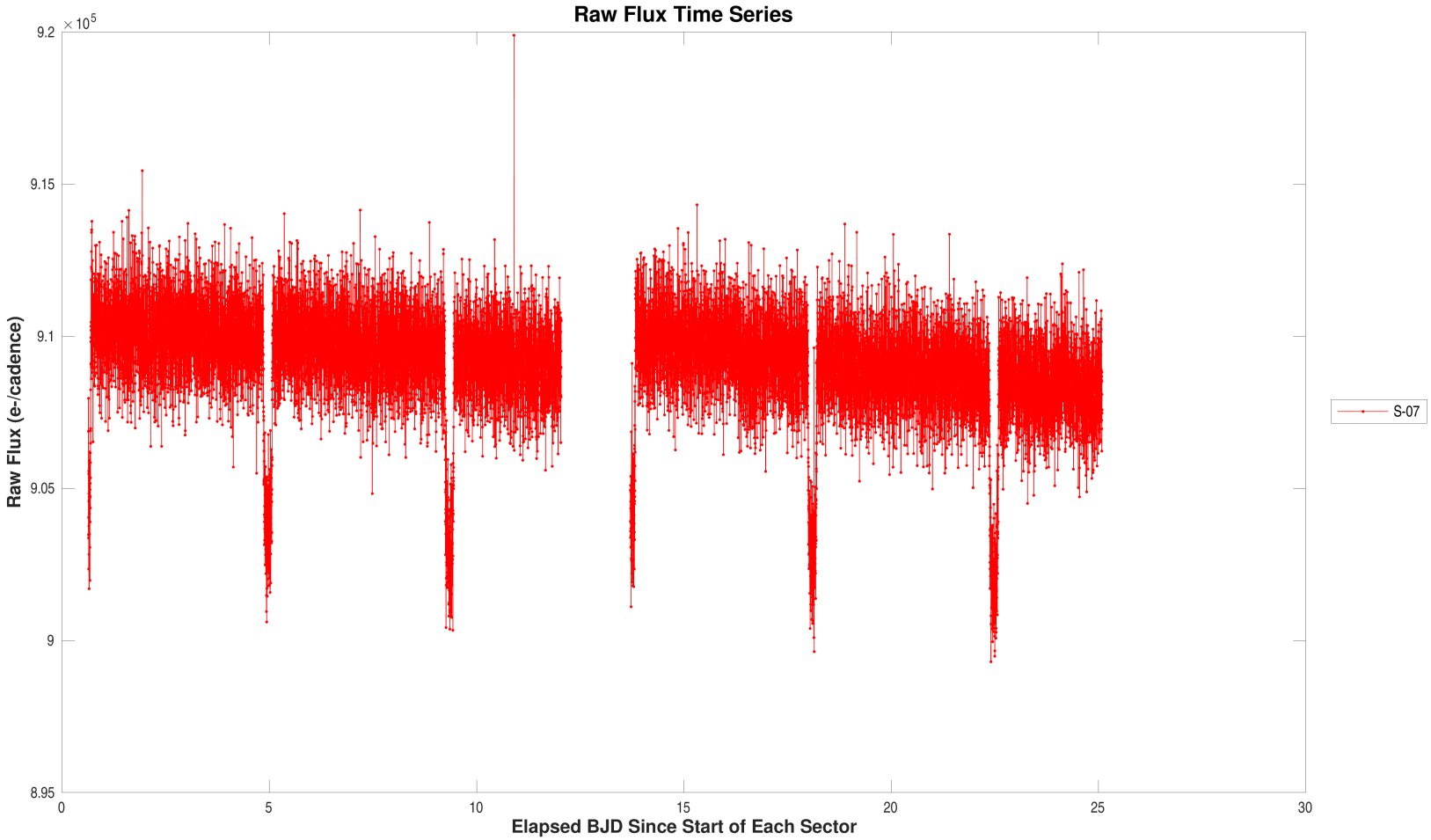


Digitized Sky Survey (DSS) red image. The 5' x 5' image is centered on the J2000 coordinates of target (393414358).

3 Flux Time Series



Summary plot of sector-stitched flux time series and transits for target 393414358, marked with DV fitted epoch/period (or TPS epoch/period if fit was not successful). Transits of identified planets are labeled with epoch BTJD and orbital period. For the data of sector 7, target table 145, start BJD is 2458491.
Open `./summary-plots/0000000393414358-00-flux-dv-fit-07-145.fig`



Summary plot of raw flux time series. For the data of sector 7, target table 145, start BJD is 2458491.
Open `./summary-plots/0000000393414358-00-raw-flux-07-145.fig`

4 Dashboards

Planet Candidate 1

<table>
<tr><td rowspan="2">Model Fitter</td><td colspan="2">Stellar Radius
1.9 ± 0.0 Solar units</td><td rowspan="2">Core Aperture Correlation Statistic
Value = 52.97
Significance = 100.00%
Halo Aperture Correlation Statistic
Value = 7.65
Significance = 100.00%
Core/Halo Ratio
Ratio = 6.93</td><td rowspan="2">Ghost Diagnostic Test</td></tr>
<tr><td colspan="2">Period = 4.4 ± 0.0 days
Depth = 6794 ± 88 ppm
Planet Radius = 15.5 ± 0.3 Earth radii
Semi-major Axis = 0.1 ± 0.0 AU
Effective Stellar Flux = 921.7 ± 0.1
Equilibrium Temperature = 1405 ± 0 Kelvin
Chi-squared/DoF = 0.8
SNR = 75.0</td></tr>
<tr><td rowspan="2">Eclipsing Binary Discrimination Test</td><td colspan="2">Odd-Even Depth Comparison Statistic
Value = 2.66e+00
Significance = 10.31%</td><td>Offsets Relative to Out of Transit Centroid
Source RA Offset = -1.85e-02 ± 2.51e+00 arcsec (-0.01 σ)
Source Dec Offset = -1.74e-01 ± 2.51e+00 arcsec (-0.07 σ)
Source Offset Distance = 1.75e-01 ± 2.51e+00 arcsec (0.07 σ)
Offsets Relative to TIC Position
Source RA Offset = 2.54e-01 ± 2.51e+00 arcsec (0.10 σ)
Source Dec Offset = -3.51e-01 ± 2.51e+00 arcsec (-0.14 σ)
Source Offset Distance = 4.33e-01 ± 2.51e+00 arcsec (0.17 σ)</td><td>Difference Image Centroid Offsets</td></tr>
<tr><td>Shorter Period Comparison Statistic
Value = N/A
Significance = N/A</td><td>Longer Period Comparison Statistic
Value = N/A
Significance = N/A</td><td>False Alarm = 0.00e+00
Transit Count = 5
Max Multiple Event Statistic = 73.6</td><td>Bootstrap Test</td></tr>
</table>

Summary of model fitter results and validation test results for target 393414358, planet candidate 1. In general, green denotes that the candidate is likely a planet, while red denotes that the candidate is unlikely to be a planet. Cyan denotes that no data is available. The color of the Model Fitter block is: green, when the SNR of the fit is greater than or equal to 10; yellow, if the SNR is greater than or equal to 7.1 but less than 10; red, if the SNR is less than 7.1 or if the fitter failed. The color of the Ghost Diagnostic Test and Eclipsing Binary Discrimination Test blocks are: green, when the significance is within 2-sigma; yellow, when the significance is between 2- and 3-sigma; red when the significance is greater than 3-sigma. The color of the Difference Image Centroid Offsets block is: green, when the max offset distance sigma is less than or equal to 2; yellow, when the max sigma is between 2 and 3; red when the max sigma is greater than 3. The color of the Bootstrap Test block is green whenever the false alarm probability is less than 10^{-12}, low enough to limit the total number of false alarms from a four year mission to less than one. If the false alarm probability is greater than 10^{-12}, the color of the Bootstrap Test block is: green, when the false alarm probability is less than or equal to the CCDF of a Gaussian distribution at the observed maximum multiple event statistic; yellow when the false alarm probability is between 1 and 2 times that of a Gaussian distribution at the max multiple event statistic; and red when the false alarm probability is more than 2 times that of a Gaussian distribution at the max multiple event statistic.

5 Pixel Level Diagnostics

To reduce clutter, the catalog IDs in the difference images have been replaced by indices representing distance from the target star. The mapping between the indices and the catalog IDs is found in a table at the end of this section.

5.1 Planet Candidate 1

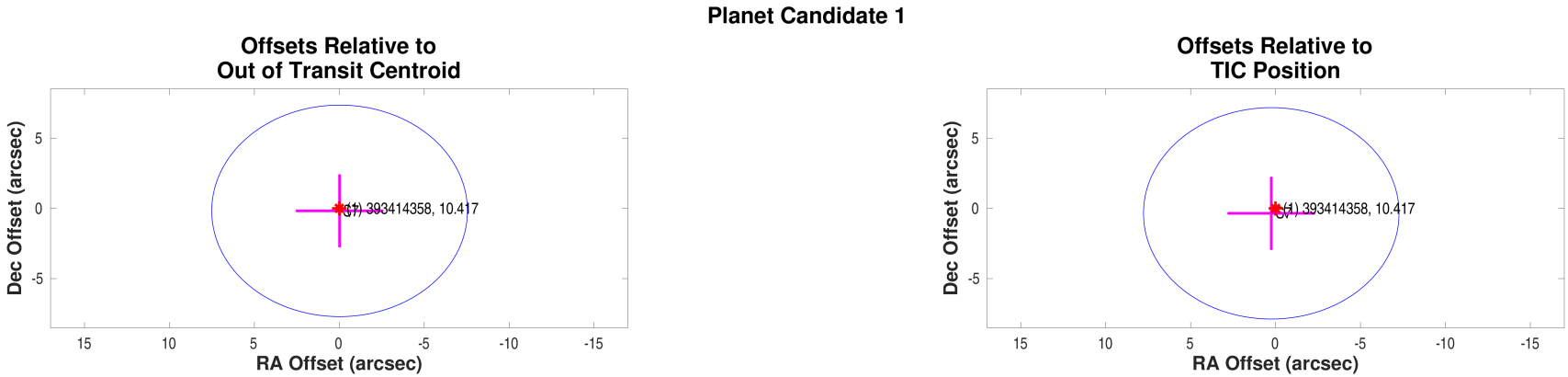
Multi-Sector Average PRF Fit of the Difference Images

Mean offset from the PRF fit to the out of transit image

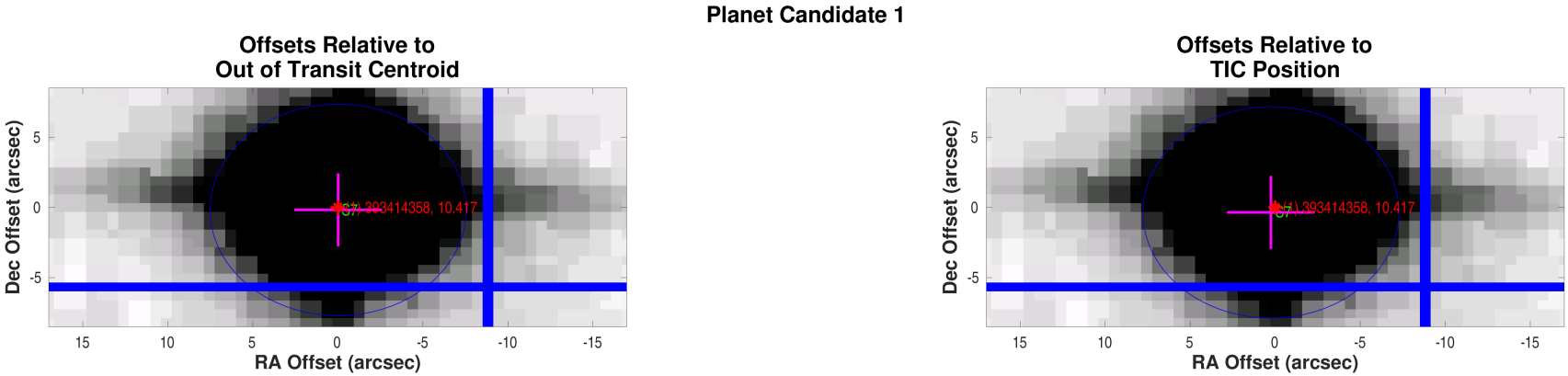
	RA	Dec	Units
Offset	$-0.0185 \pm 2.51e+00$	$-0.1737 \pm 2.51e+00$	arcseconds
Offset/σ	-0.01	-0.07	
Offset Distance	$0.1747 \pm 2.51e+00$		arcseconds
Offset Distance/σ	0.07		
3σ Radius	7.5312		arcseconds

Mean offset from the TIC RA and Dec

	RA	Dec	Units
Offset	$0.2539 \pm 2.51e+00$	$-0.3509 \pm 2.51e+00$	arcseconds
Offset/σ	0.10	-0.14	
Offset Distance	$0.4331 \pm 2.51e+00$		arcseconds
Offset Distance/σ	0.17		
3σ Radius	7.5269		arcseconds



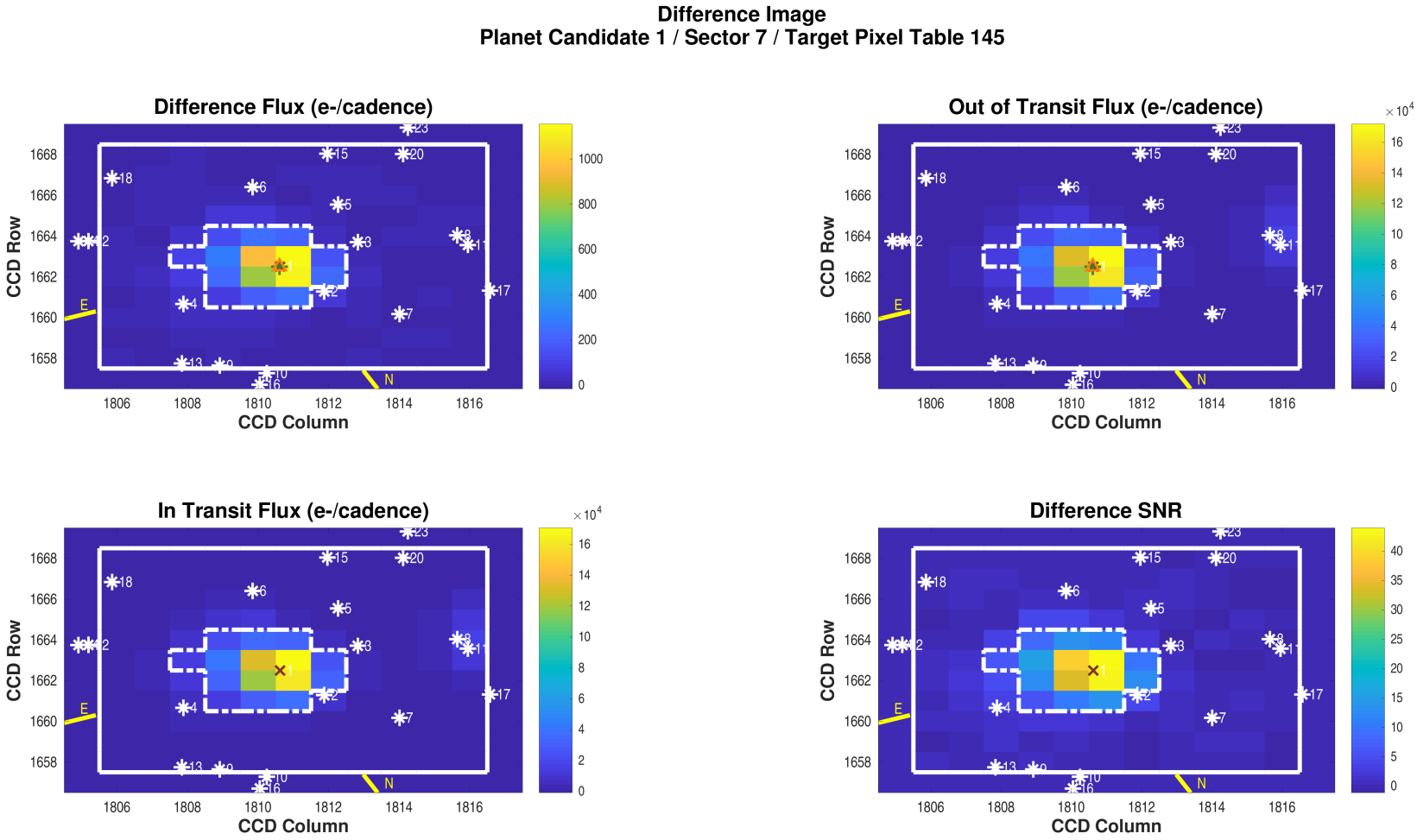
Difference image centroid offsets for target 393414358, planet candidate 1. Left: difference image PRF centroid offsets in RA and Dec with respect to the per sector out-of-transit centroids for the given target. Right: difference image PRF centroid offsets in RA and Dec with respect to the TC coordinates of the given target. Symbol key: green cross: per sector centroid offsets with 1-sigma error bars in RA and Dec; magenta cross: robust weighted mean offset over all sectors with 1-sigma error bars in RA and Dec; blue circle: 3-sigma radius of confusion for weighted mean offset; red asterisk: location of target star; blue asterisk: location of other TIC objects in the neighborhood. TIC ID and magnitude are noted in the text associated with each marked object. A constant error term of 2.5000 arcseconds has been added in quadrature to the computed uncertainty in the RA and Dec components of the robust mean offset.
Open `./planet-01/difference-image/0000000393414358-01-difference-image-centroid-offsets.fig`



Difference image centroid offsets for target 393414358, planet candidate 1, diplayed on survey image for given target. Left: difference image PRF centroid offsets in RA and Dec with respect to the per sector out-of-transit centroids for the given target. Right: difference image PRF centroid offsets in RA and Dec with respect to the TIC coordinates of the given target. Symbol key: green cross: per sector centroid offsets with 1-sigma error bars in RA and Dec; magenta cross: robust weighted mean offset over all sectors with 1-sigma error bars in RA and Dec; blue circle: 3-sigma radius of confusion for weighted mean offset; red asterisk: location of target star; blue asterisk: location of other TIC objects in the neighborhood. TIC ID and magnitude are noted in the text associated with each marked object. A constant error term of 2.5000 arcseconds has been added in quadrature to the computed uncertainty in the RA and Dec components of the robust mean offset.
Open `./planet-01/difference-image/0000000393414358-01-difference-image-centroid-offsets-survey.fig`

Difference Image Summary Metrics

Number of Difference Images	Number of Metrics	Number of Good Metrics	Fraction of Good Metrics	Quality Threshold
1	1	1	1.0000	0.70



Difference image for target 393414358, planet candidate 1, sector 7, target pixel table 145. Upper left: difference between mean flux out-of-transit and in-transit; upper right: mean out-of-transit flux; lower left: mean in-transit flux; lower right: difference between mean flux out-of-transit and in-transit after normalizing by the uncertainty in the difference for each pixel. The optimal aperture is outlined with a white dash-dotted line in each panel and the target mask is outlined with a solid white line. Symbol key: x: target position from TIC RA and Dec converted to CCD coordinates via motion polynomials; *: position of nearby TIC objects converted to CCD coordinates via motion polynomials; +: PRF-fit location of target from out-of-transit image; triangle: PRF-fit location of transit source from the difference image. Number of transits = 4; number of valid in-transit cadences = 526; number of in-transit cadence gaps = 1; number of valid out-of-transit cadences = 1327; number of out-of-transit cadence gaps = 0. Difference image quality metric = 1.00 (good).
Open `./planet-01/difference-image/0000000393414358-01-difference-image-07-145.fig`

PRF Fit of the Difference Image

Offset from the PRF fit to the out of transit image

	Row	Column	Units	RA	Dec	Units
Out of Transit Image Centroid	$1662.50 \pm 4.22e-05$	$1810.61 \pm 3.73e-05$	pixels	$94.33640718 \pm 1.01e-06$	$-38.32344403 \pm 1.01e-06$	degrees
Difference Image Centroid	$1662.51 \pm 1.16e-02$	$1810.60 \pm 1.03e-02$	pixels	$94.33640062 \pm 6.20e-05$	$-38.32349227 \pm 6.35e-05$	degrees
Offset	$0.0081 \pm 1.16e-02$	$-0.0027 \pm 1.03e-02$	pixels	$-0.0185 \pm 1.75e-01$	$-0.1737 \pm 2.29e-01$	arcseconds
Offset/σ	0.70	−0.27		−0.11	−0.76	
Offset Distance	$0.0086 \pm 1.12e-02$		pixels	$0.1747 \pm 2.31e-01$		arcseconds
Offset Distance/σ	0.76			0.76		

Offset from the TIC RA and Dec converted to pixels via motion polynomials

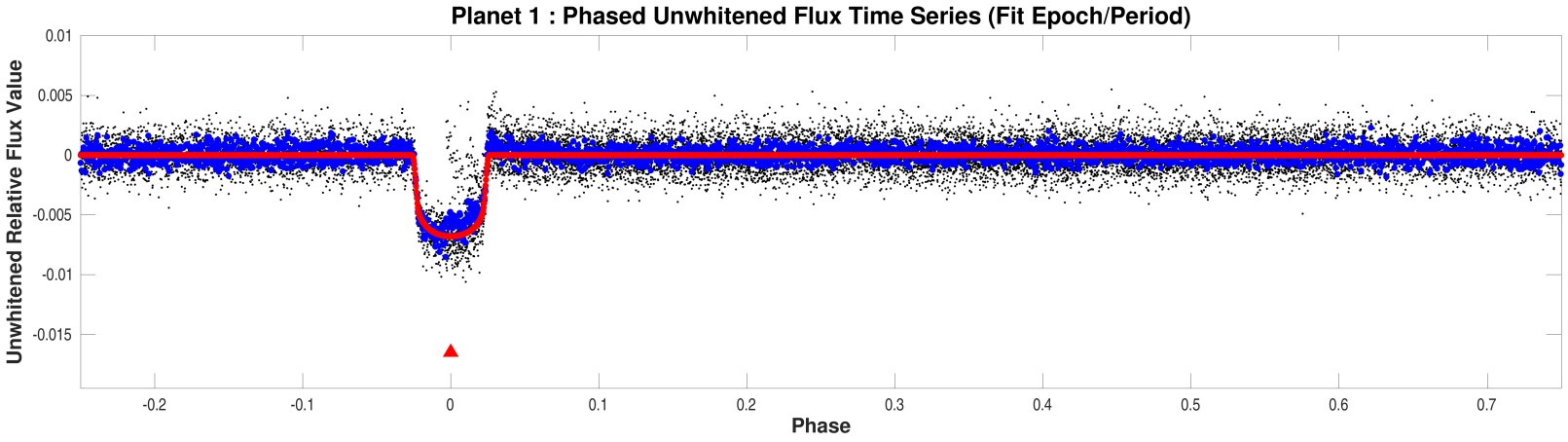
	Row	Column	Units	RA	Dec	Units
TIC Reference Centroid	$1662.50 \pm 1.74e-04$	$1810.62 \pm 1.70e-04$	pixels	$94.33631072 \pm 0.00e+00$	$-38.32339481 \pm 0.00e+00$	degrees
Difference Image Centroid	$1662.51 \pm 1.16e-02$	$1810.60 \pm 1.03e-02$	pixels	$94.33640062 \pm 6.20e-05$	$-38.32349227 \pm 6.35e-05$	degrees
Offset	$0.0108 \pm 1.16e-02$	$-0.0189 \pm 1.03e-02$	pixels	$0.2539 \pm 1.75e-01$	$-0.3509 \pm 2.29e-01$	arcseconds
Offset/σ	0.93	−1.84		1.45	−1.53	
Offset Distance	$0.0217 \pm 1.02e-02$		pixels	$0.4331 \pm 1.96e-01$		arcseconds
Offset Distance/σ	2.14			2.21		

5.2 Difference Image TIC Key

Index	Catalog ID	Mag	RA (degrees)	Dec (degrees)	Distance (arcsec)
1	393414358	10.417	94.33631072	-38.32339481	0.00
2	393414362	17.170	94.33183661	-38.31432739	35.00
3	393414356	17.308	94.31840004	-38.32488498	50.87
4	393414361	17.342	94.35956298	-38.31983391	66.91
5	393389075	17.342	94.31653100	-38.33573200	71.37
6	393414346	15.381	94.32965287	-38.34546324	81.64
7	393414366	17.019	94.32135212	-38.30385580	82.05
8	393389065	16.726	94.29914570	-38.32042272	105.51
9	393414368	16.385	94.36191821	-38.30183293	106.09
10	393414370	16.221	94.35437411	-38.29698132	107.91
11	393389063	16.841	94.29861201	-38.31729833	108.71
12	393414349	17.029	94.36776007	-38.34183160	110.88
13	393414364	17.446	94.36855584	-38.30474303	113.15
14	393414348	17.079	94.36960900	-38.34243800	116.38
15	393414344	17.927	94.31099258	-38.34940517	117.82
16	393414371	16.398	94.35739068	-38.29446340	119.97
17	393389055	16.514	94.30127530	-38.30425402	120.58
18	393414340	17.273	94.35418461	-38.35649283	129.41
19	393414350	17.093	94.37586282	-38.34169977	129.70
20	393414347	16.549	94.29714000	-38.34457000	134.35
21	393414372	17.684	94.36681821	-38.29465262	134.65
22	393414373	13.551	94.37585300	-38.29272800	157.04
23	393389081	17.501	94.29239011	-38.35108703	159.14
24	393414374	13.837	94.37751300	-38.29266000	160.57

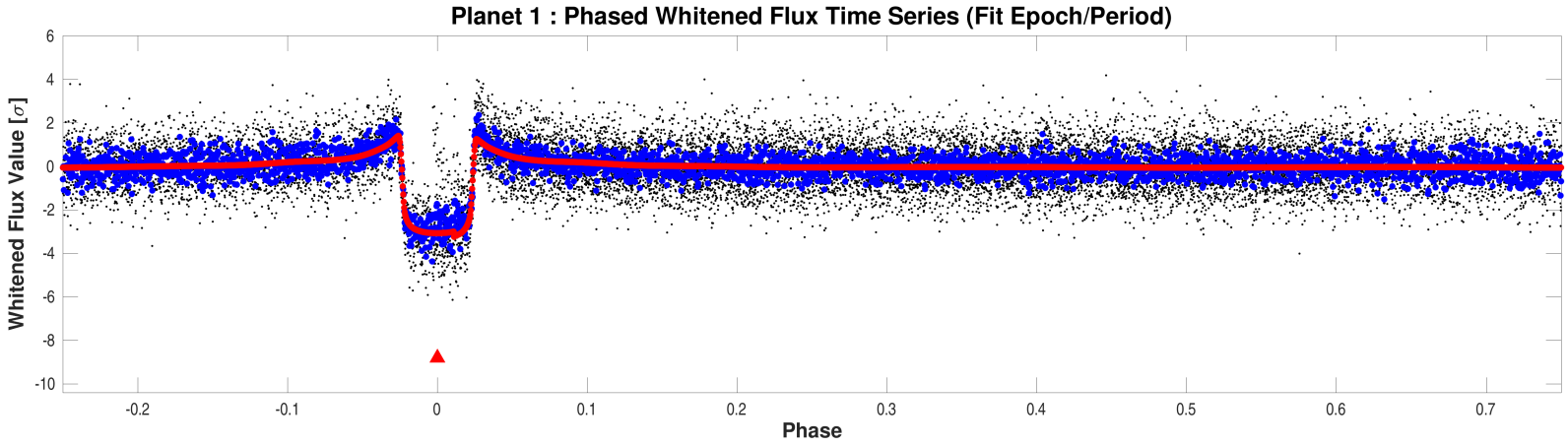
RA, Dec and Distances are corrected for proper motion. This table may not contain all of the objects shown.

6 Phased Light Curves

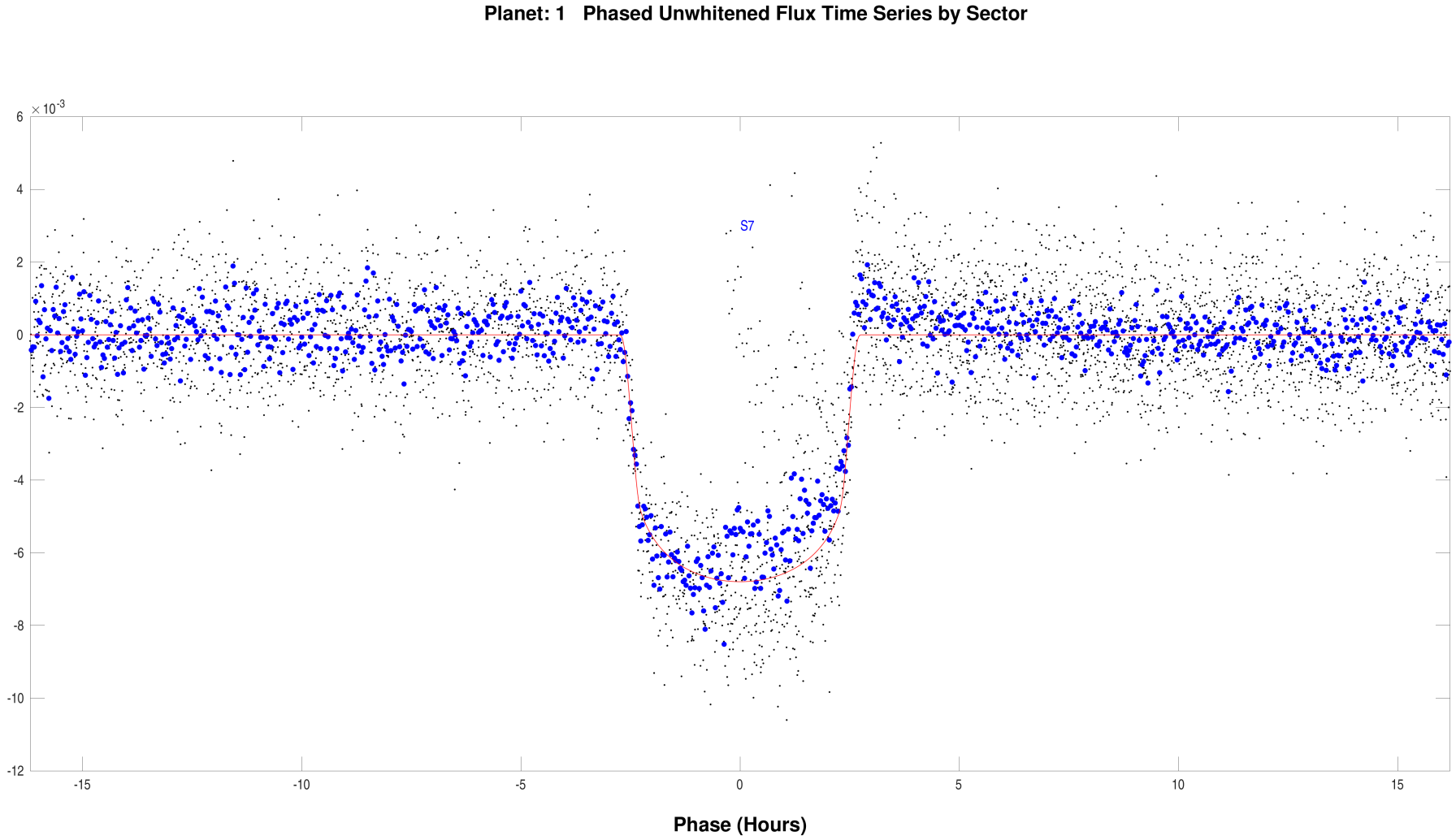


Phased unwhitened flux time series is plotted in black dots. When all transits fit completed with full or secondary convergence, the phase is determined with the fitted epoch and period; otherwise, the phase is determined with the TPS epoch and period. The values of the phased unwhitened flux time series averaged in one cadence wide bins are plotted in bigger blue dots. When all transits fit completes with full or secondary convergence, the averaged values of the phased unwhitened fitted model light curve are plotted in red dots. Transit event markers in different colors indicate the locations of the transits of all planet candidates. The transits of the same planet candidate are labeled with the markers of the same color, for example, blue markers for transits of plane candidate #1, red markers for transits of planet candidate #2, etc.

Open `./summary-plots/0000000393414358-01-phased-unwhitened-flux-time-series.fig`



Phased whitened flux time series is plotted in black dots. When all transits fit completed with full or secondary convergence, the phase is determined with the fitted epoch and period; otherwise, the phase is determined with the TPS epoch and period. The values of the phased whitened flux time series averaged in one cadence wide bins are plotted in bigger blue dots. When all transits fit completes with full or secondary convergence, the averaged values of the phased whitened fitted model light curve are plotted in red dots. Transit event markers in different colors indicate the locations of the transits of all planet candidates. The transits of the same planet candidate are labeled with the markers of the same color, for example, blue markers for transits of plane candidate #1, red markers for transits of planet candidate #2, etc.
Open `./summary-plots/0000000393414358-01-phased-whitened-flux-time-series.fig`



Phased unwhitened flux time series by sector for target 393414358, planet candidate 1. Period = 4.3786 days; transit epoch = 1495.964 BTJD.
Open `./summary-plots/0000000393414358-01-phased-unwhitened-flux-time-series-by-sector.fig`

7 Planet Candidate 1

7.1 Model Fitter: All Transits

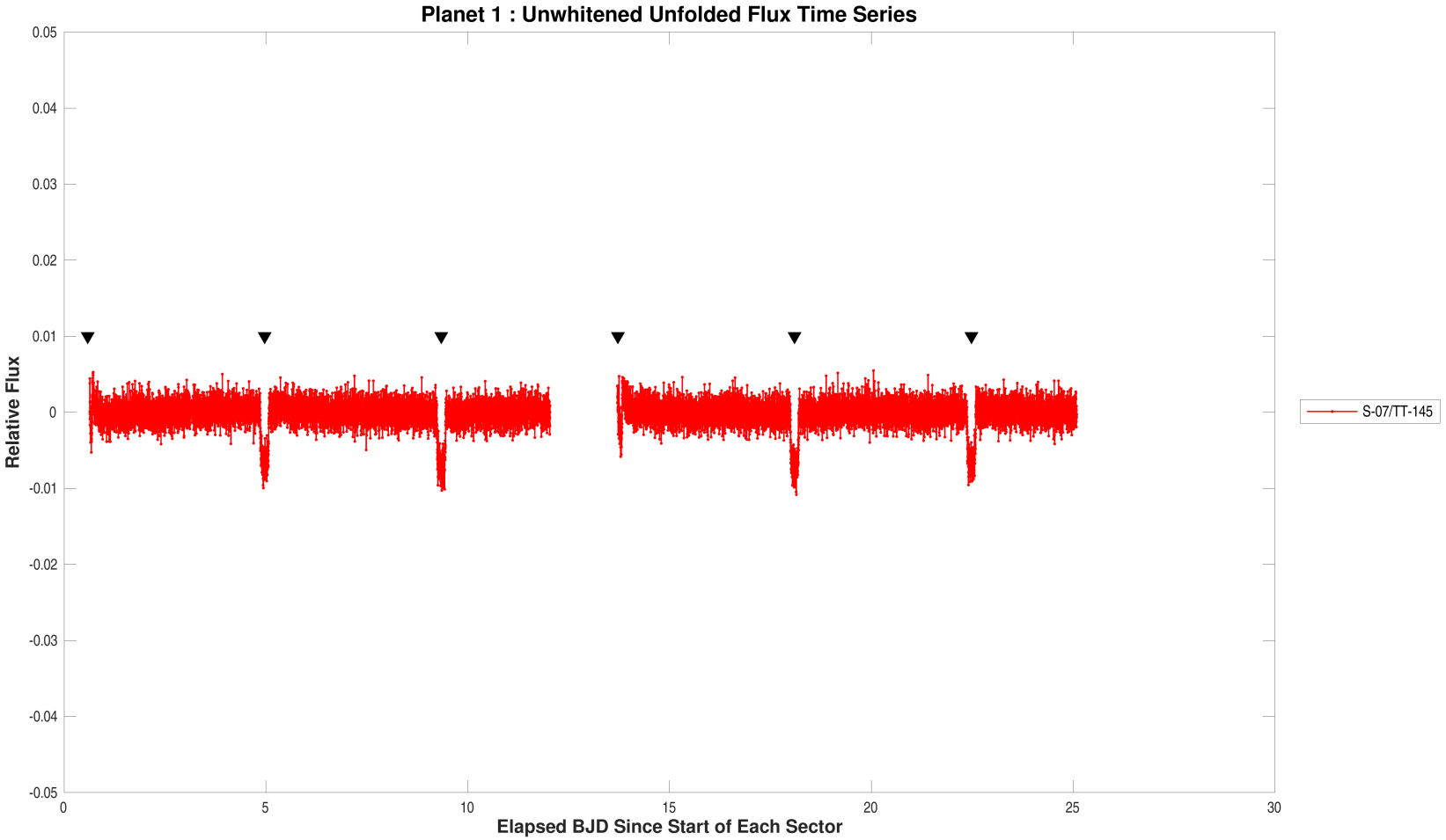
Model Characteristic	Name
Transit Model	mandel-agol_geometric_transit_model
Limb Darkening Model	claret_tess_nonlinear_limb_darkening_model

TCE Parameter	Value	Units
Trial Transit Pulse Duration	5.0	hours
Transit Epoch	1495.9505319	TJD
Orbital Period	4.3763871	days
Maximum SES	40.2	
Maximum MES	73.6	
Robust Statistic	77.3	
Chi Square Goodness of Fit Statistic (DoF)	1138.2 (597)	
Chi Square2 Statistic (DoF)	4.5 (532.1)	
Threshold for Desired PFA		

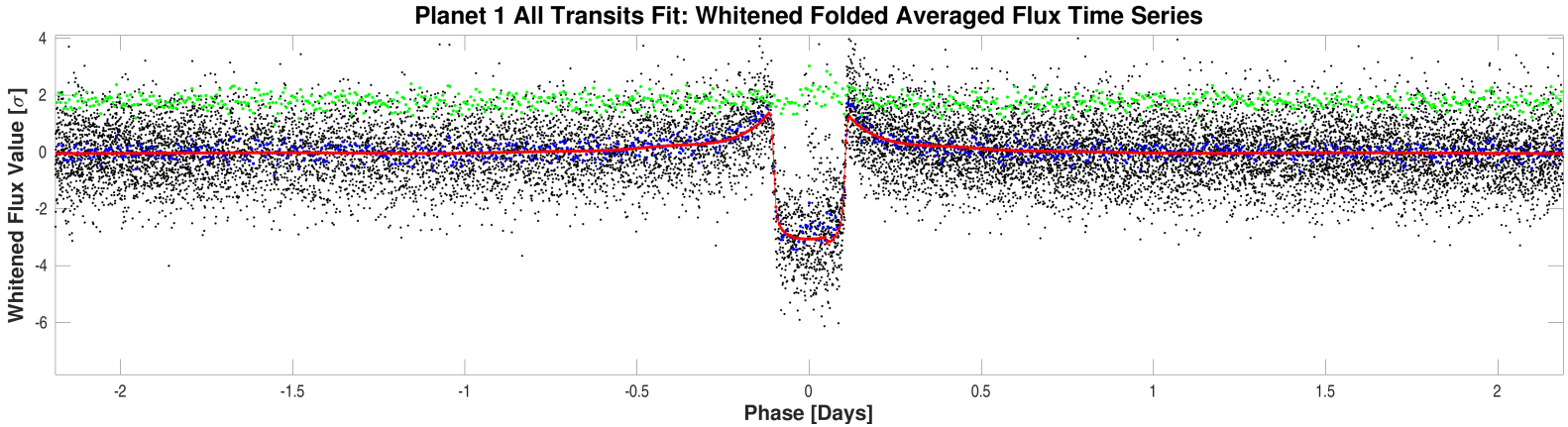
DoF: Degrees of Freedom

Parameter	Value	Uncertainty	Units
SNR	75.0		
Orbital Period	4.3785729	2.5584e-04	days
Transit Epoch	1495.9639876	6.3502e-04	BTJD
Impact Parameter	0.0100	7.5217e+00	
Planet Radius to Star Radius Ratio	0.0757152	1.2735e-03	
Semi-major Axis to Star Radius Ratio	6.6964	4.8994e-01	
Planet Radius	15.5397	2.6137e-01	Earth radii
Semi-major Axis	0.0575	2.2400e-06	AU
Effective Stellar Flux	921.7233	7.1808e-02	Goldilocks
Equilibrium Temperature	1405	2.7371e-02	Kelvin
Stellar Density	0.2104	4.6187e-02	Solar density
Transit Depth	6794	8.8251e+01	ppm
Transit Duration	5.3966	6.3271e-02	hours
Transit Ingress Duration	0.3825	6.3534e-02	hours
Eccentricity	0.0000	0.0000e+00	
Peri Longitude	0.0000	0.0000e+00	degrees
Model Chi Square Statistic (DoF)	3179.0 (3772.6)		
Model Chi Square Goodness of Fit Statistic (DoF)	539.1 (877)		
Model Chi Square2 Statistic (DoF)	118.9 (5)		

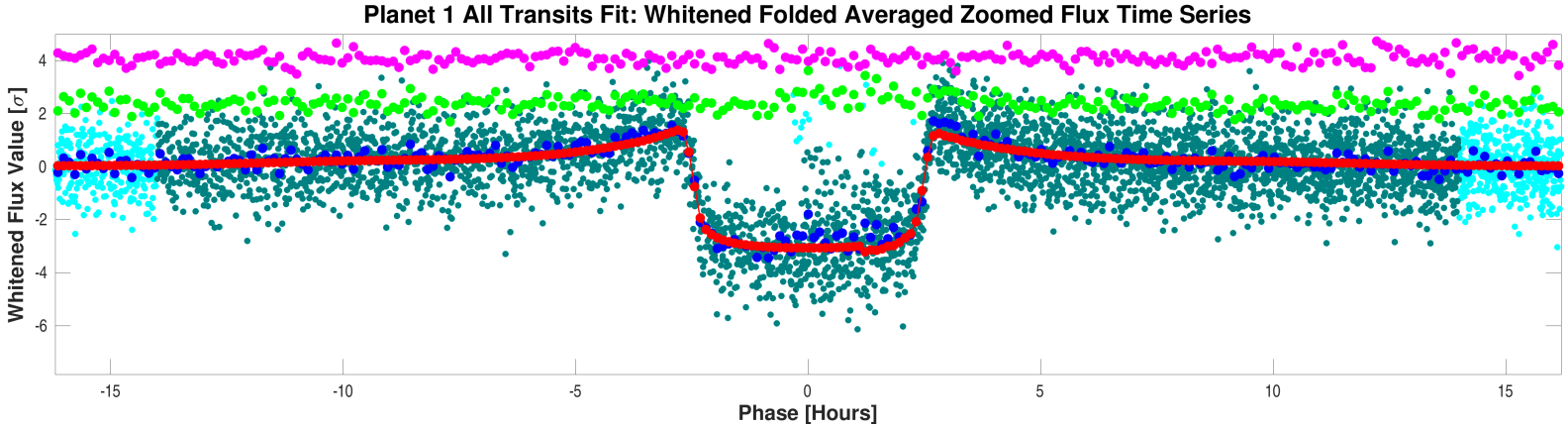
DoF: Degrees of Freedom



Flux time series for CatId 393414358, Planet candidate 1 in the unwhitened domain. For the data of Sector-07/TargetTableId-145, start BJD is 2458491. Transit event markers indicate the location of transits of the given planet candidate. All transits fit completed with full convergence.
Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000393414358-01-all-unwhitened-07-145.fig`



Folded flux time series for CatId 393414358, Planet candidate 1 in the whitened domain is plotted in black dots. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged values of the folded flux time series; the red dots represent the averaged values of the folded model light curve of the all transits fit; the green dots are the averaged folded fit residuals, vertically offset for clarity. All transits fit completed with full convergence.
Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000393414358-01-all-whitened.fig`

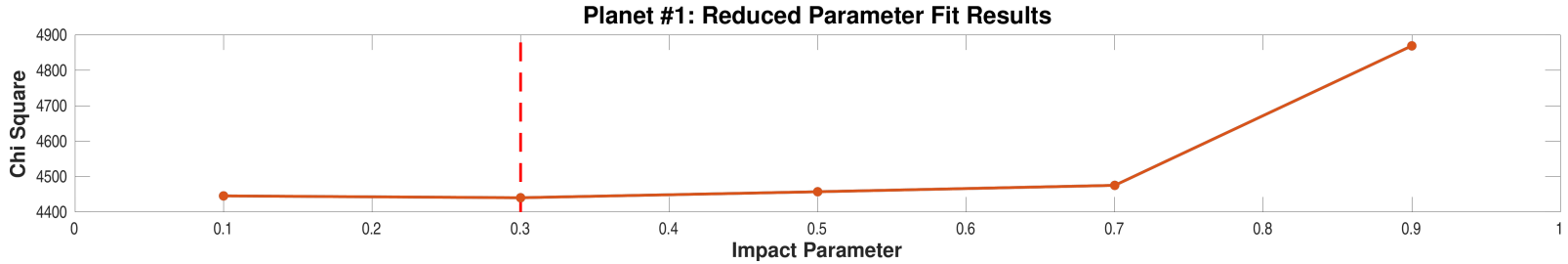


Folded flux time series for CatId 393414358, Planet candidate 1 in the whitened domain, zoomed on the transit. The flux data whose robust weights are larger/smaller than 0.1 are plotted in dark green/cyan dots, respectively. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged values of the folded flux time series; the red dots represent the averaged values of the fitted model light curve of the all transits fit; the green dots are the averaged folded fit residuals, vertically offset for clarity. Magenta dots are the averaged values of the folded flux time series, with a phase shift of 0.5 relative to the blue dots, vertically offset for clarity. All transits fit completed with full convergence.
Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000393414358-01-all-whitened-zoomed.fig`

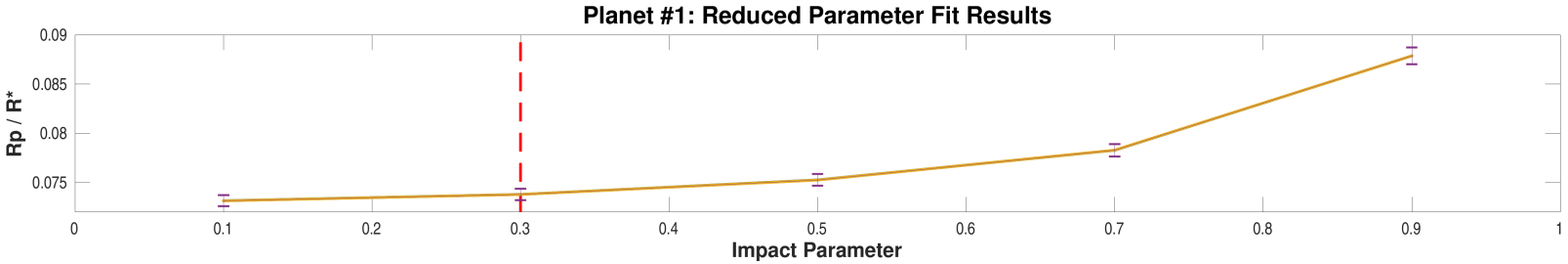
7.2 Model Fitter: Reduced Parameter Fit Results

Impact Parameter	SNR	Model Chi Square	Planet Radius to Star Radius	Uncert	Semi-major Axis to Star Radius	Uncert	Transit Depth (ppm)	Uncert	Transit Duration (hours)	Uncert
0.10	69.6	4445.6	0.0731516	5.7112e-04	6.6394	3.1670e-02	6330	9.8295e+01	5.4072	2.6079e-02
0.30	69.6	4440.4	0.0737951	5.7736e-04	6.3754	3.1361e-02	6337	9.8597e+01	5.4393	2.7082e-02
0.50	69.4	4457.4	0.0752687	5.9332e-04	5.8113	3.0818e-02	6347	9.9443e+01	5.5247	2.9792e-02
0.70	67.9	4475.4	0.0782791	6.4112e-04	4.8436	3.0771e-02	6358	1.0337e+02	5.7520	3.7684e-02
0.90	65.2	4869.2	0.0878692	8.5254e-04	3.2398	3.4868e-02	6583	1.2422e+02	6.6126	7.6588e-02

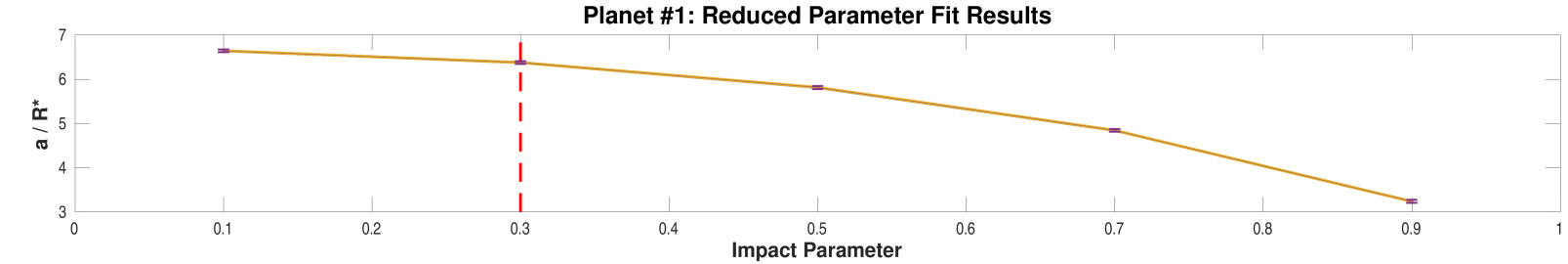
Highlighted row is the best reduced-parameter model fit.



Model chi squares of reduced parameter fits vs. impact parameter for CatId 393414358, Planet candidate 1. The fit result with the minimum chi square is marked with a dashed line in the plot.
Open `./planet-01/planet-search-and-model-fitting-results/reduced-parameter-fits/0000000393414358-01-reduced-fits-chi-square.fig`



Ratios of planet radius to star radius of reduced parameter fits vs. impact parameter for CatId 393414358, Planet candidate 1. The fit result with the minimum chi square is marked with a dashed line in the plot.
Open `./planet-01/planet-search-and-model-fitting-results/reduced-parameter-fits/0000000393414358-01-reduced-fits-rp-over-rstar.fig`



Ratios of semimajor axis to star radius of reduced parameter fits vs. impact parameter for CatId 393414358, Planet candidate 1. The fit result with the minimum chi square is marked with a dashed line in the plot.
Open `./planet-01/planet-search-and-model-fitting-results/reduced-parameter-fits/0000000393414358-01-reduced-fits-a-over-rstar.fig`

7.3 Model Fitter: Trapezoidal Fit Results

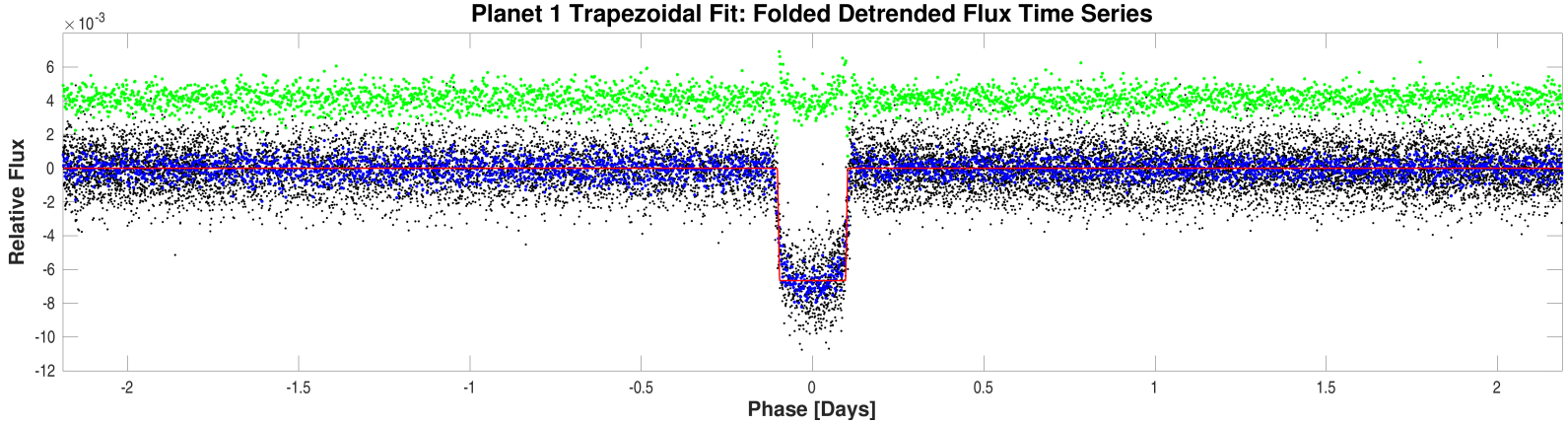
Model Characteristic	Name
Transit Model	trapezoidal_model
Limb Darkening Model	

TCE Parameter	Value	Units
Trial Transit Pulse Duration	5.0	hours
Transit Epoch	1495.9505319	TJD
Orbital Period	4.3763871	days
Maximum SES	40.2	
Maximum MES	73.6	
Robust Statistic	77.3	
Chi Square Goodness of Fit Statistic (DoF)	1138.2 (597)	
Chi Square2 Statistic (DoF)	4.5 (532.1)	
Threshold for Desired PFA		

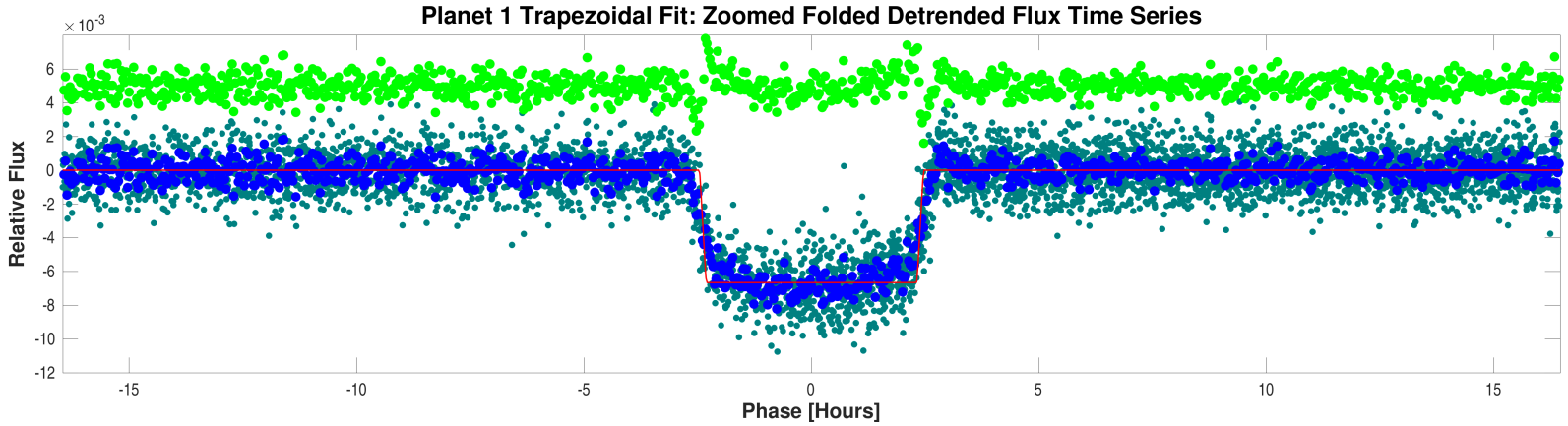
DoF: Degrees of Freedom

Parameter	Value	Uncertainty	Units
SNR	133.4		
Orbital Period	4.3763871		days
Transit Epoch	1495.9671925		BTJD
Transit Depth	6657		ppm
Transit Duration	5.4858		hours
Transit Ingress Duration	0.7097		hours
Model Chi Square Statistic (DoF)	17344.3 (5914)		

DoF: Degrees of Freedom



Folded detrended flux time series for CatId 393414358, Planet candidate 1 and folded trapezoidal model light curve.
Open `./planet-01/planet-search-and-model-fitting-results/trapezoidal-model-fit/0000000393414358-01-all-trapezoidal.fig`



Zoomed folded detrended flux time series for CatId 393414358, Planet candidate 1 and folded trapezoidal model light curve.
Open `./planet-01/planet-search-and-model-fitting-results/trapezoidal-model-fit/0000000393414358-01-all-trapezoidal-zoomed.fig`

7.4 Validation Tests

The Centroid Test and Eclipsing Binary Discrimination Test are chi-squared hypothesis tests. For these tests, a significance of 100% favors a planet, while 0% indicates an unlikely planet.

7.4.1 Weak Secondary Test

Result	Value	Uncertainty	Units	Statistic in Sigmas	Significance (%)
Orbital Period	4.3764		days		
Transit Duration	5		hours		
Maximum MES	73.6				
Secondary Phase	-0.58056		days		
Secondary MES	2.3				
Minimum Phase	1.2583		days		
Minimum MES	-1.9				
Median MES	-0.0				
MAD MES	0.41881				
Robust Statistic	1.4				
Secondary Depth	277.6	1.7845e+02	ppm		
Geometric Albedo	2.1	1.3462e+00		0.8107	20.88
Planet Effective Temperature	2613	4.2048e+02	Kelvin	2.8719	0.20

7.4.2 Eclipsing Binary Discrimination Test

Result	Value	Value in Sigmas	Significance (%)
Odd Even Transit Depth Comparison Statistic	2.6567e+00	1.6299	10.31

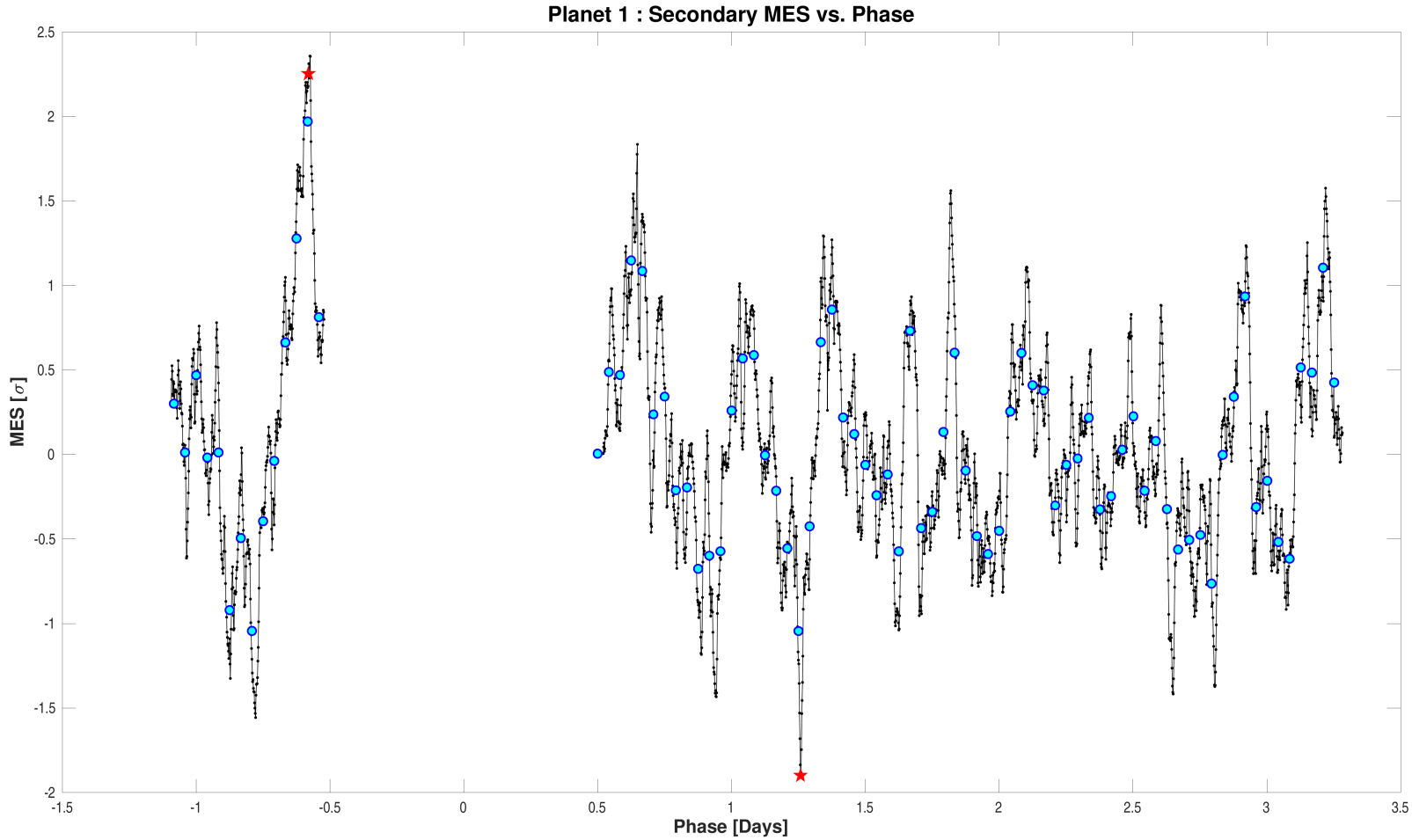
7.4.3 Bootstrap Test

Result	Value
False Alarm Probability	0.0000e+00
Bootstrap Threshold for Desired PFA	6.5
MES Mean	0.63
MES Standard Deviation	0.85
Transit Count	5

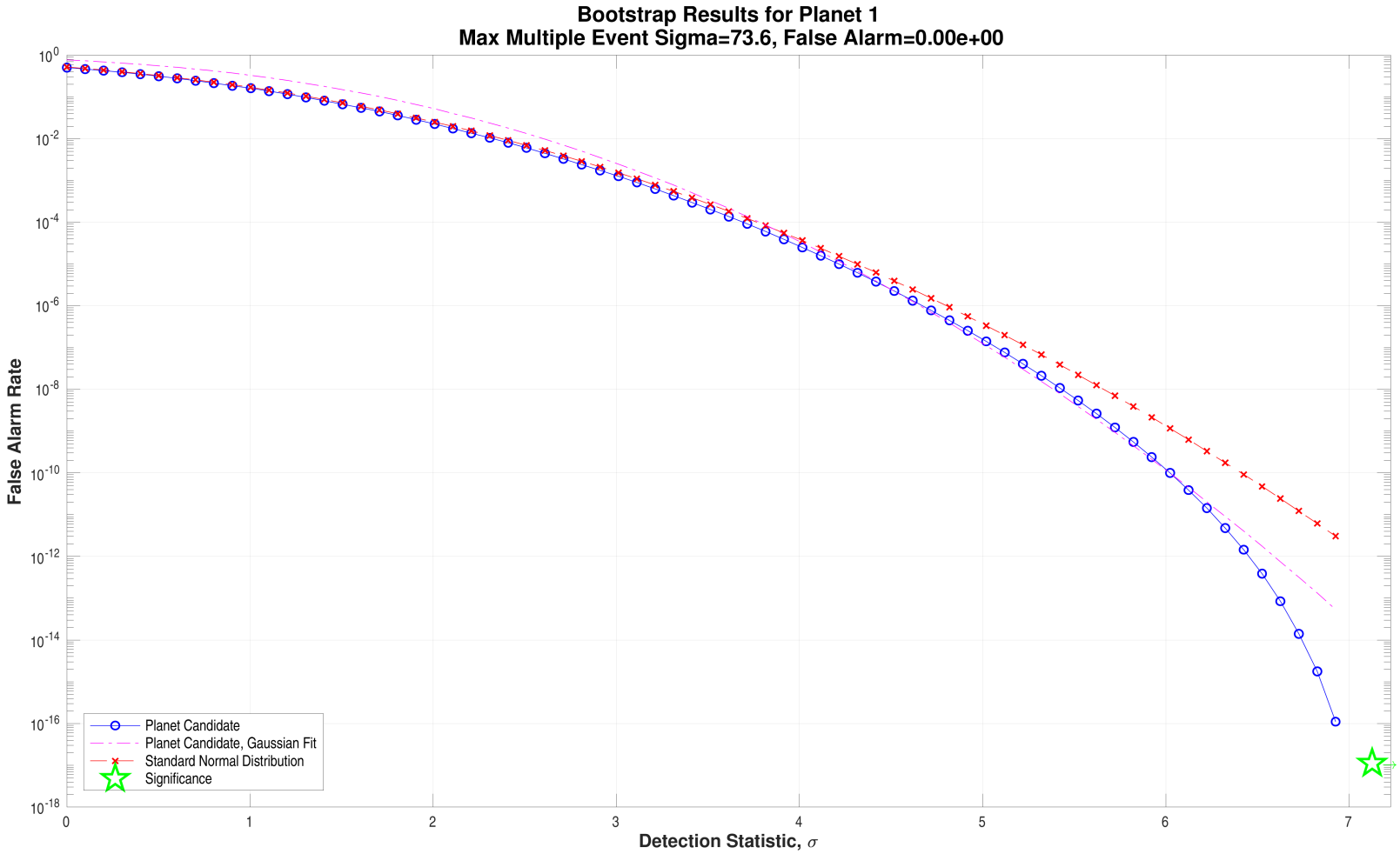
7.4.4 Ghost Diagnostic Test

Result	Value	Significance (%)
Maximum MES	73.6	
SNR	75.0	
Core Aperture Statistic	5.2973e+01	100.00
Halo Aperture Statistic	7.6478e+00	100.00
Ratio of Core/Halo Aperture Statistics	6.9266e+00	

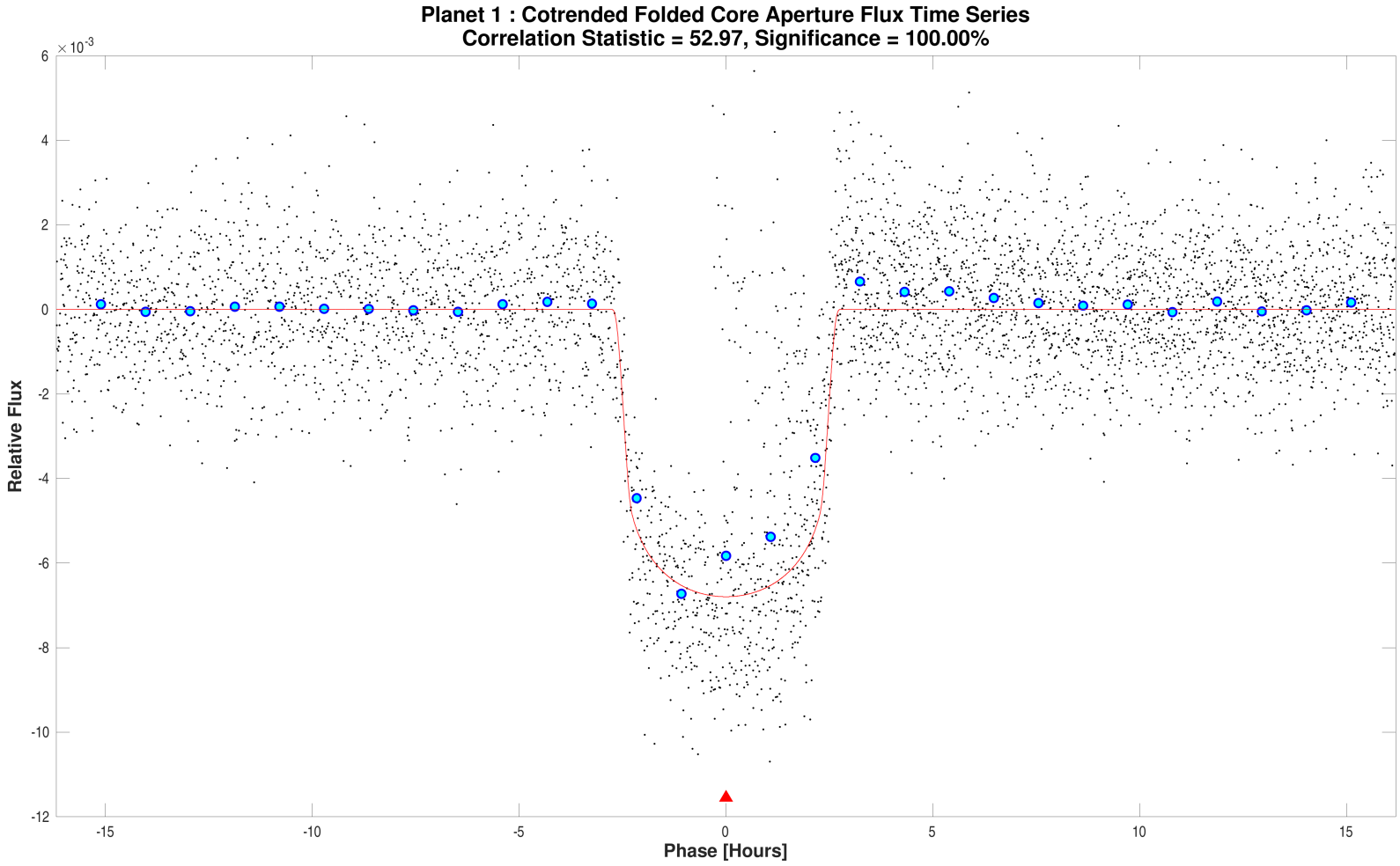
7.4.5 Validation Test Figures



The primary event has been set to zero and both the max and min of the resulting MES vs. Phase are marked with a red star. The best matched pulse duration in hours is 5. The maximum secondary MES and corresponding phase are 2.2533 and -0.58056 days respectively. The minimum secondary MES and corresponding phase are -1.8991 and 1.2583 days respectively.
Open `./planet-01/report-summary/0000000393414358-01-weak-secondary-diagnostic.fig`

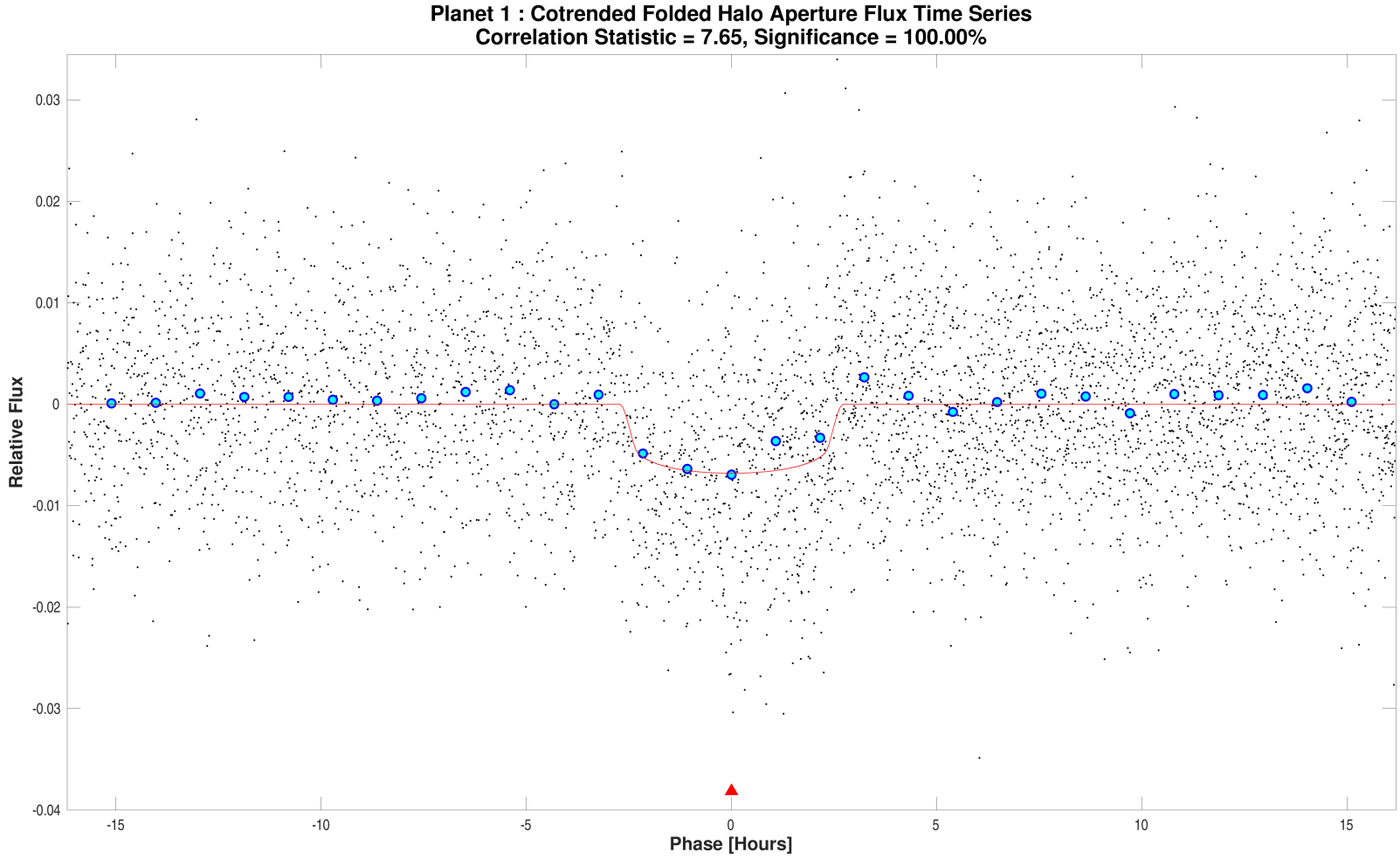


Bootstrap results for target 393414358, planet 1. Cumulative sum of the probabilities (derived from the histogram of counts) from upper tail to the search transit threshold; false alarm probability is indicated by the star. The Gaussian equivalent threshold for this false alarm probability is Inf. The threshold on this distribution that achieves the same false alarm rate as a 7.1 sigma threshold on a Gaussian distribution is 6.5029.
Open `./planet-01/bootstrap-results/0000000393414358-01-bootstrap-false-alarm.fig`



Optical ghost diagnostic core aperture flux time series for target 393414358, planet candidate 1. The unwhitened time series is phase folded at the orbital period associated with the planet candidate and centered on the epoch of the first transit. The time series was first cotrended against spacecraft engineering data, motion proxies, and/or cotrending basis vectors (CBVs) to remove systematic effects. Flux time series data represent the mean per pixel flux in the core or haloaperture; phase folded data points are shown in the figure with black dots. Binned and averaged phase folded flux values are marked with filled blue circles. The unwhitened transit model light curve is displayed in the figure with a red line. The value and significance of the core aperture correlation statistic are displayed in the figure title if the statistic was successfully computed.

Open `./planet-01/ghost-diagnostic-results/0000000393414358-01-core-unwhitened-cotrended-zoomed-model.fig`

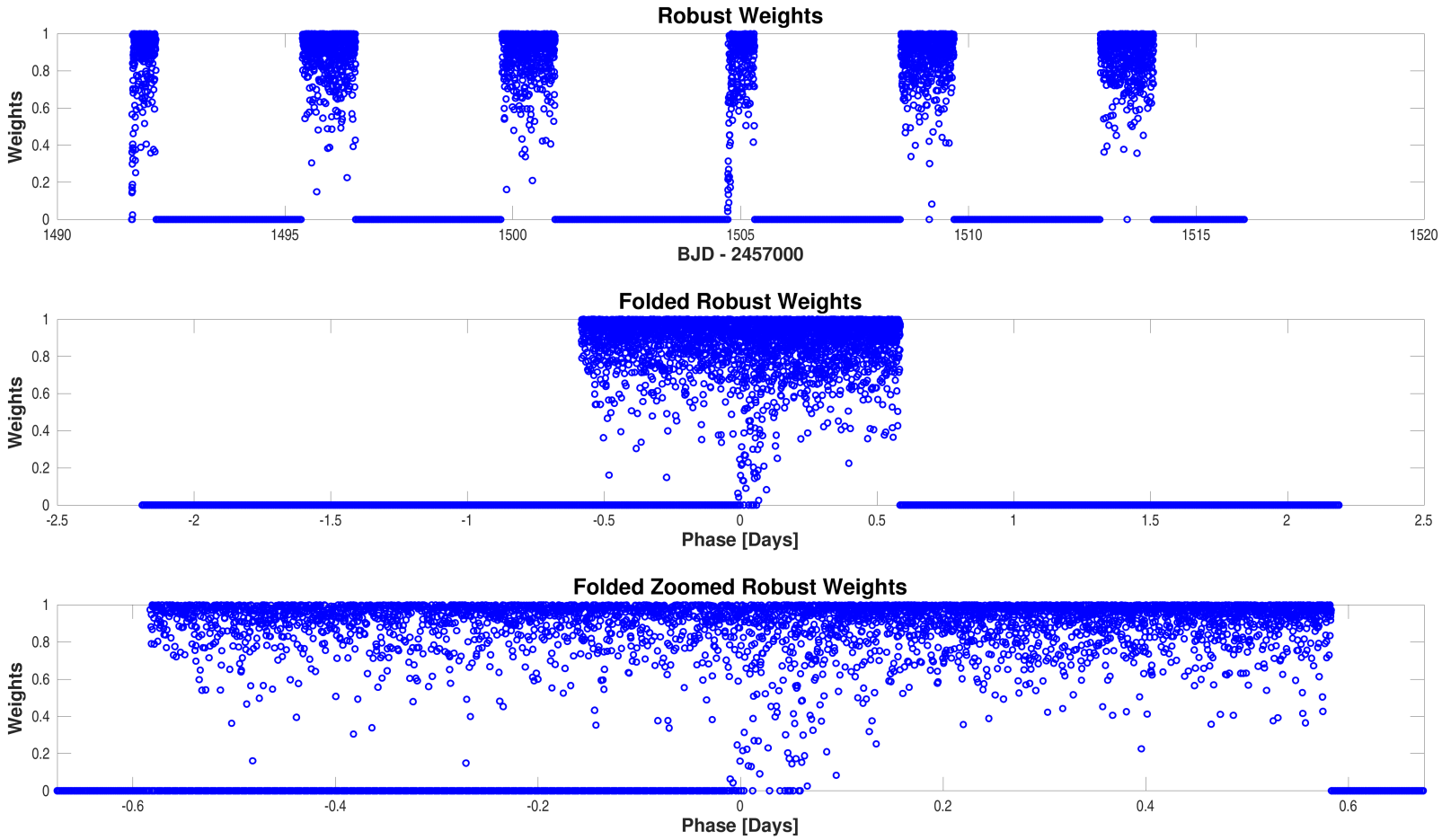


Optical ghost diagnostic halo aperture flux time series for target 393414358, planet candidate 1. The unwhitened time series is phase folded at the orbital period associated with the planet candidate and centered on the epoch of the first transit. The time series was first cotrended against spacecraft engineering data, motion proxies, and/or cotrending basis vectors (CBVs) to remove systematic effects. Flux time series data represent the mean per pixel flux in the core or haloaperture; phase folded data points are shown in the figure with black dots. Binned and averaged phase folded flux values are marked with filled blue circles. The unwhitened transit model light curve is displayed in the figure with a red line. The value and significance of the halo aperture correlation statistic are displayed in the figure title if the statistic was successfully computed.

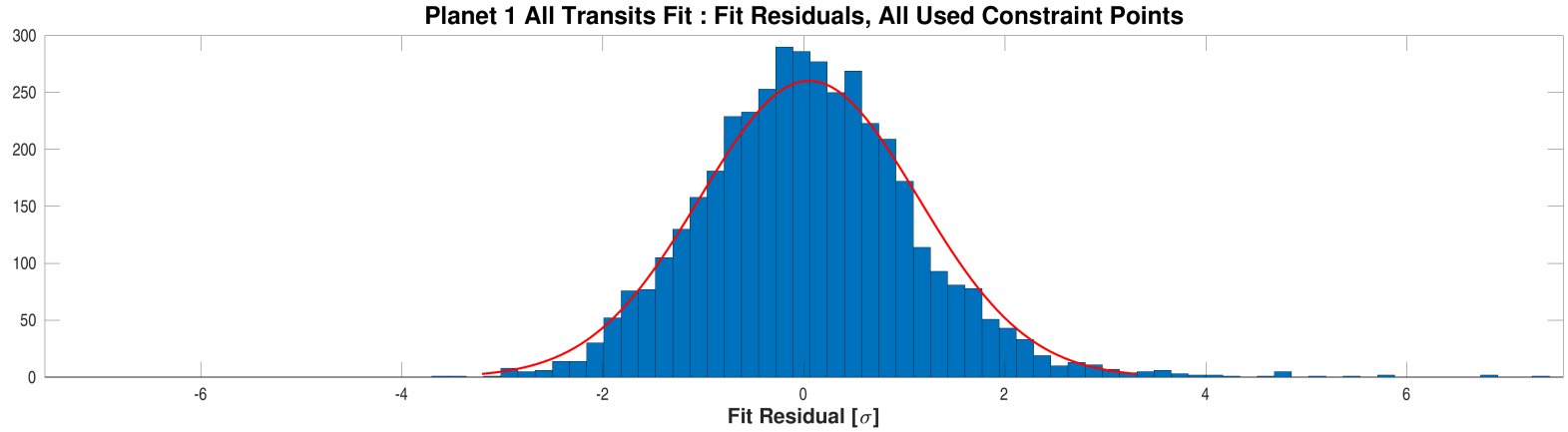
Open `./planet-01/ghost-diagnostic-results/0000000393414358-01-halo-unwhitened-cotrended-zoomed-model.fig`

Appendix A Planet Candidate 1

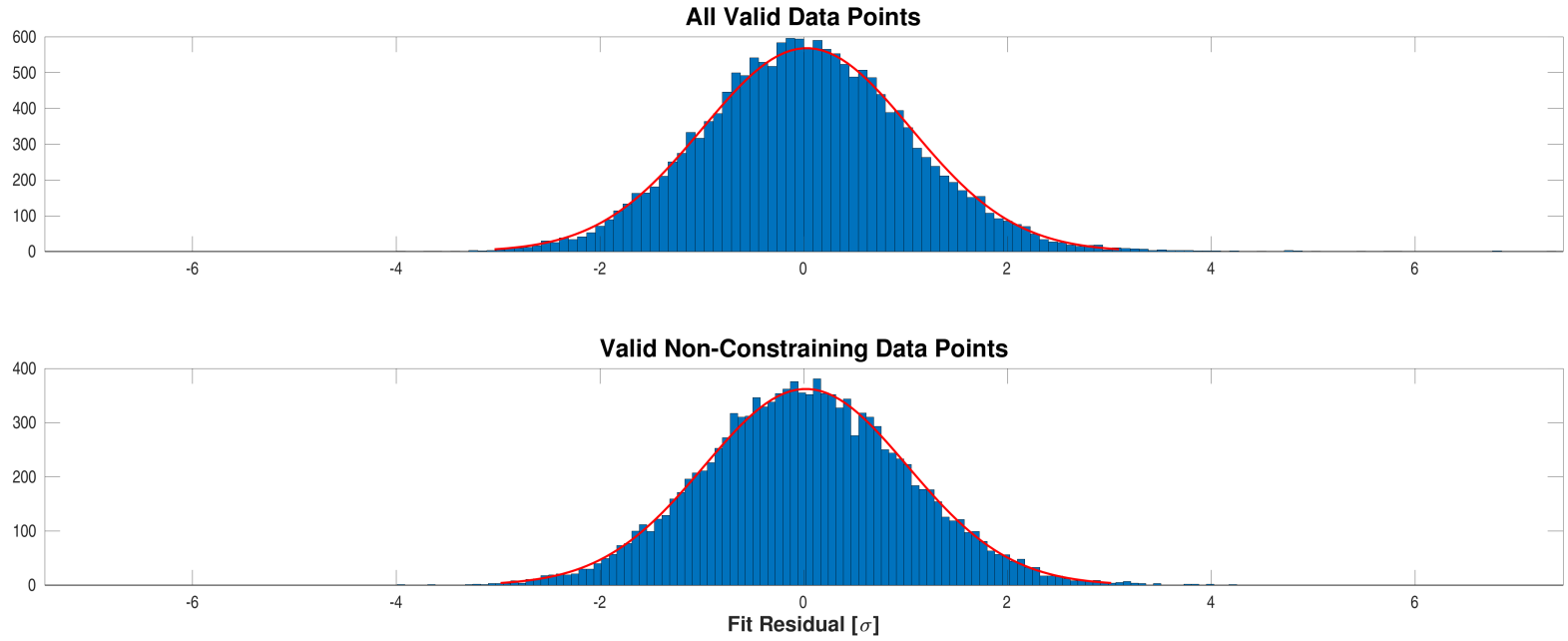
A.1 Model Fitter: All Transits



Robust weights distribution for CatId 393414358, Planet candidate 1. Top plot: all data points. Middle plot: all data points, folded per the fitted period and epoch. Bottom plot: all data points, folded and zoomed.
Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000393414358-01-all-robust-weights.fig`



Fit residuals distribution for CatId 393414358, Planet candidate 1. Only the valid data points used to constrain the fit are shown here. A Gaussian fit to the histogram is shown in red.
Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000393414358-01-all-histo-used.fig`

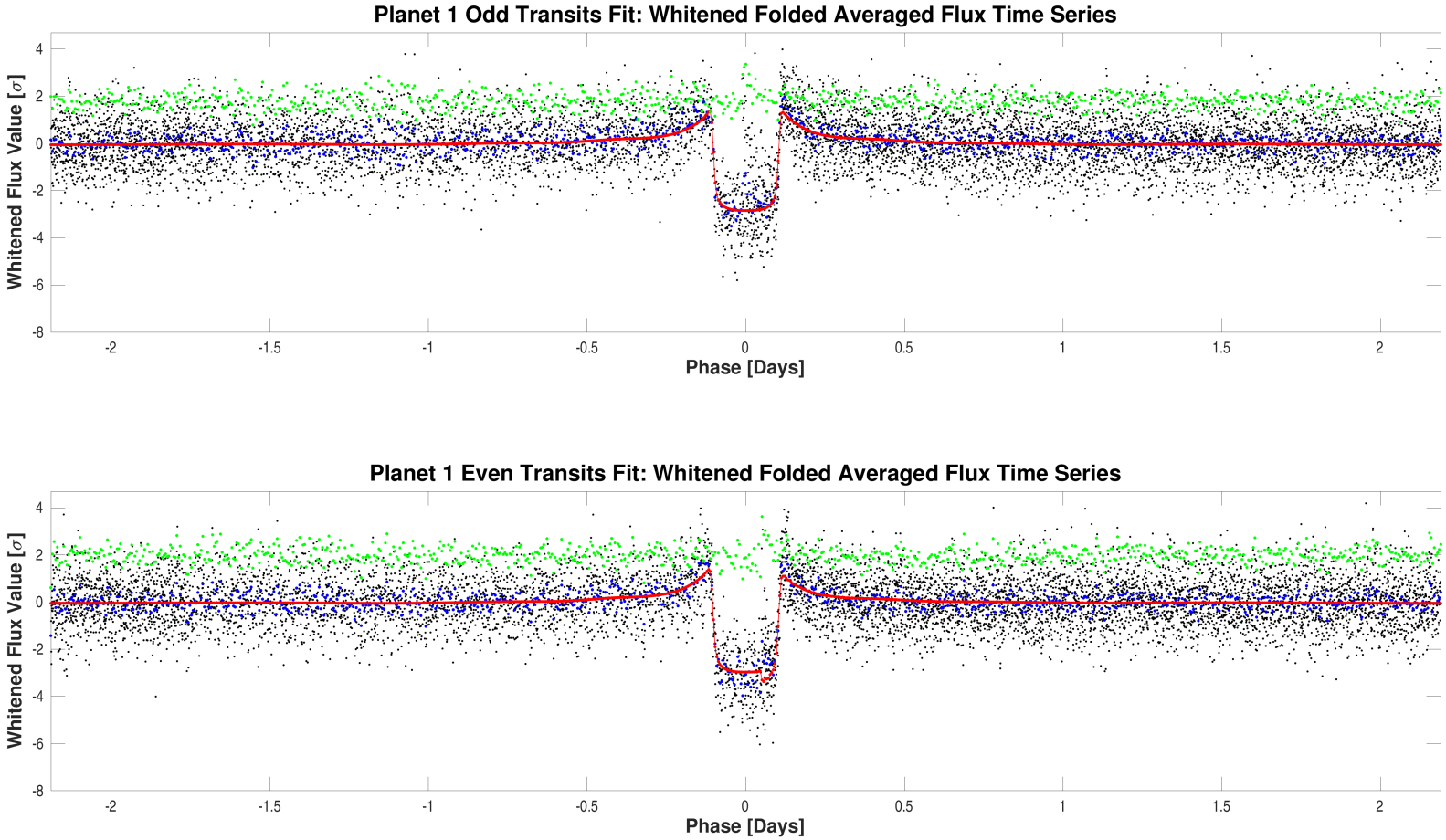


Fit residuals distribution for CatId 393414358, Planet candidate 1. Top plot: all valid data. Bottom plot: valid data not used to constrain fit (due to distance from a transit). Gaussian fits to the histograms are shown in red.
Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000393414358-01-all-histo-all-and-unused.fig`

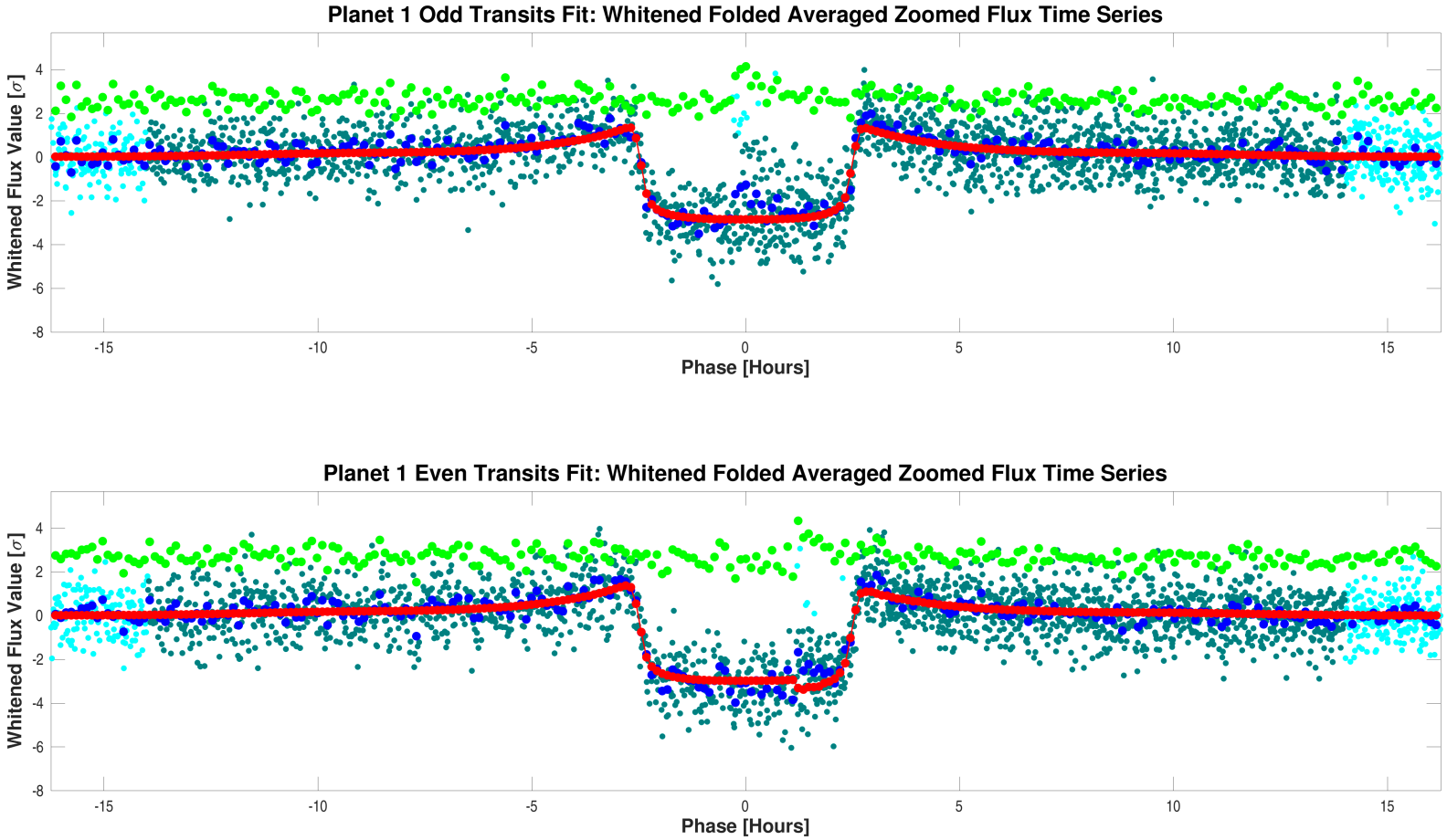
A.2 Model Fitter: Odd & Even Transits

Parameter	Odd Transits Value	Odd Transits Uncertainty	Even Transits Value	Even Transits Uncertainty	Units	Difference / Uncertainty
SNR	50.9		50.5			
Orbital Period	4.3788029	4.3975e-04	4.3783273	3.4441e-04	days	8.5157e-01
Transit Epoch	1495.9632340	9.2239e-04	1500.3432475	7.3330e-04	BTJD	1.2226e+00
Impact Parameter	0.2068	4.7194e-01	0.0142	7.8941e+00		2.4353e-02
Planet Radius to Star Radius Ratio	0.0762108	1.7775e-03	0.0742167	1.8633e-03		7.7438e-01
Semi-major Axis to Star Radius Ratio	6.5582	6.4958e-01	6.7371	7.3667e-01		1.8214e-01
Planet Radius	15.6415	3.6482e-01	15.2322	3.8241e-01	Earth radii	7.7438e-01
Semi-major Axis	0.0575	3.8502e-06	0.0575	3.0156e-06	AU	8.5157e-01
Effective Stellar Flux	921.6587	1.2341e-01	921.7923	9.6681e-02	Goldilocks	8.5159e-01
Equilibrium Temperature	1405	4.7043e-02	1405	3.6849e-02	Kelvin	8.5158e-01
Stellar Density	0.1976	5.8730e-02	0.2143	7.0301e-02	Solar density	1.8193e-01
Transit Depth	6826	1.3125e+02	6528	1.2682e+02	ppm	1.6299e+00
Transit Duration	5.4134	9.0593e-02	5.3556	9.2062e-02	hours	4.4757e-01
Transit Ingress Duration	0.4021	9.0642e-02	0.3726	9.2444e-02	hours	2.2743e-01
Eccentricity	0.0000	0.0000e+00	0.0000	0.0000e+00		
Peri Longitude	0.0000	0.0000e+00	0.0000	0.0000e+00	degrees	
Model Chi Square Statistic (DoF)	3179.1 (3769.7)		3179.1 (3769.7)			

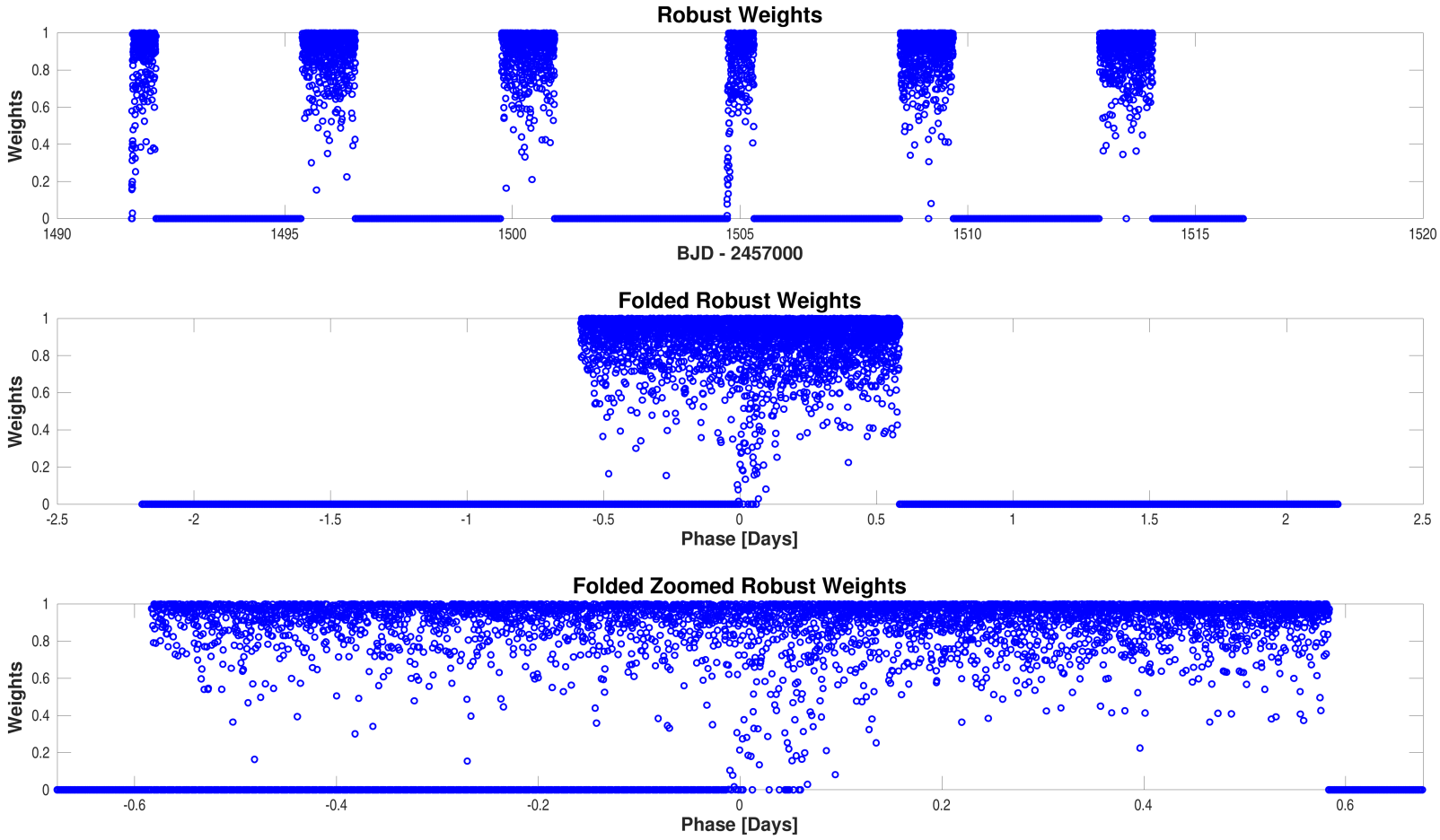
DoF: Degrees of Freedom



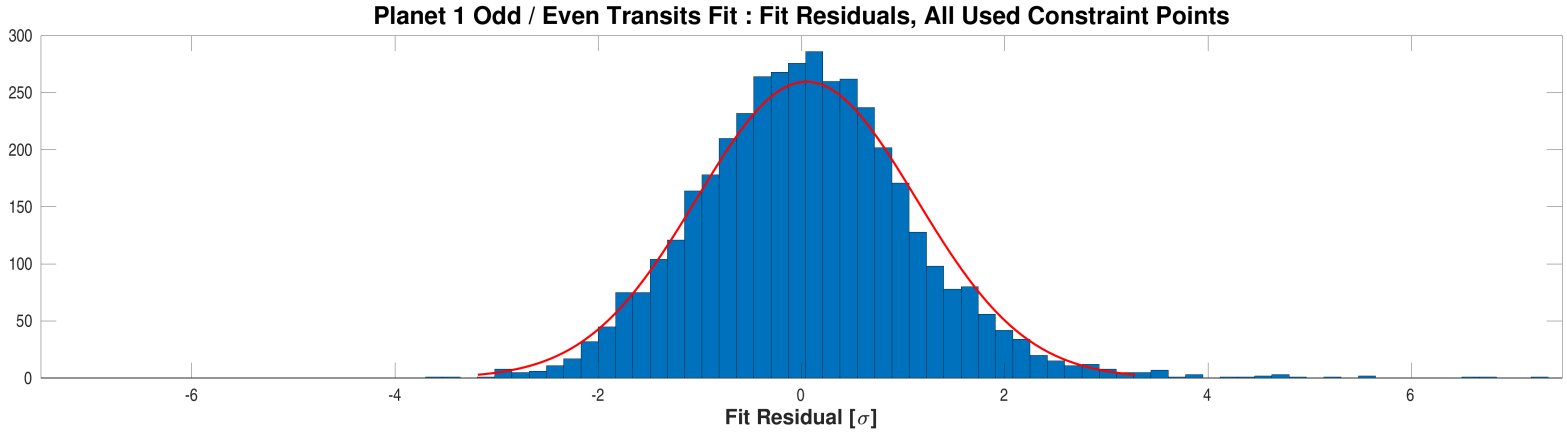
Folded flux time series for CatId 393414358, Planet candidate 1 in the whitened domain is plotted in black dots. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged values of the folded flux time series; the red dots represent the averaged values of the folded model light curve of the odd/even transits fit; the green dots are the averaged folded fit residuals, vertically offset for clarity. Odd-even transits fit completed with full convergence.
Open `./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000393414358-01-odd-even-whitened.fig`



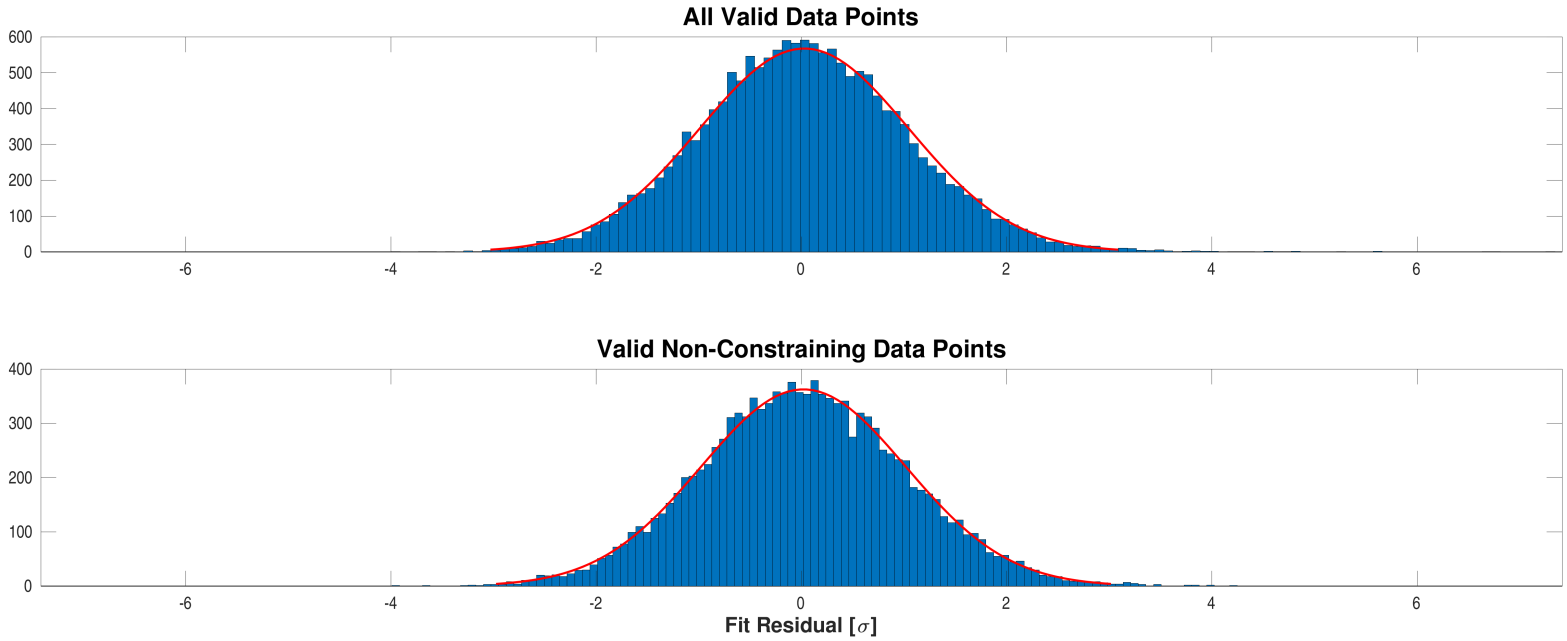
Folded flux time series for CatId 393414358, Planet candidate 1 in the whitened domain, zoomed on the transit. The flux data whose robust weights are larger/smaller than 0.1 are plotted in dark green/cyan dots, respectively. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged values of the folded flux time series; the red dots represent the averaged values of the fitted model light curve of the odd/even transits fit; the green dots are the averaged folded fit residuals, vertically offset for clarity. Magenta dots are the averaged values of the folded flux time series, with a phase shift of 0.5 relative to the blue dots, vertically offset for clarity. Odd-even transits fit completed with full convergence.
Open `./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000393414358-01-odd-even-whitened-zoomed.fig`



Robust weights distribution for CatId 393414358, Planet candidate 1. Top plot: all data points. Middle plot: all data points, folded per the fitted period and epoch. Bottom plot: all data points, folded and zoomed.
Open `./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000393414358-01-odd-even-robust-weights.fig`

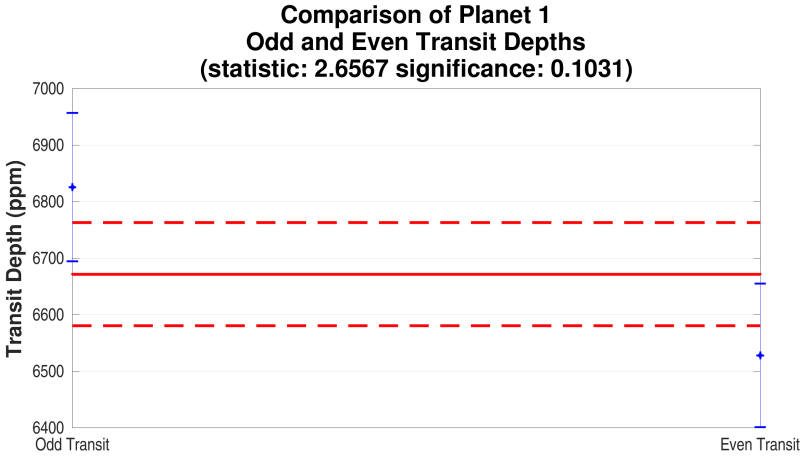


Fit residuals distribution for CatId 393414358, Planet candidate 1. Only the valid data points used to constrain the fit are shown here. A Gaussian fit to the histogram is shown in red.
Open `./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000393414358-01-odd-even-histo-used.fig`



Fit residuals distribution for CatId 393414358, Planet candidate 1. Top plot: all valid data. Bottom plot: valid data not used to constrain fit (due to distance from a transit). Gaussian fits to the histograms are shown in red.
Open `./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000393414358-01-odd-even-histo-all-and-unused.fig`

A.3 Eclipsing Binary Discrimination Test



Top-left: Diagnostic plot of Odd/Even Transit Depth Test for catId 393414358, planet 1. A significance level close to 1/0 favors a transiting planet/an eclipsing binary. Open `./planet-01/binary-discrimination-test-results/0000000393414358-01-eclipsing-binary-discrimination-tests.fig`

Appendix B Alerts

Time	Severity	Message
1537.5849	warning	TOI matching is disabled (target=1, catId=393414358, component=performDvToiMatching)