

Data Validation (DV) Report
for TESS ID 158324245
Sectors 14 - 14

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

13-Sep-2019 11:09:35 Z

Contents

1	Summary	1
2	Survey Image	2
3	Flux Time Series	3
4	Dashboards	5
5	Pixel Level Diagnostics	6
5.1	Planet Candidate 1	6
5.2	Difference Image TIC Key	10
6	Phased Light Curves	12
7	Planet Candidate 1	15
7.1	Model Fitter: All Transits	15
7.2	Model Fitter: Reduced Parameter Fit Results	18
7.3	Model Fitter: Trapezoidal Fit Results	20
7.4	Validation Tests	22
7.4.1	Weak Secondary Test	22
7.4.2	Eclipsing Binary Discrimination Test	22
7.4.3	Bootstrap Test	23
7.4.4	Ghost Diagnostic Test	23
7.4.5	Validation Test Figures	24
Appendices		28
A	Planet Candidate 1	28
A.1	Model Fitter: All Transits	28
A.2	Model Fitter: Odd & Even Transits	30
A.3	Eclipsing Binary Discrimination Test	35
B	Alerts	36

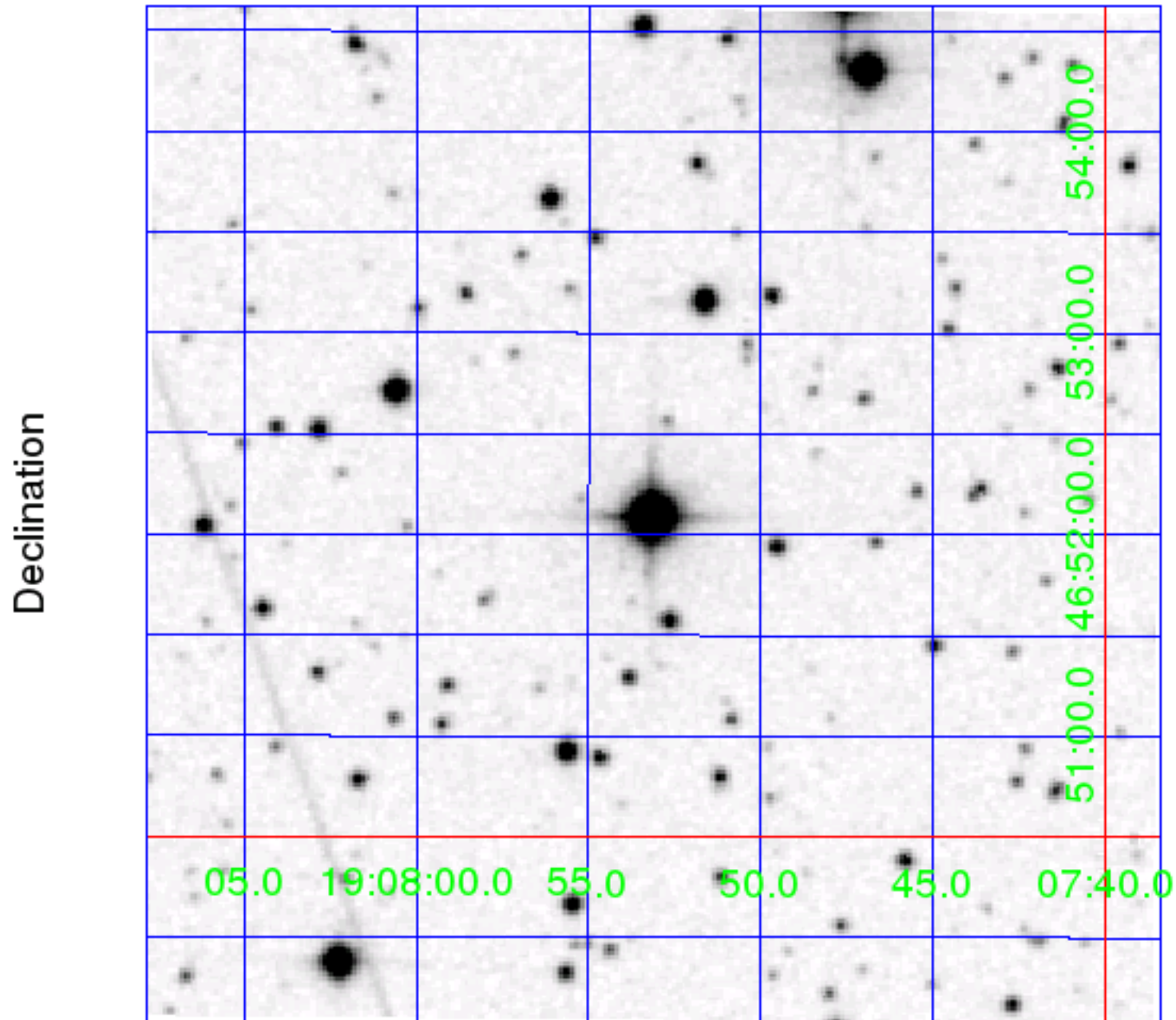
1 Summary

Target Properties	Value	Uncertainty	Units	Provenance
Catalog ID	158324245			
TOI ID	-			
TESS Name	-			
RA	286.97119800	0	degrees	TIC8
Dec	46.86835500	0	degrees	TIC8
Magnitude	9.567	0.018		TIC8
Radius	1.000	0.000	Solar radii	Solar
Effective Temperature	7986	177	Kelvin	TIC8
log(g)	4.438	0	cm/sec ²	Solar
[M/H]	0.000	0	Solar metallicity	Solar
Stellar Density	1.000	0.000	Solar density	Solar
Limb Darkening Coefficient 1	0.4523			
Limb Darkening Coefficient 2	0.52984			
Limb Darkening Coefficient 3	-0.68058			
Limb Darkening Coefficient 4	0.2541			
Number of Planet Candidates	1			
TOI Model	toi-plus-2019-08-29.csv			
TESS Names Model	-			
External TCE Model	-			
Software Revision	spoc-4.0.8-20190912			
Date Report Generated	13-Sep-2019 11:09:35 Z			

Sector	Target Table	Camera/ CCD	Crowding Metric	Flux Fraction
14	167	2:3	0.5036	0.8980

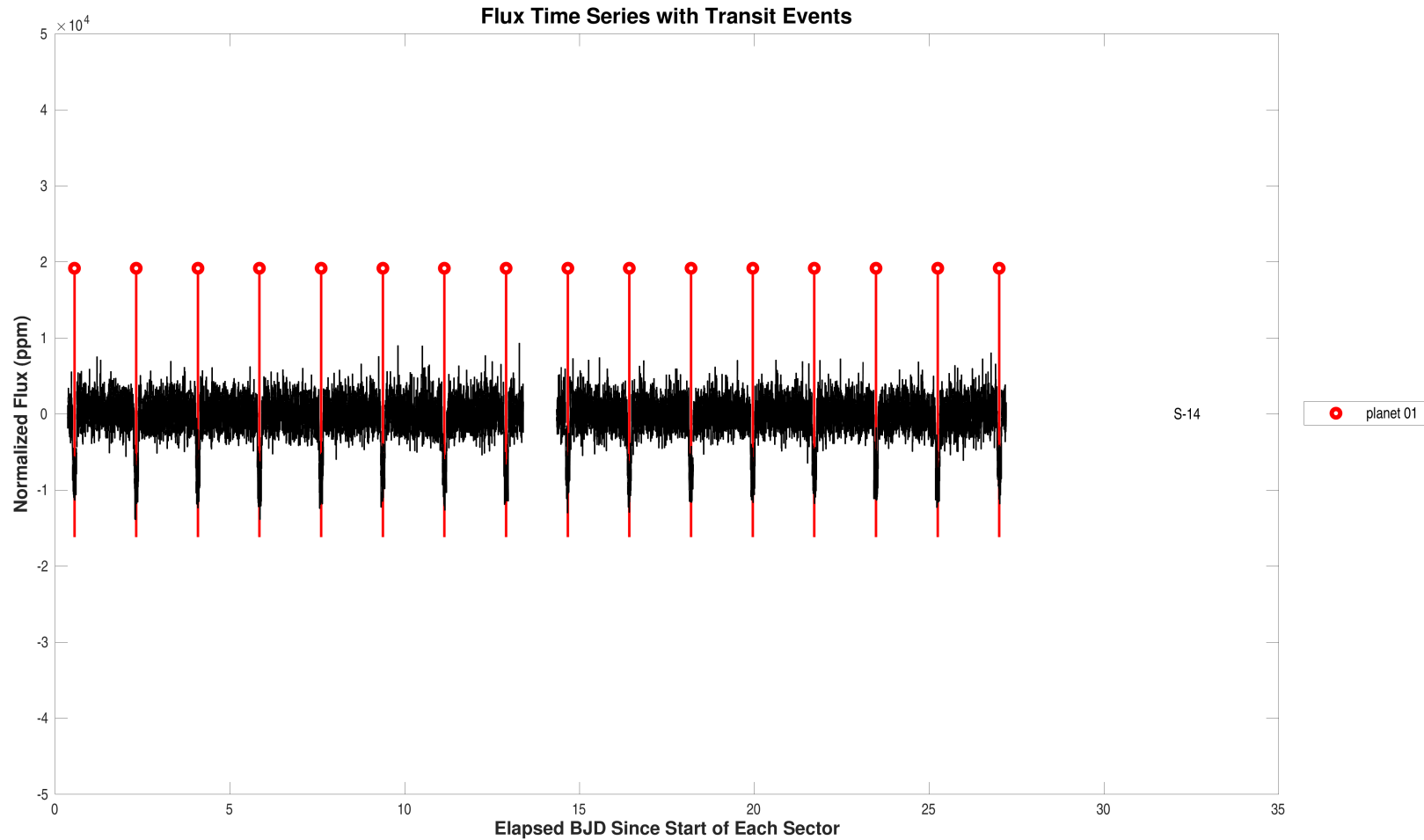
Planet Candidate	TOI ID	TESS Name	TOI Correlation	Period (days)	Period Ratio	Epoch (BTJD)	Semi-major Axis (AU)	Radius (Re)	Seff	Teq (K)	False Alarm	Suspected EB
1	-	-	-	1.764	1.00	1683.554	0.03	9.5	4461.3	2084	0.00e+00	false

2 Survey Image

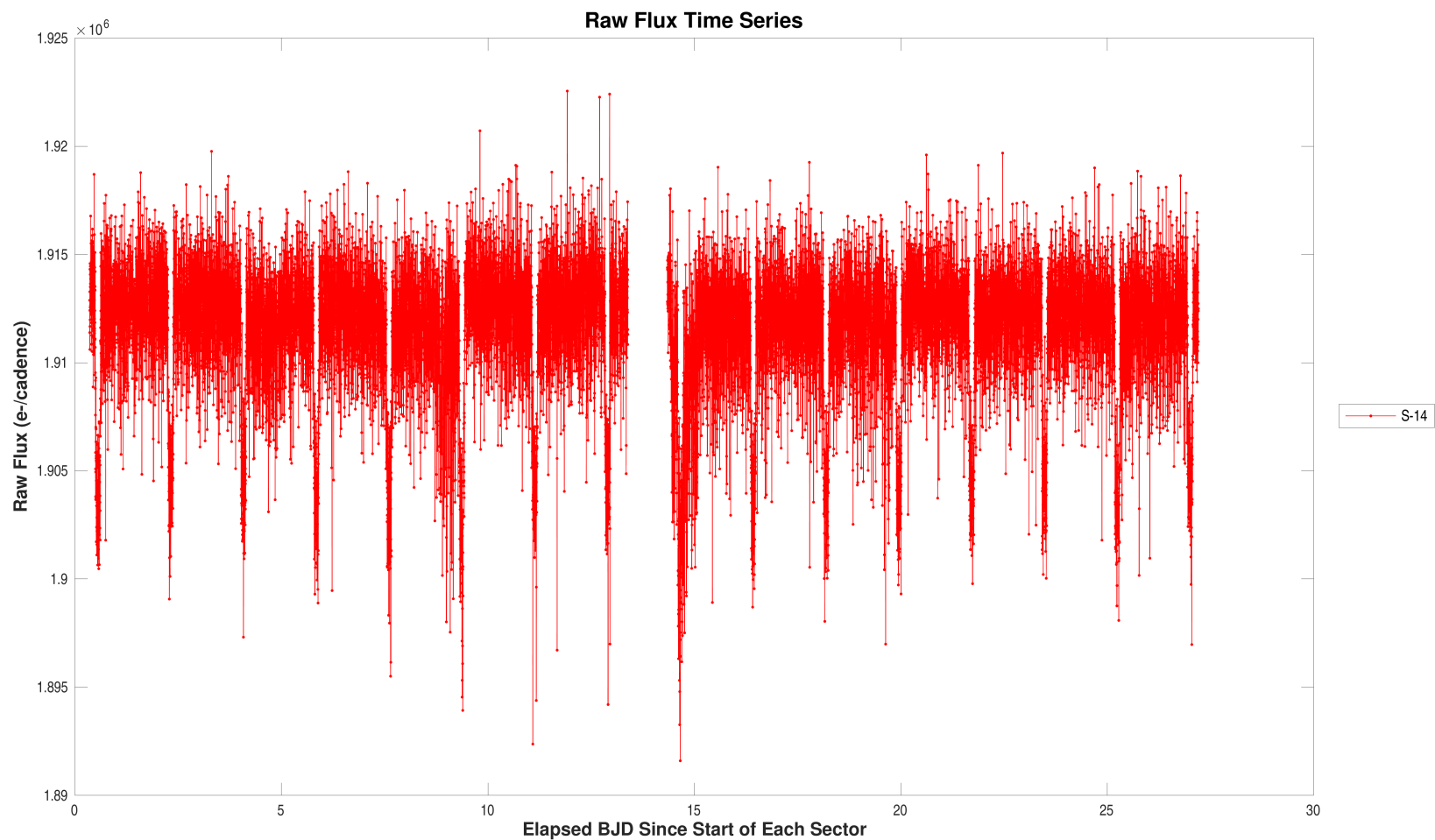


Digitized Sky Survey (DSS) red image. The 5' x 5' image is centered on the J2000 coordinates of target (158324245).

3 Flux Time Series



Summary plot of sector-stitched flux time series and transits for target 158324245, 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 14, target table 167, start BJD is 2458683. Open `./summary-plots/0000000158324245-00-flux-dv-fit-14-167.fig`



Summary plot of raw flux time series. For the data of sector 14, target table 167, start BJD is 2458683.

Open `./summary-plots/0000000158324245-00-raw-flux-14-167.fig`

4 Dashboards

Planet Candidate 1

Model Fitter	Stellar Radius 1.0 ± 0.0 Solar units		Core Aperture Correlation Statistic Value = 67.36 Significance = 100.00%		Ghost Diagnostic Test	
	Period = 1.8 ± 0.0 days Depth = 8509 ± 66 ppm Planet Radius = 9.5 ± 0.1 Earth radii Semi-major Axis = 0.0 ± 0.0 AU Effective Stellar Flux = 4461.3 ± 396.0 Equilibrium Temperature = 2084 ± 46 Kelvin Chi-squared/DoF = 0.8 SNR = 127.7		Halo Aperture Correlation Statistic Value = 14.17 Significance = 100.00% Core/Halo Ratio Ratio = 4.75			
Eclipsing Binary Discrimination Test	Odd-Even Depth Comparison Statistic Value = 2.78e-01 Significance = 59.82%		Offsets Relative to Out of Transit Centroid Source RA Offset = 8.98e-01 ± 2.50e+00 arcsec (0.36 σ) Source Dec Offset = 3.15e-01 ± 2.50e+00 arcsec (0.13 σ) Source Offset Distance = 9.52e-01 ± 2.50e+00 arcsec (0.38 σ) Offsets Relative to TIC Position Source RA Offset = 6.43e-01 ± 2.50e+00 arcsec (0.26 σ) Source Dec Offset = 1.05e+00 ± 2.50e+00 arcsec (0.42 σ) Source Offset Distance = 1.23e+00 ± 2.50e+00 arcsec (0.49 σ)		Difference Image Centroid Offsets	
	Shorter Period Comparison Statistic Value = <i>N/A</i> Significance = <i>N/A</i>	Longer Period Comparison Statistic Value = <i>N/A</i> Significance = <i>N/A</i>	False Alarm = 0.00e+00 Transit Count = 16 Max Multiple Event Statistic = 99.8		Bootstrap Test	

Summary of model fitter results and validation test results for target 158324245, 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

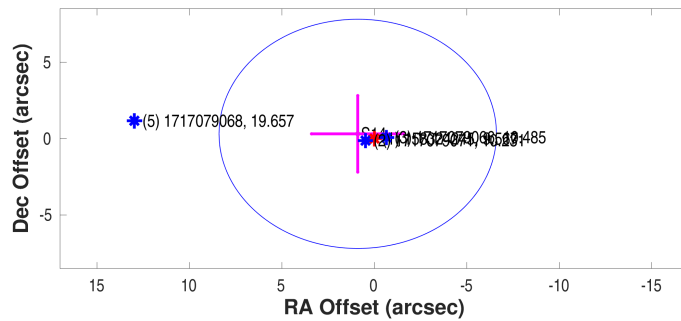
	RA	Dec	Units
Offset	$0.8979 \pm 2.50e + 00$	$0.3152 \pm 2.50e + 00$	arcseconds
Offset/ σ	0.36	0.13	
Offset Distance	$0.9516 \pm 2.50e + 00$		arcseconds
Offset Distance/ σ	0.38		
3σ Radius	7.5046		arcseconds

Mean offset from the TIC RA and Dec

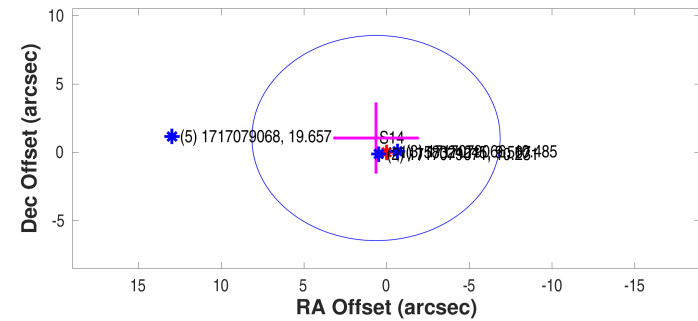
	RA	Dec	Units
Offset	$0.6430 \pm 2.50e + 00$	$1.0454 \pm 2.50e + 00$	arcseconds
Offset/ σ	0.26	0.42	
Offset Distance	$1.2273 \pm 2.50e + 00$		arcseconds
Offset Distance/ σ	0.49		
3σ Radius	7.5065		arcseconds

Planet Candidate 1

Offsets Relative to Out of Transit Centroid



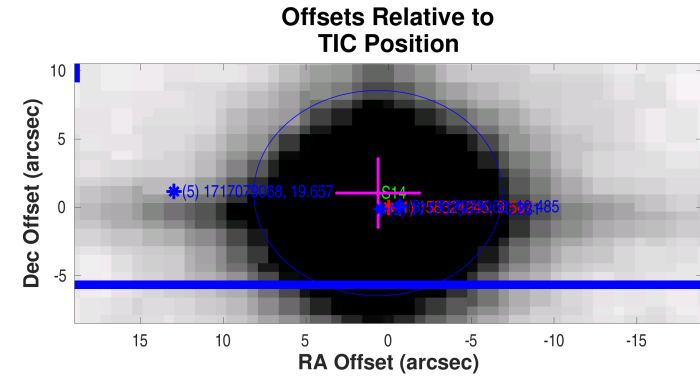
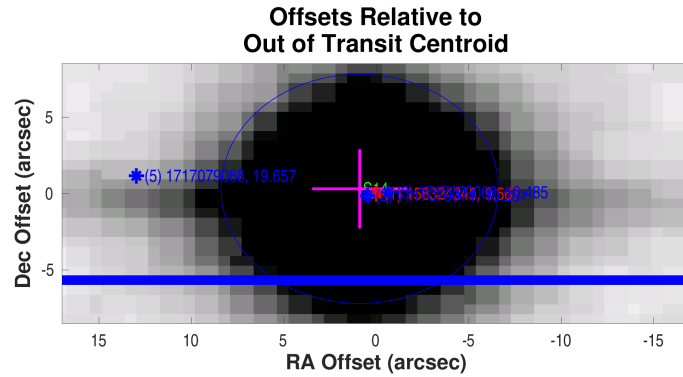
Offsets Relative to TIC Position



Difference image centroid offsets for target 158324245, 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/0000000158324245-01-difference-image-centroid-offsets.fig`

Planet Candidate 1



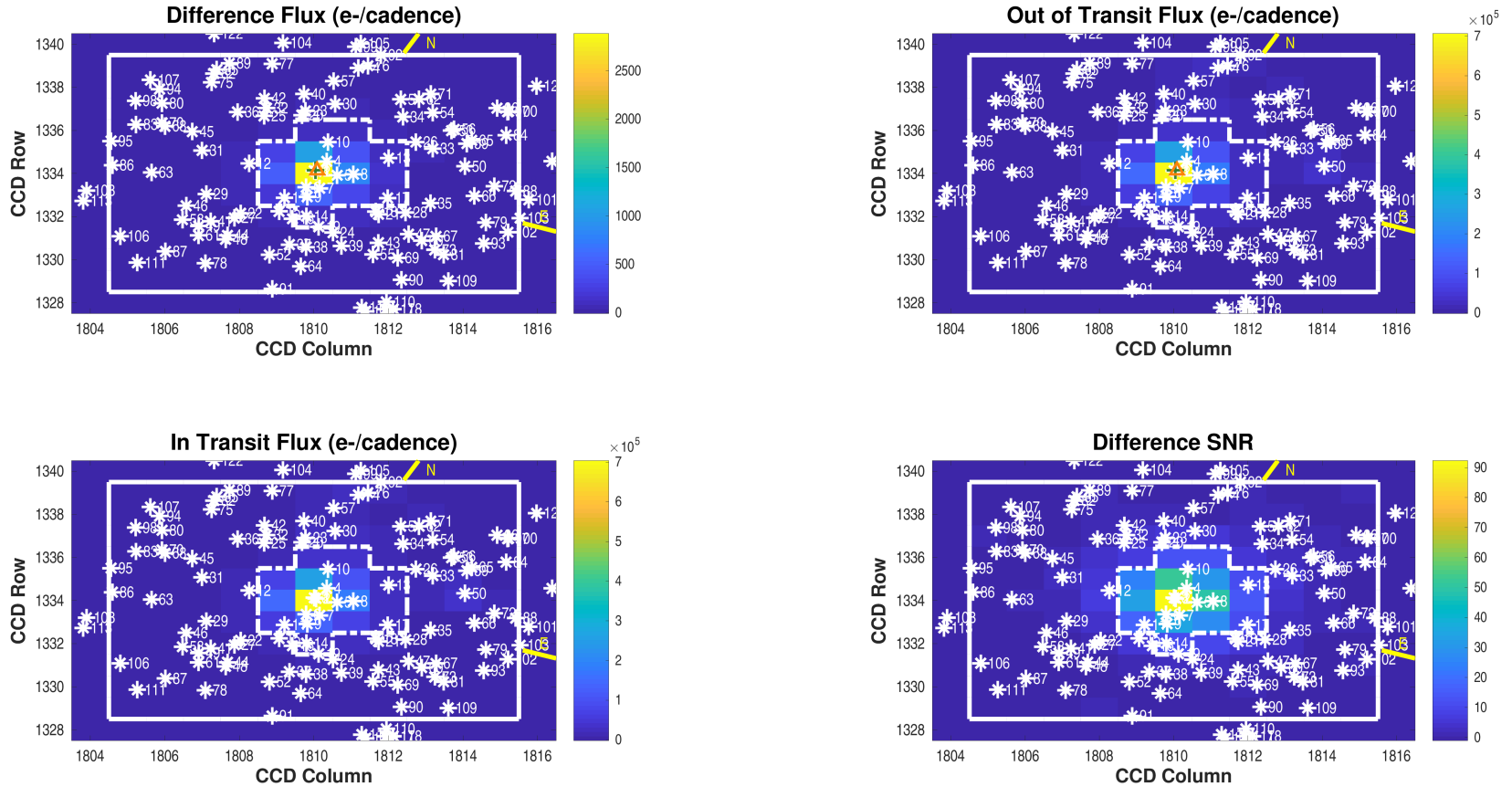
Difference image centroid offsets for target 158324245, planet candidate 1, displayed on survey image for given target. Left: difference image PRF centroid offsets in RA and Dec with respect to the per sector out-of-transit centroids for the given target. Right: difference image PRF centroid offsets 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/0000000158324245-01-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
Planet Candidate 1 / Sector 14 / Target Pixel Table 167



Difference image for target 158324245, planet candidate 1, sector 14, target pixel table 167. 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. Number of transits = 14; number of valid in-transit cadences = 1145; number of in-transit cadence gaps = 9; number of valid out-of-transit cadences = 2825; number of out-of-transit cadence gaps = 18. Difference image quality metric = 1.00 (good).

Open `./planet-01/difference-image/0000000158324245-01-difference-image-14-167.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	$1334.15 \pm 1.18e - 05$	$1810.04 \pm 1.29e - 05$	pixels	$286.97108250 \pm 6.43e - 07$	$46.86846756 \pm 6.27e - 07$	degrees
Difference Image Centroid	$1334.15 \pm 5.39e - 03$	$1810.09 \pm 5.96e - 03$	pixels	$286.97144731 \pm 3.43e - 05$	$46.86855511 \pm 3.06e - 05$	degrees
Offset	$-0.0031 \pm 5.39e - 03$	$0.0451 \pm 5.96e - 03$	pixels	$0.8979 \pm 8.45e - 02$	$0.3152 \pm 1.10e - 01$	arcseconds
Offset/ σ	-0.58	7.56		10.63	2.86	
Offset Distance	$0.0452 \pm 5.98e - 03$		pixels	$0.9516 \pm 8.91e - 02$		arcseconds
Offset Distance/ σ	7.56			10.68		

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

	Row	Column	Units	RA	Dec	Units
TIC Reference Centroid	$1334.11 \pm 1.10e - 04$	$1810.04 \pm 1.11e - 04$	pixels	$286.97118607 \pm 0.00e + 00$	$46.86826471 \pm 0.00e + 00$	degrees
Difference Image Centroid	$1334.15 \pm 5.39e - 03$	$1810.09 \pm 5.96e - 03$	pixels	$286.97144731 \pm 3.43e - 05$	$46.86855511 \pm 3.06e - 05$	degrees
Offset	$0.0337 \pm 5.39e - 03$	$0.0479 \pm 5.97e - 03$	pixels	$0.6430 \pm 8.45e - 02$	$1.0454 \pm 1.10e - 01$	arcseconds
Offset/ σ	6.25	8.02		7.61	9.48	
Offset Distance	$0.0585 \pm 5.67e - 03$		pixels	$1.2273 \pm 1.05e - 01$		arcseconds
Offset Distance/ σ	10.32			11.64		

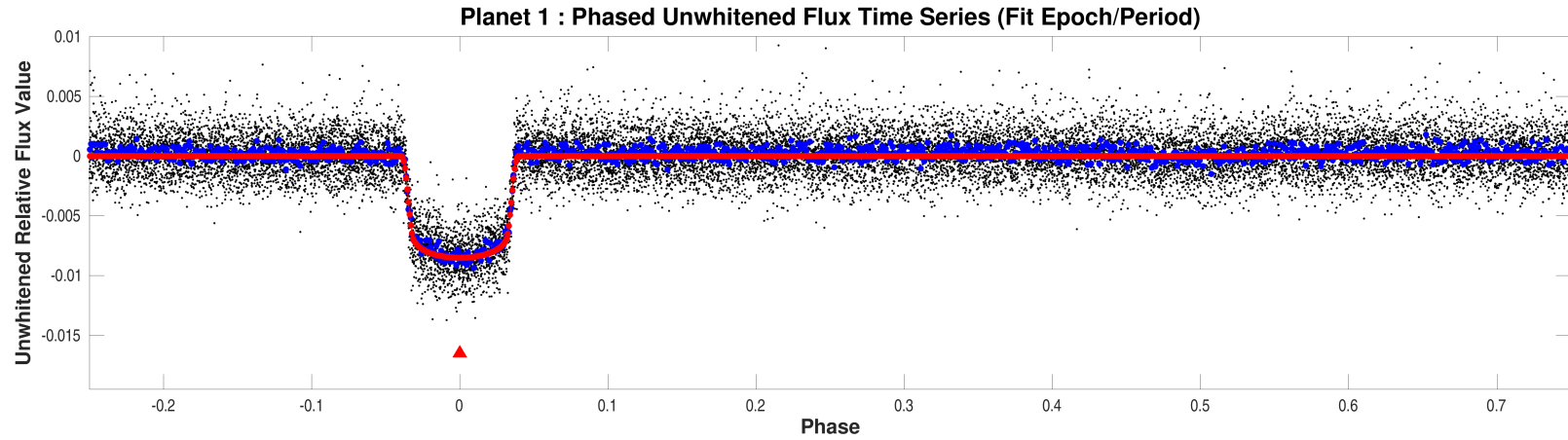
5.2 Difference Image TIC Key

Index	Catalog ID	Mag	RA (degrees)	Dec (degrees)	Distance (arcsec)
1	158324245	9.567	286.97118607	46.86826471	0.00
2	1717079071	10.231	286.97138026	46.86822840	0.50
3	1717079066	10.485	286.97091843	46.86828453	0.66
4	1717079067	20.748	286.97205481	46.87138662	11.44
5	1717079068	19.657	286.97645895	46.86858802	13.03
6	1717079070	19.668	286.97181780	46.86369659	16.52
7	1717079065	20.598	286.97482751	46.86427915	16.92
8	1717079069	18.885	286.97971389	46.86986416	21.76
9	1717079063	19.730	286.97355157	46.86141319	25.34
10	1717079064	18.371	286.96928451	46.87624434	29.11
11	158324254	15.139	286.96891661	46.85975254	31.15
12	158324249	15.354	286.95607596	46.86604998	38.03
13	1717079632	20.080	286.98459820	46.87602585	43.25
14	1717079062	20.160	286.97643480	46.85657301	44.03
15	1717079061	20.260	286.96991915	46.85604056	44.12
16	158324260	16.158	286.97389228	46.85504363	48.06
17	1717079357	20.224	286.99070026	46.86609737	48.66
18	1717078739	19.600	286.99038680	46.86198035	52.39
19	1717078737	20.583	286.98070226	46.85468057	54.22
20	1717079074	18.860	286.95951274	46.88130047	55.03
21	1717078740	17.841	286.99135967	46.86148772	55.32
22	1717079059	19.774	286.96213047	46.85316268	58.76
23	1717079634	18.052	286.95956592	46.88258225	58.95
24	1717078736	19.202	286.98462771	46.85413289	60.69
25	158324230	17.879	286.95167568	46.87874405	61.07
26	158324226	17.838	286.98779846	46.88171292	63.37
27	158324264	17.193	286.96154016	46.85166630	64.30
28	1717079358	19.741	286.99677491	46.86359685	65.18
29	1717079058	19.935	286.95183734	46.85582726	65.37
30	158324219	13.319	286.96474628	46.88612318	66.22
31	158324248	17.028	286.94405265	46.86636673	67.13
32	1717079073	18.785	286.95094429	46.88083857	67.31
33	1717079360	19.962	286.99242590	46.88110003	69.77
34	158324216	18.095	286.98107444	46.88712609	72.13
35	1717079356	18.504	287.00054422	46.86744878	72.32
36	158324232	17.362	286.94542394	46.87808289	72.59
37	158324268	15.898	286.97735799	46.84844320	72.96
38	158324267	13.937	286.98129165	46.84887154	74.11

Index	Catalog ID	Mag	RA (degrees)	Dec (degrees)	Distance (arcsec)
39	1717078738	20.282	286.98851904	46.85137405	74.28
40	158324218	15.673	286.95660587	46.88663347	75.24
41	1717079053	19.278	286.95708460	46.84932629	76.50
42	1717079075	19.887	286.94895339	46.88311853	76.51
43	158324261	16.787	286.99581283	46.85442085	78.47
44	158324271	16.230	286.96284861	46.84692244	79.53
45	1717079072	17.398	286.93899682	46.87042413	79.61
46	158324262	18.823	286.94947157	46.85168675	80.11
47	1717079355	19.629	287.00081696	46.85841417	81.09
48	1717079054	20.213	286.96309621	46.84580643	83.27
49	1717079055	20.602	286.95529011	46.84744901	84.53
50	158324229	12.901	287.00195489	46.87871876	84.57
51	158324209	16.663	286.97785062	46.89133891	84.67
52	1717079060	19.750	286.97473778	46.84471766	85.22
53	158324217	17.115	286.99351258	46.88671699	86.21
54	158324211	16.956	286.98670446	46.89000609	87.09
55	158324265	16.797	286.99651553	46.85120261	87.52
56	1717079361	19.307	286.99385140	46.88721569	88.13
57	1717079635	18.709	286.96080670	46.89171668	88.21
58	1717079057	19.987	286.95087234	46.84799293	88.46
59	1717079362	20.662	286.99880031	46.88448496	89.60
60	1717079354	19.022	287.00458842	46.85766423	90.64
61	1717079052	18.569	286.95674078	46.84510007	90.66
62	1717079633	19.162	286.98169006	46.89251311	91.04
63	158324258	16.312	286.93688362	46.85777398	92.49
64	1717078735	20.638	286.98315420	46.84376623	92.98
65	158324220	17.276	286.99931099	46.88558517	93.16
66	1717079359	18.777	287.00867792	46.87194797	93.22
67	1717079348	19.449	287.00694455	46.85959657	93.38
68	1717079086	18.012	286.93240219	46.87005288	95.67
69	158324263	17.224	287.00223663	46.85189129	96.51
70	158324238	16.655	286.93124814	46.87068649	98.68
71	158324206	14.422	286.98335584	46.89450573	99.10
72	158394203	14.922	287.01134265	46.87561767	102.32
73	1717079349	19.931	287.00882899	46.85618017	102.35
74	1717079637	19.205	286.96395909	46.89648753	103.15
75	158324222	17.247	286.93527514	46.88376950	104.53
76	158324200	16.132	286.96559807	46.89761489	106.55

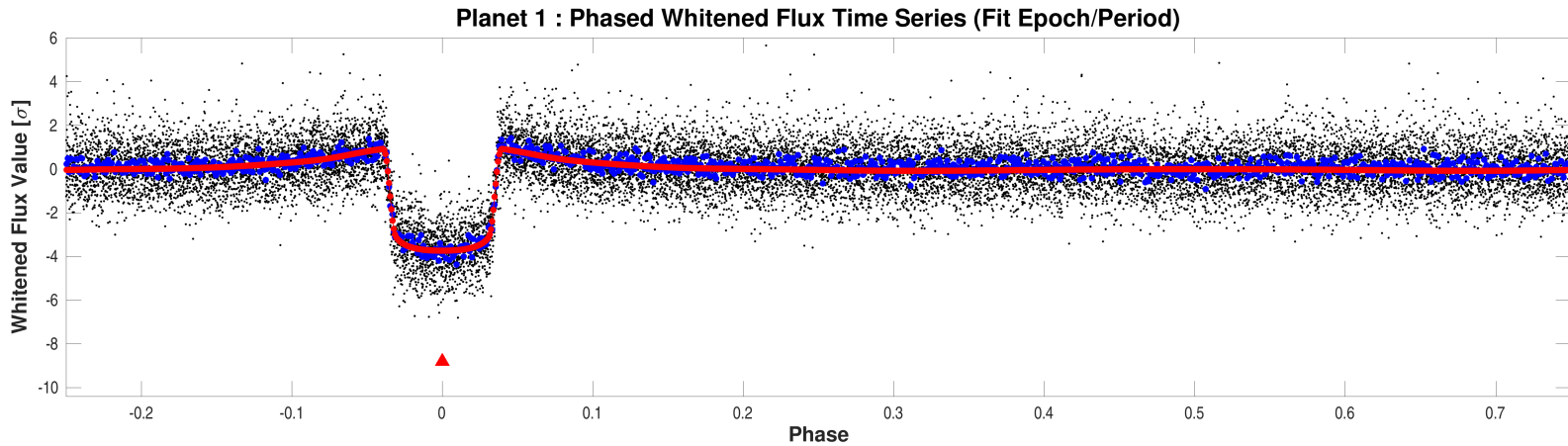
RA, Dec and Distances are corrected for proper motion. This table may not contain all of the objects shown.

6 Phased Light Curves



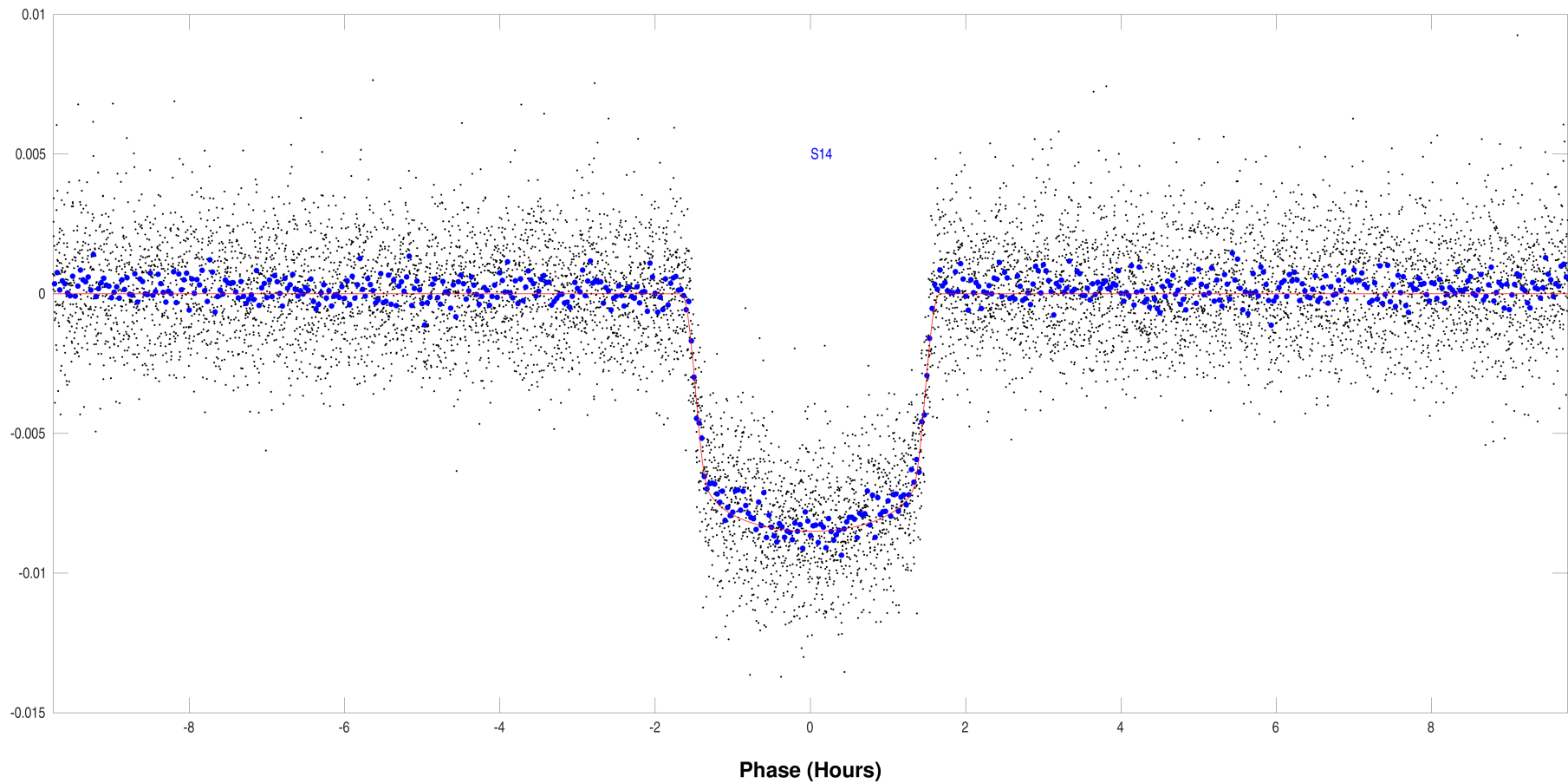
Phased unwhitened flux time series is plotted in black dots. When all transits fit completed with full or secondary convergence, the phase is determined with the fitted epoch and period; otherwise, the phase is determined with the TPS epoch and period. The values of the phased unwhitened flux time series 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/0000000158324245-01-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/0000000158324245-01-phased-whitened-flux-time-series.fig`

Planet: 1 Phased Unwhitened Flux Time Series by Sector

Phased unwhitened flux time series by sector for target 158324245, planet candidate 1. Period = 1.7635 days; transit epoch = 1683.5541 BTJD.
Open `./summary-plots/0000000158324245-01-phased-unwhitened-flux-time-series-by-sector.fig`

7 Planet Candidate 1

7.1 Model Fitter: All Transits

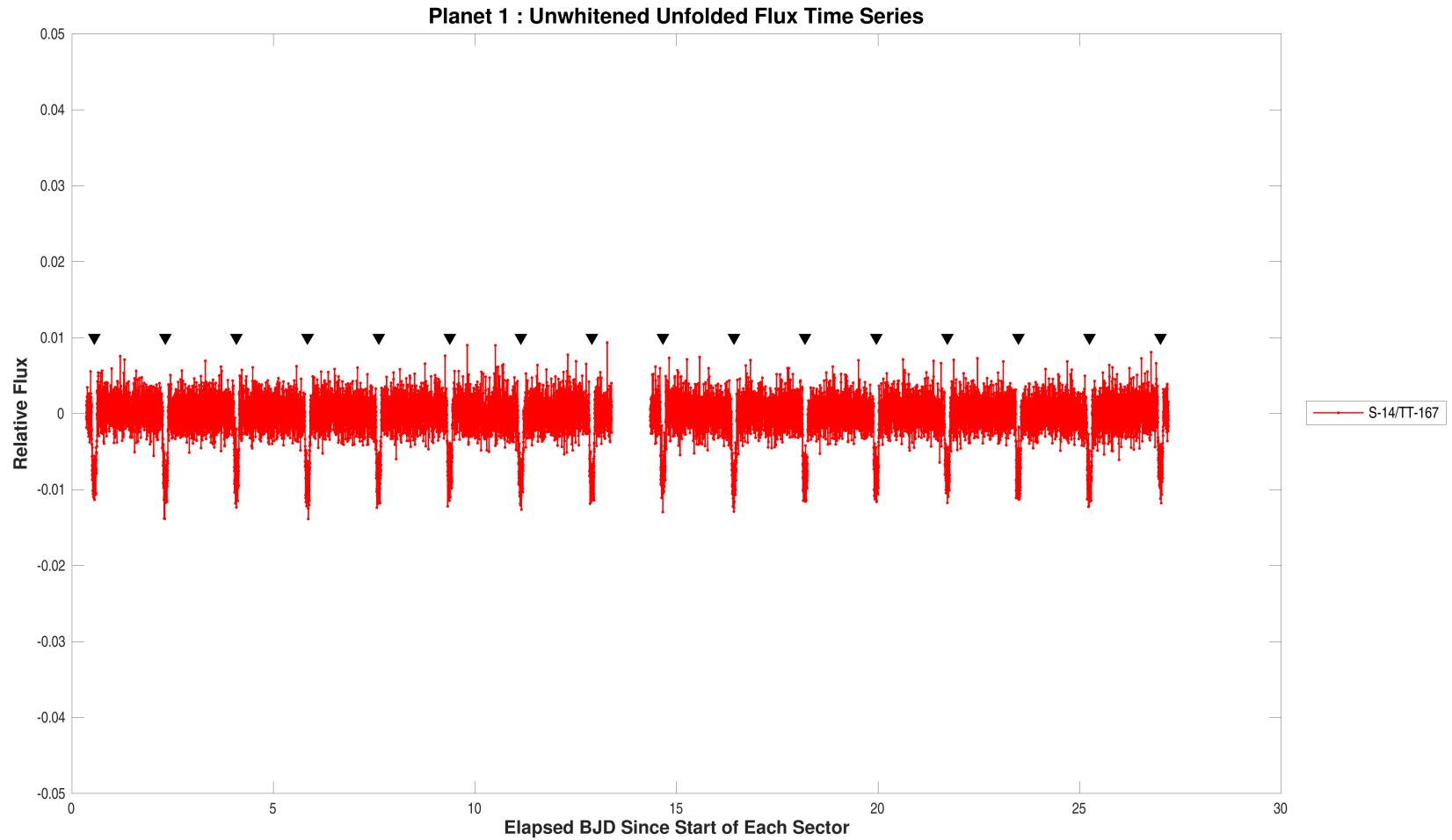
Model Characteristic	Name
Transit Model	mandel-agol_geometric_transit_model
Limb Darkening Model	claret_tess_nonlinear_limb_darkening_model

TCE Parameter	Value	Units
Trial Transit Pulse Duration	3.0	hours
Transit Epoch	1683.5504528	TJD
Orbital Period	1.7638881	days
Maximum SES	30.1	
Maximum MES	99.8	
Robust Statistic	108.7	
Chi Square Goodness of Fit Statistic (DoF)	1707.9 (1242)	
Chi Square2 Statistic (DoF)	388.7 (1092.6)	
Threshold for Desired PFA		

DoF: Degrees of Freedom

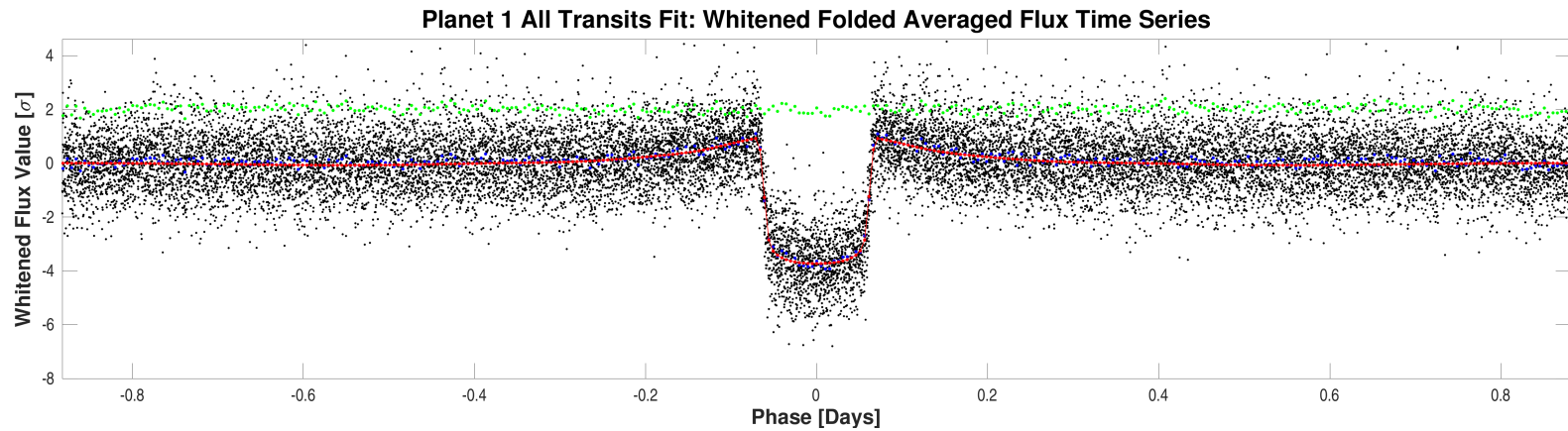
Parameter	Value	Uncertainty	Units
SNR	127.7		
Orbital Period	1.7635488	3.9654e-05	days
Transit Epoch	1683.5541100	3.5411e-04	BTJD
Impact Parameter	0.0143	3.3857e+00	
Planet Radius to Star Radius Ratio	0.0874145	6.4720e-04	
Semi-major Axis to Star Radius Ratio	4.5506	2.0917e-01	
Planet Radius	9.5430	7.0654e-02	Earth radii
Semi-major Axis	0.0286	4.2844e-07	AU
Effective Stellar Flux	4461.2897	3.9595e+02	Goldilocks
Equilibrium Temperature	2084	4.6250e+01	Kelvin
Stellar Density	0.4071	5.6133e-02	Solar density
Transit Depth	8509	6.5867e+01	ppm
Transit Duration	3.2506	2.7794e-02	hours
Transit Ingress Duration	0.2653	2.7416e-02	hours
Eccentricity	0.0000	0.0000e+00	
Peri Longitude	0.0000	0.0000e+00	degrees
Model Chi Square Statistic (DoF)	5892.0 (7186.3)		
Model Chi Square Goodness of Fit Statistic (DoF)	965.9 (1614)		
Model Chi Square2 Statistic (DoF)	8.8 (15)		

DoF: Degrees of Freedom



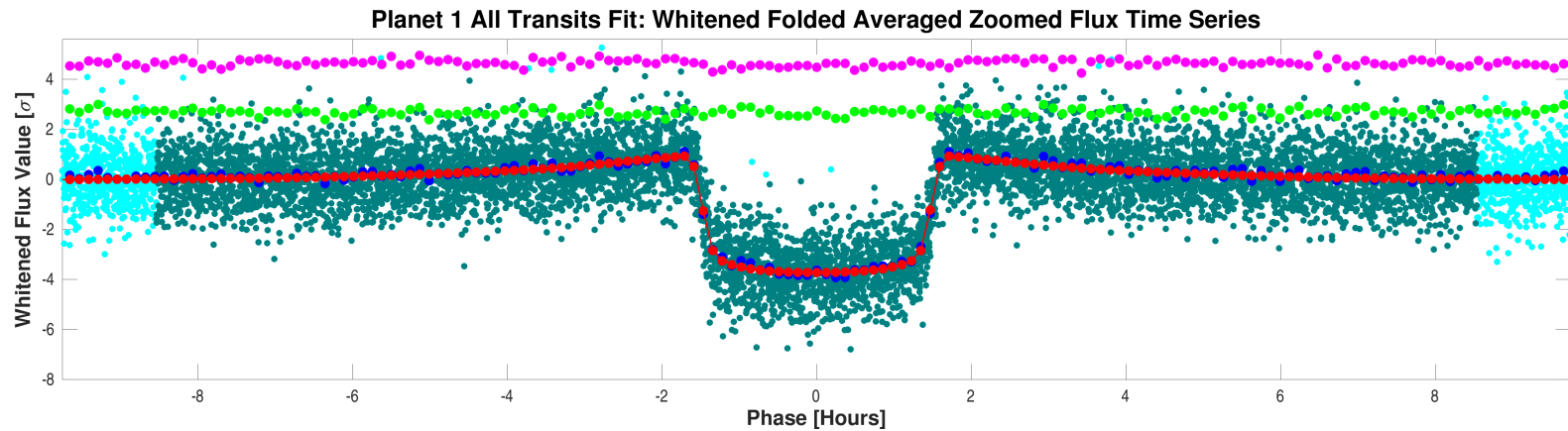
Flux time series for CatId 158324245, Planet candidate 1 in the unwhitened domain. For the data of Sector-14/TargetTableId-167, start BJD is 2458683. Transit event markers indicate the location of transits of the given planet candidate. All transits fit completed with full convergence.

Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000158324245-01-all-unwhitened-14-167.fig`



Folded flux time series for CatId 158324245, 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/0000000158324245-01-all-whitened.fig`



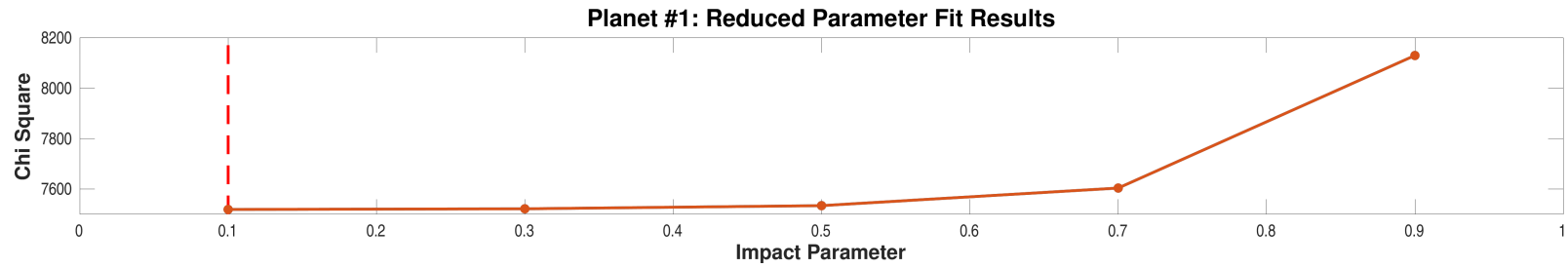
Folded flux time series for CatId 158324245, Planet candidate 1 in the whitened domain, zoomed on the transit. The flux data whose robust weights are larger/smaller than 0.1 are plotted in dark green/cyan dots, respectively. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged 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/0000000158324245-01-all-whitened-zoomed.fig`

7.2 Model Fitter: Reduced Parameter Fit Results

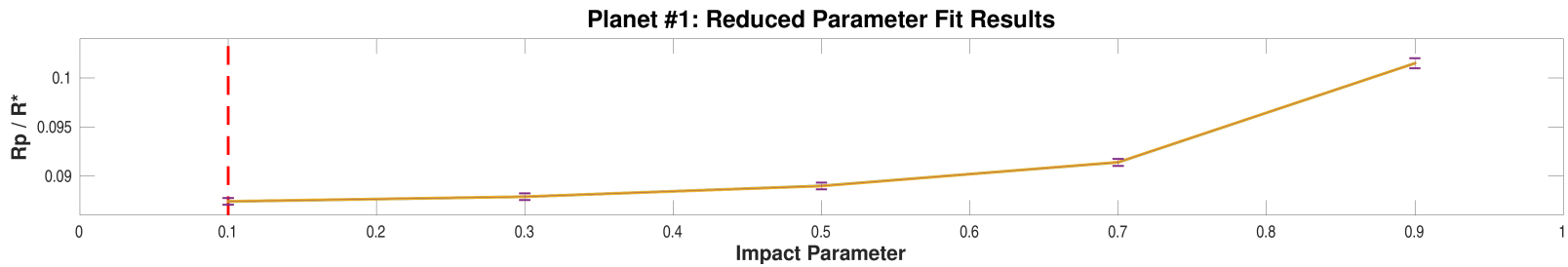
Impact Parameter	SNR	Model Chi Square	Planet Radius to Star Radius	Uncert	Semi-major Axis to Star Radius	Uncert	Transit Depth (ppm)	Uncert	Transit Duration (hours)	Uncert
0.10	133.7	7519.1	0.0874070	3.3553e-04	4.5260	1.3604e-02	8497	6.4878e+01	3.2555	9.9297e-03
0.30	133.9	7521.8	0.0878899	3.3738e-04	4.3503	1.3436e-02	8503	6.4922e+01	3.2784	1.0317e-02
0.50	133.6	7534.3	0.0889928	3.4391e-04	3.9766	1.3091e-02	8518	6.5452e+01	3.3378	1.1322e-02
0.70	133.4	7604.0	0.0913967	3.5878e-04	3.3437	1.2692e-02	8582	6.6924e+01	3.4891	1.4044e-02
0.90	127.5	8129.5	0.1014935	5.0819e-04	2.3134	1.4151e-02	9291	8.6510e+01	4.0765	2.8895e-02

Highlighted row is the best reduced-parameter model fit.



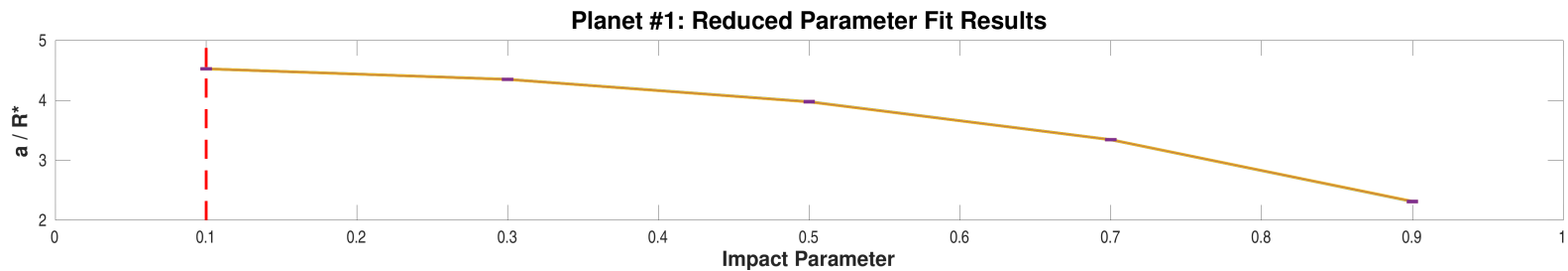
Model chi squares of reduced parameter fits vs. impact parameter for CatId 158324245, Planet candidate 1. The fit result with the minimum chi square is marked with a dashed line in the plot.

Open `./planet-01/planet-search-and-model-fitting-results/reduced-parameter-fits/0000000158324245-01-reduced-fits-chi-square.fig`



Ratios of planet radius to star radius of reduced parameter fits vs. impact parameter for CatId 158324245, 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/0000000158324245-01-reduced-fits-rp-over-rstar.fig`



Ratios of semimajor axis to star radius of reduced parameter fits vs. impact parameter for CatId 158324245, 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/0000000158324245-01-reduced-fits-a-over-rstar.fig`

7.3 Model Fitter: Trapezoidal Fit Results

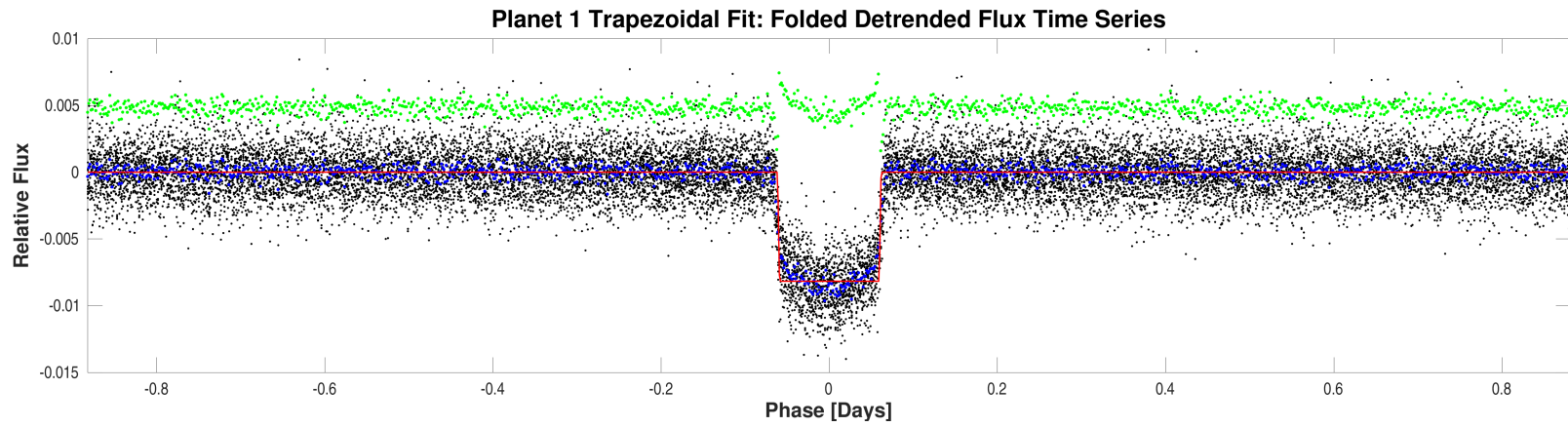
Model Characteristic	Name
Transit Model	trapezoidal_model
Limb Darkening Model	

TCE Parameter	Value	Units
Trial Transit Pulse Duration	3.0	hours
Transit Epoch	1683.5504528	TJD
Orbital Period	1.7638881	days
Maximum SES	30.1	
Maximum MES	99.8	
Robust Statistic	108.7	
Chi Square Goodness of Fit Statistic (DoF)	1707.9 (1242)	
Chi Square2 Statistic (DoF)	388.7 (1092.6)	
Threshold for Desired PFA		

DoF: Degrees of Freedom

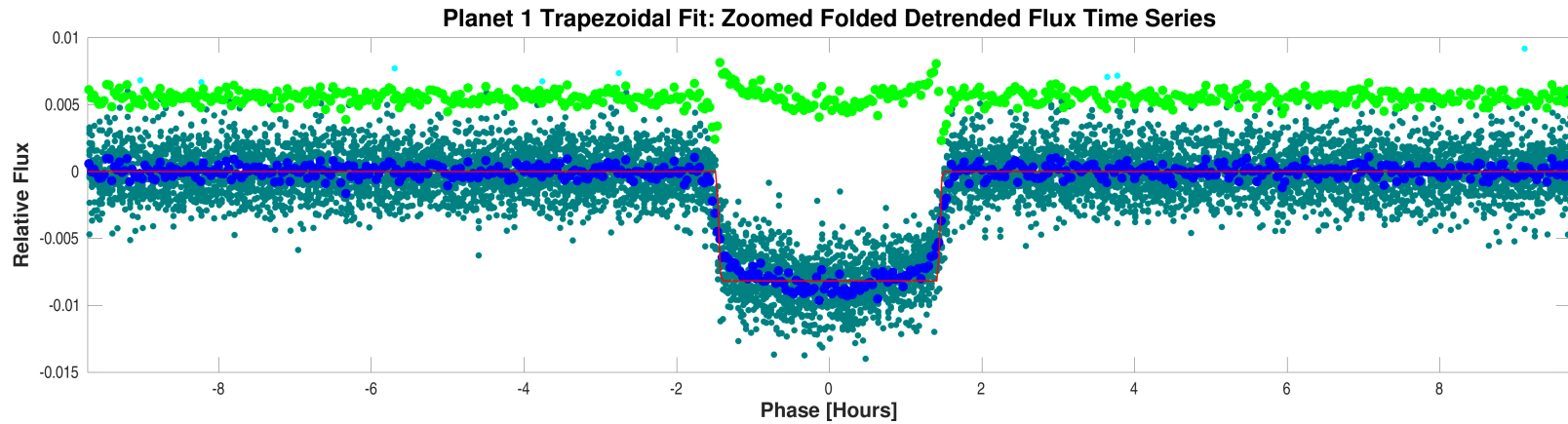
Parameter	Value	Uncertainty	Units
SNR	174.7		
Orbital Period	1.7638881		days
Transit Epoch	1683.5515591		BTJD
Transit Depth	8170		ppm
Transit Duration	3.2389		hours
Transit Ingress Duration	0.3393		hours
Model Chi Square Statistic (DoF)	19872.7 (9634)		

DoF: Degrees of Freedom



Folded detrended flux time series for CatId 158324245, Planet candidate 1 and folded trapezoidal model light curve.

Open `./planet-01/planet-search-and-model-fitting-results/trapezoidal-model-fit/0000000158324245-01-all-trapezoidal.fig`



Zoomed folded detrended flux time series for CatId 158324245, Planet candidate 1 and folded trapezoidal model light curve.

Open `./planet-01/planet-search-and-model-fitting-results/trapezoidal-model-fit/0000000158324245-01-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	1.7639		days		
Transit Duration	3		hours		
Maximum MES	99.8				
Secondary Phase	0.875		days		
Secondary MES	5.4				
Minimum Phase	0.63056		days		
Minimum MES	-3.6				
Median MES	-1.3				
MAD MES	0.59133				
Robust Statistic	4.9				
Secondary Depth	351.4	6.7483e+01	ppm		
Geometric Albedo	1.7	3.3400e-01		2.1979	1.40
Planet Effective Temperature	3698	1.9607e+02	Kelvin	8.0109	0.00

7.4.2 Eclipsing Binary Discrimination Test

Result	Value	Value in Sigmas	Significance (%)
Odd Even Transit Depth Comparison Statistic	2.7778e-01	0.5270	59.82

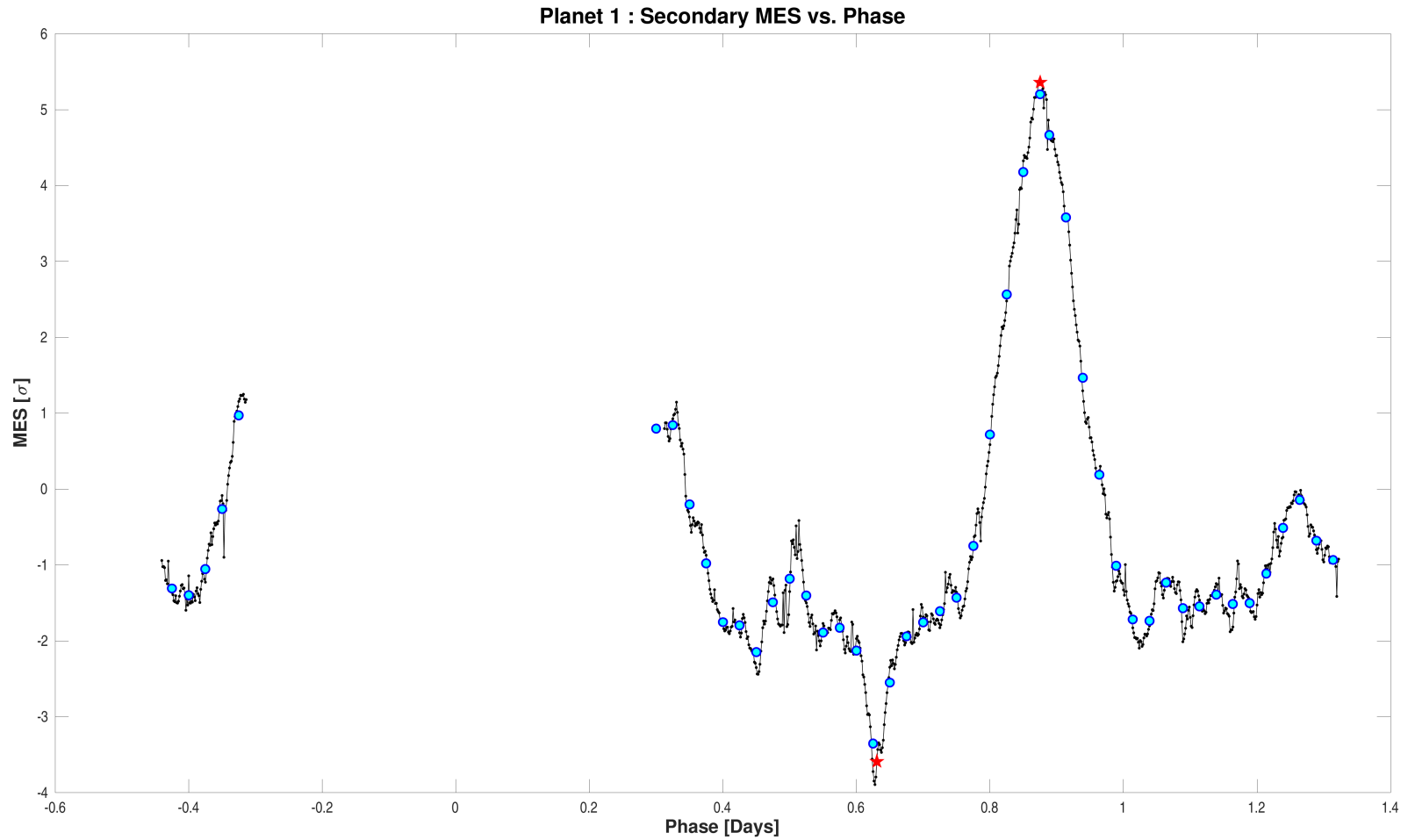
7.4.3 Bootstrap Test

Result	Value
False Alarm Probability	0.0000e+00
Bootstrap Threshold for Desired PFA	7.6
MES Mean	-0.20
MES Standard Deviation	1.10
Transit Count	16

7.4.4 Ghost Diagnostic Test

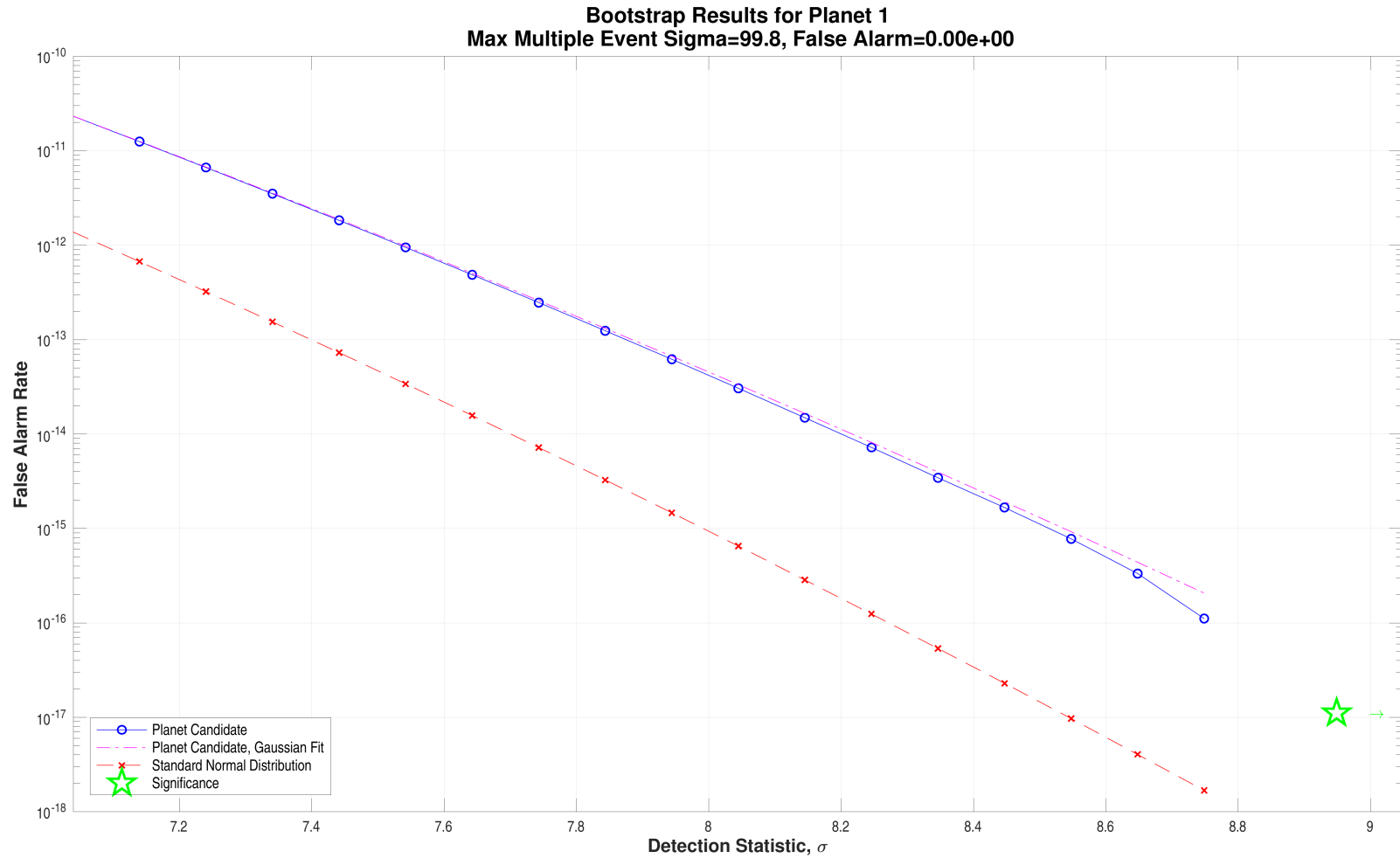
Result	Value	Significance (%)
Maximum MES	99.8	
SNR	127.7	
Core Aperture Statistic	6.7362e+01	100.00
Halo Aperture Statistic	1.4168e+01	100.00
Ratio of Core/Halo Aperture Statistics	4.7546e+00	

7.4.5 Validation Test Figures



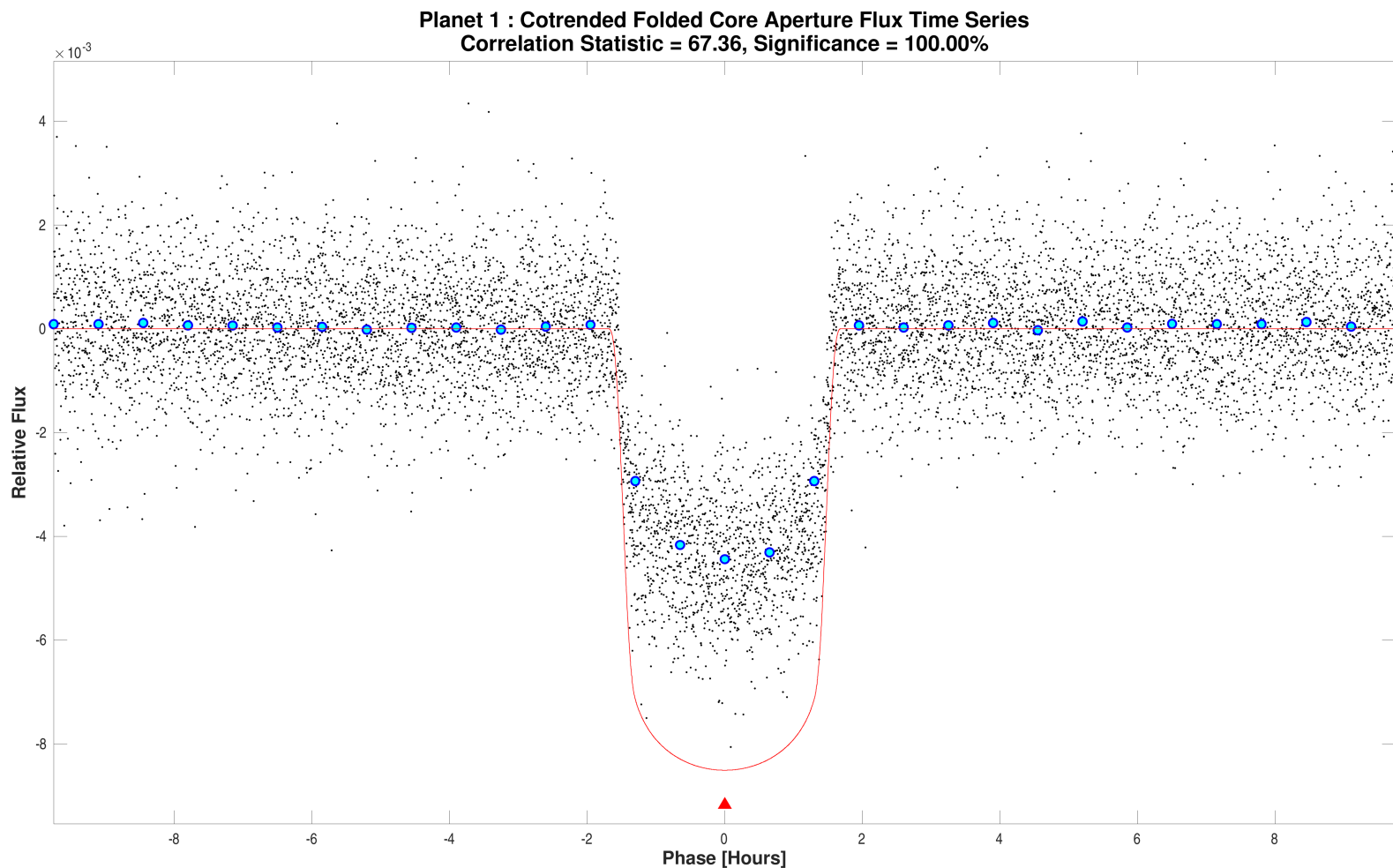
The primary event has been set to zero and both the max and min of the resulting MES vs. Phase are marked with a red star. The best matched pulse duration in hours is 3. The maximum secondary MES and corresponding phase are 5.3588 and 0.875 days respectively. The minimum secondary MES and corresponding phase are -3.5912 and 0.63056 days respectively.

Open `./planet-01/report-summary/0000000158324245-01-weak-secondary-diagnostic.fig`



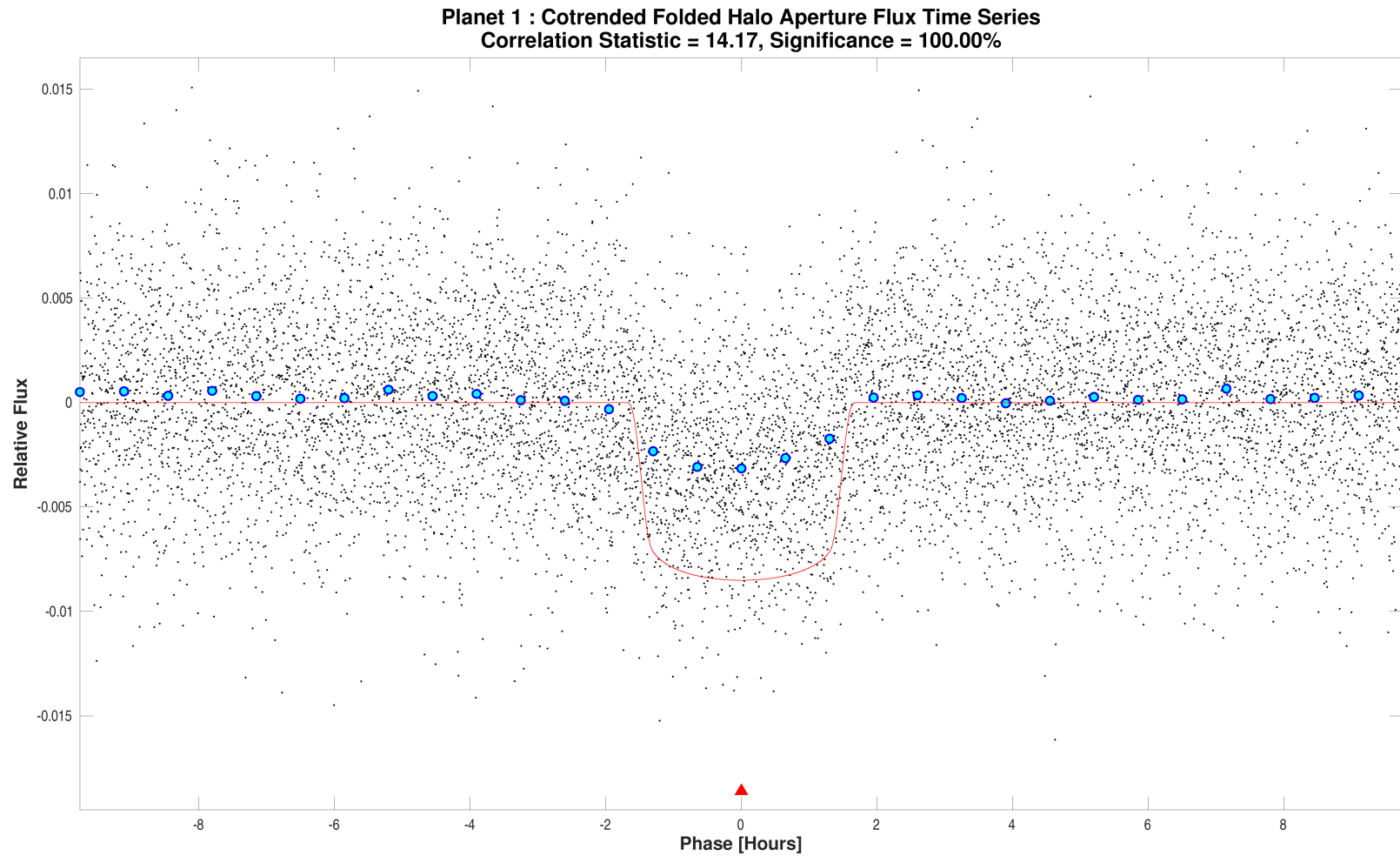
Bootstrap results for target 158324245, planet 1. Cumulative sum of the probabilities (derived from the histogram of counts) from upper tail to the search transit threshold; false alarm probability is indicated by the star. The Gaussian equivalent threshold for this false alarm probability is Inf. The threshold on this distribution that achieves the same false alarm rate as a 7.1 sigma threshold on a Gaussian distribution is 7.6125.

Open `./planet-01/bootstrap-results/0000000158324245-01-bootstrap-false-alarm.fig`



Optical ghost diagnostic core aperture flux time series for target 158324245, 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/000000158324245-01-core-unwhitened-cotrended-zoomed-model.fig`

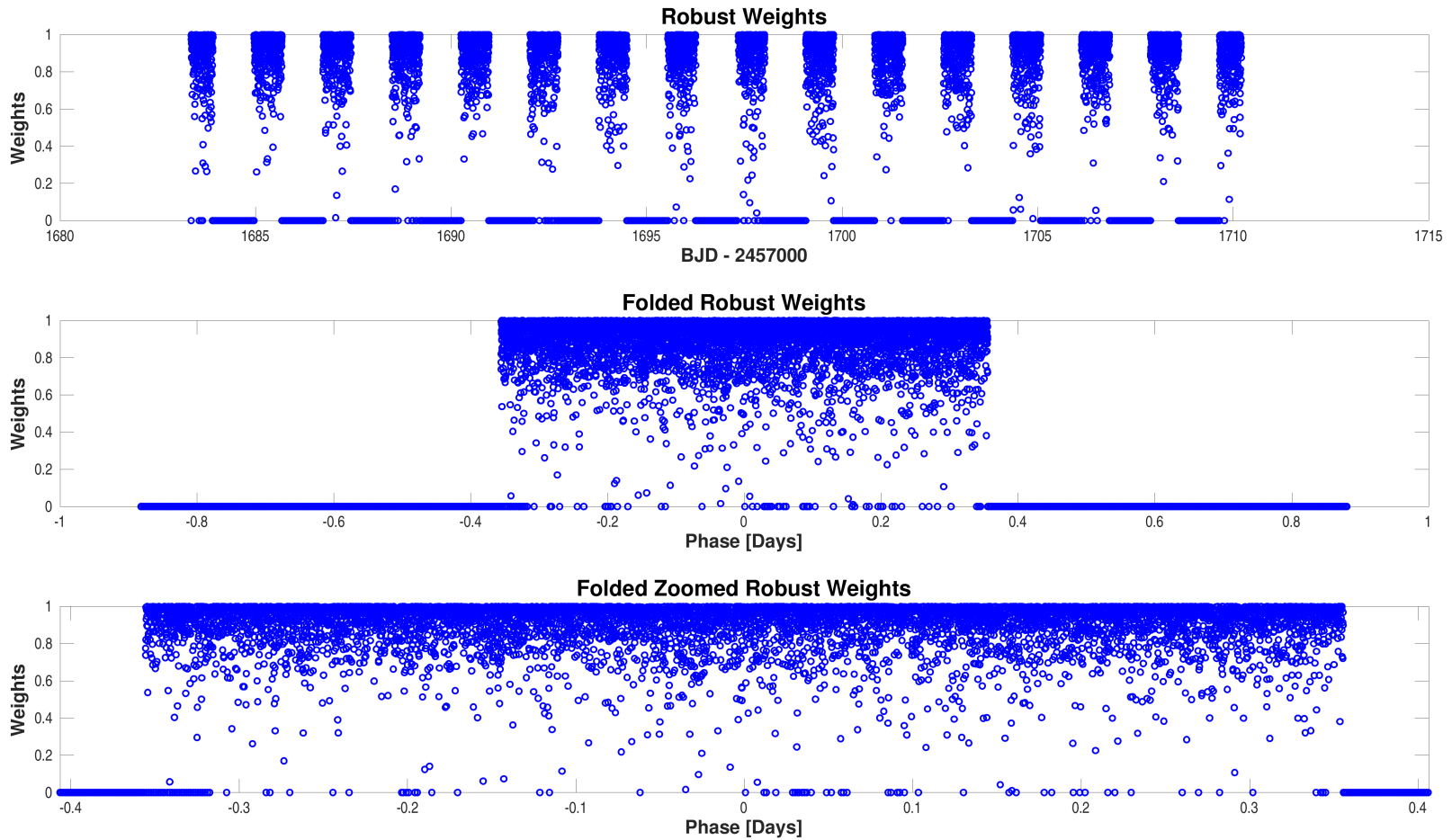


Optical ghost diagnostic halo aperture flux time series for target 158324245, planet candidate 1. The unwhitened time series is phase folded at the orbital period associated with the planet candidate and centered on the epoch of the first transit. The time series was first cotrended against spacecraft 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/000000158324245-01-halo-unwhitened-cotrended-zoomed-model.fig`

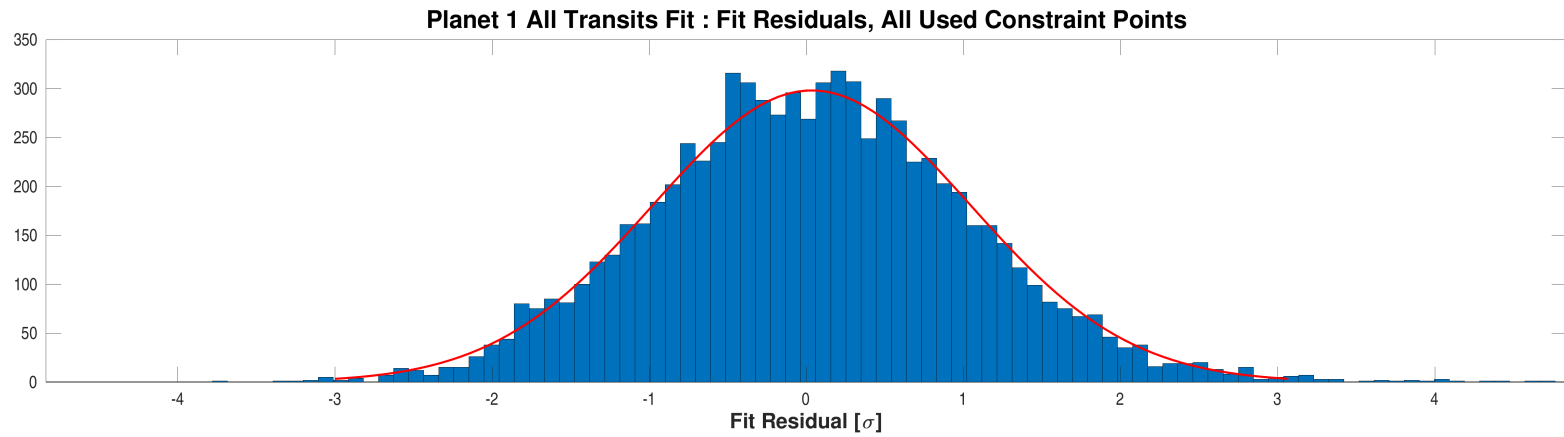
Appendix A Planet Candidate 1

A.1 Model Fitter: All Transits



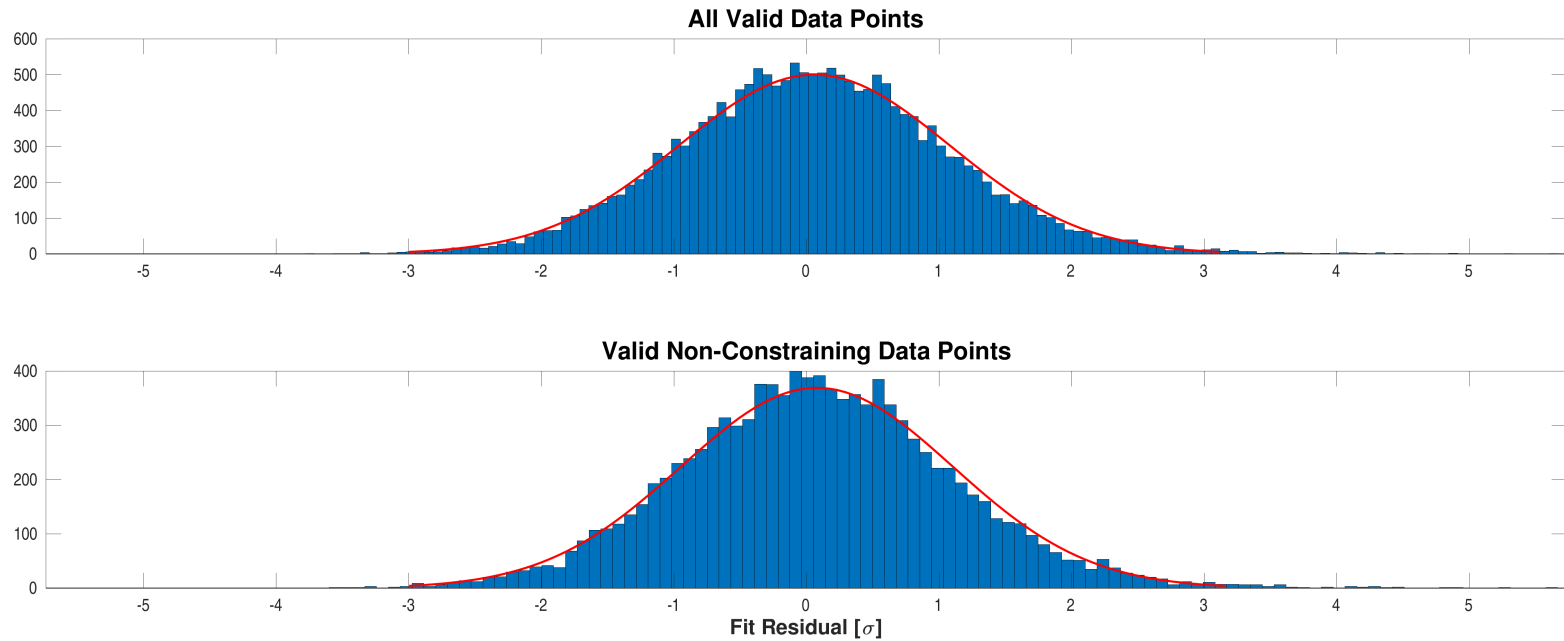
Robust weights distribution for CatId 158324245, Planet candidate 1. Top plot: all data points. Middle plot: all data points, folded per the fitted period and epoch. Bottom plot: all data points, folded and zoomed.

Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000158324245-01-all-robust-weights.fig`



Fit residuals distribution for CatId 158324245, 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/0000000158324245-01-all-histo-used.fig`



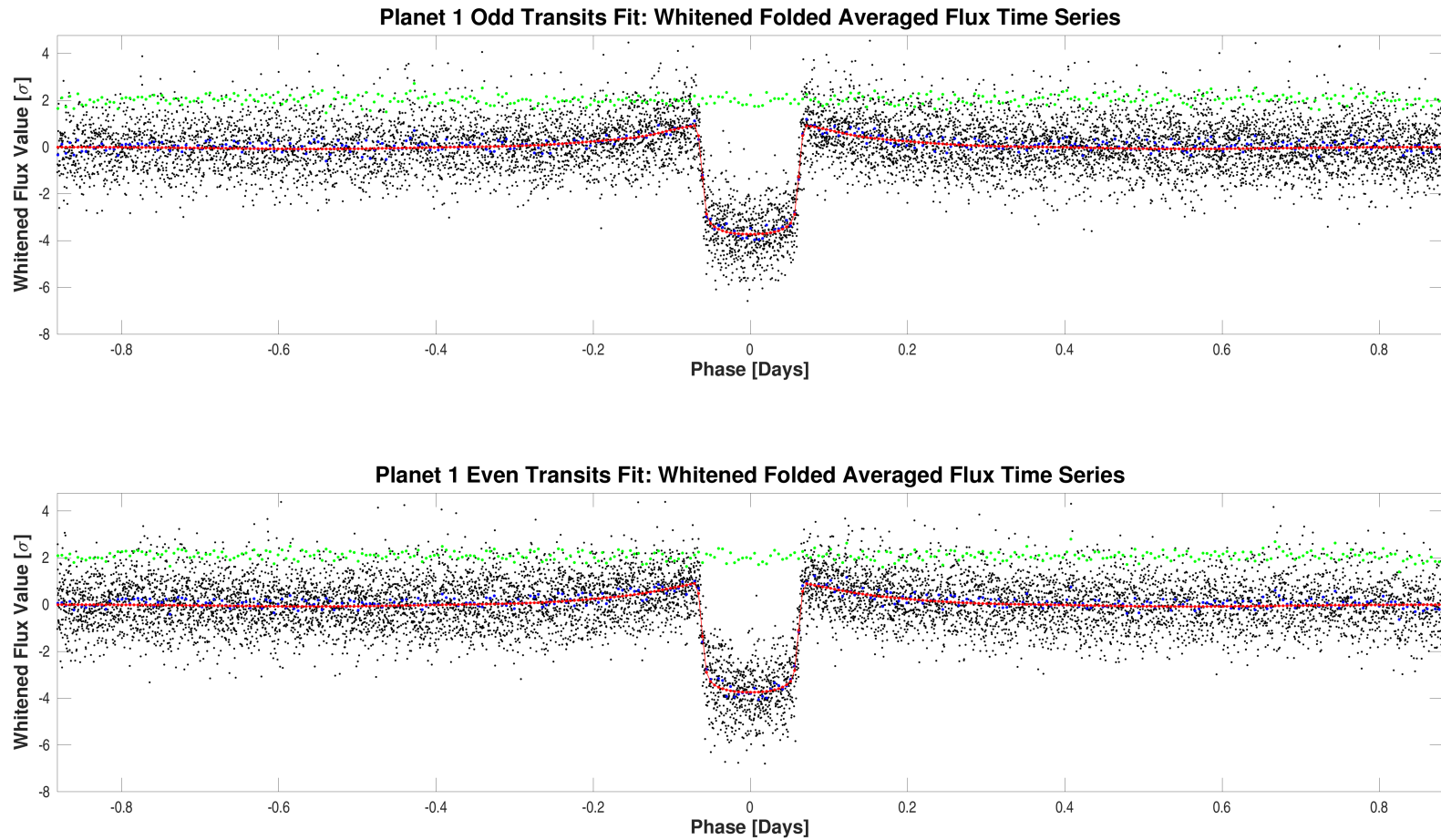
Fit residuals distribution for CatId 158324245, Planet candidate 1. Top plot: all valid data. Bottom plot: valid data not used to constrain fit (due to distance from a transit). Gaussian fits to the histograms are shown in red.

Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000158324245-01-all-histo-all-and-unused.fig`

A.2 Model Fitter: Odd & Even Transits

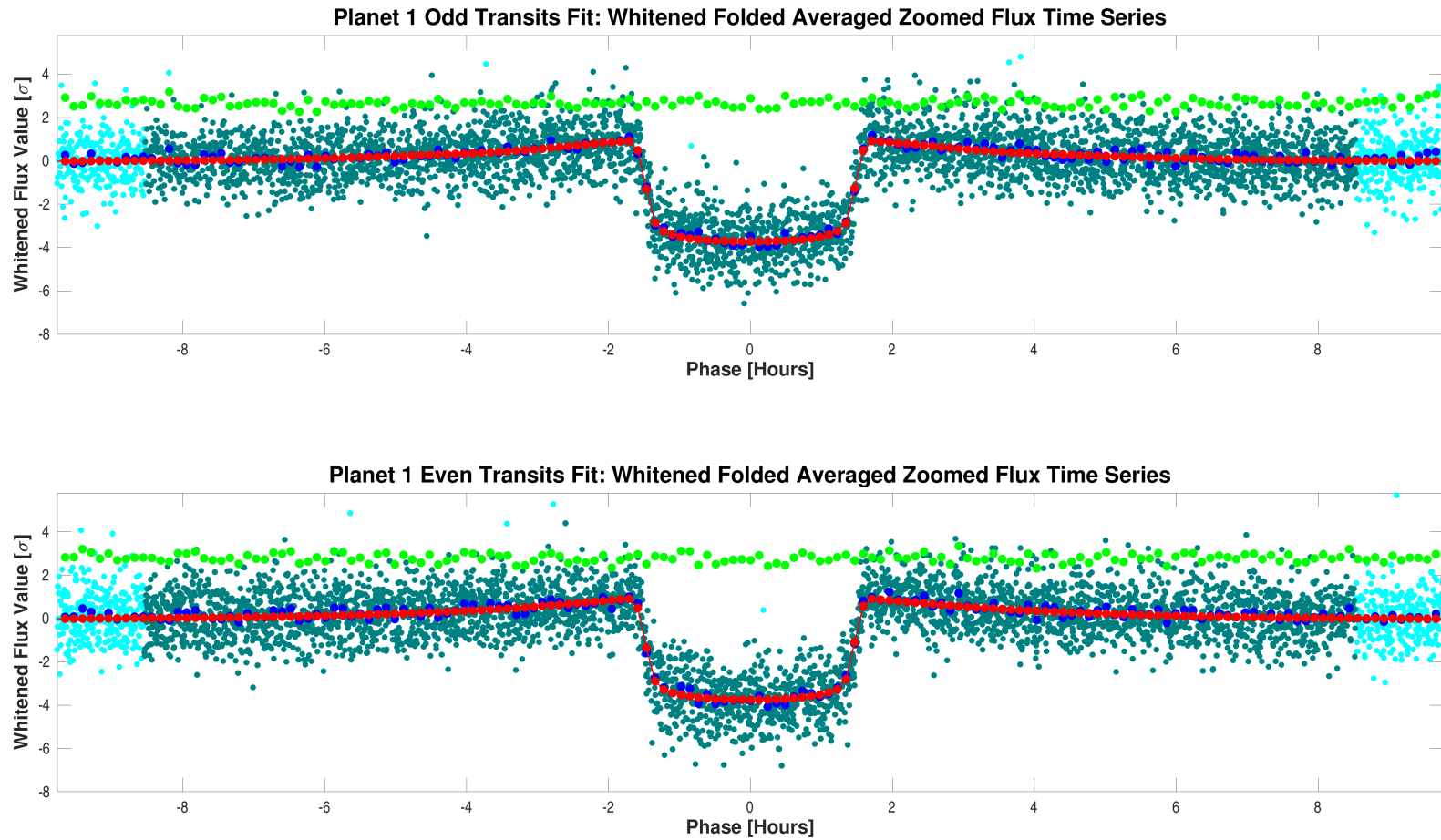
Parameter	Odd Transits Value	Odd Transits Uncertainty	Even Transits Value	Even Transits Uncertainty	Units	$\frac{\text{Difference}}{\ \text{Uncertainty}\ }$
SNR	90.6		90.3			
Orbital Period	1.7635733	5.6985e-05	1.7635267	5.5914e-05	days	5.8288e-01
Transit Epoch	1683.5540268	4.8562e-04	1685.3177330	4.7252e-04	BTJD	2.3224e-01
Impact Parameter	0.0520	1.3229e+00	0.0100	6.7754e+00		6.0786e-03
Planet Radius to Star Radius Ratio	0.0872566	9.1976e-04	0.0876008	9.1307e-04		2.6560e-01
Semi-major Axis to Star Radius Ratio	4.5384	2.9718e-01	4.5594	2.9402e-01		5.0301e-02
Planet Radius	9.5258	1.0041e-01	9.5634	9.9680e-02	Earth radii	2.6560e-01
Semi-major Axis	0.0286	6.1568e-07	0.0286	6.0412e-07	AU	5.8288e-01
Effective Stellar Flux	4461.2074	3.9595e+02	4461.3644	3.9596e+02	Goldilocks	2.8030e-04
Equilibrium Temperature	2084	4.6249e+01	2084	4.6250e+01	Kelvin	2.8030e-04
Stellar Density	0.4038	7.9320e-02	0.4094	7.9209e-02	Solar density	5.0495e-02
Transit Depth	8475	9.3143e+01	8545	9.3853e+01	ppm	5.2705e-01
Transit Duration	3.2558	3.9589e-02	3.2449	3.9081e-02	hours	1.9629e-01
Transit Ingress Duration	0.2659	3.9170e-02	0.2653	3.8448e-02	hours	1.0930e-02
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)	5909.6 (7185.4)		5909.6 (7185.4)			

DoF: Degrees of Freedom



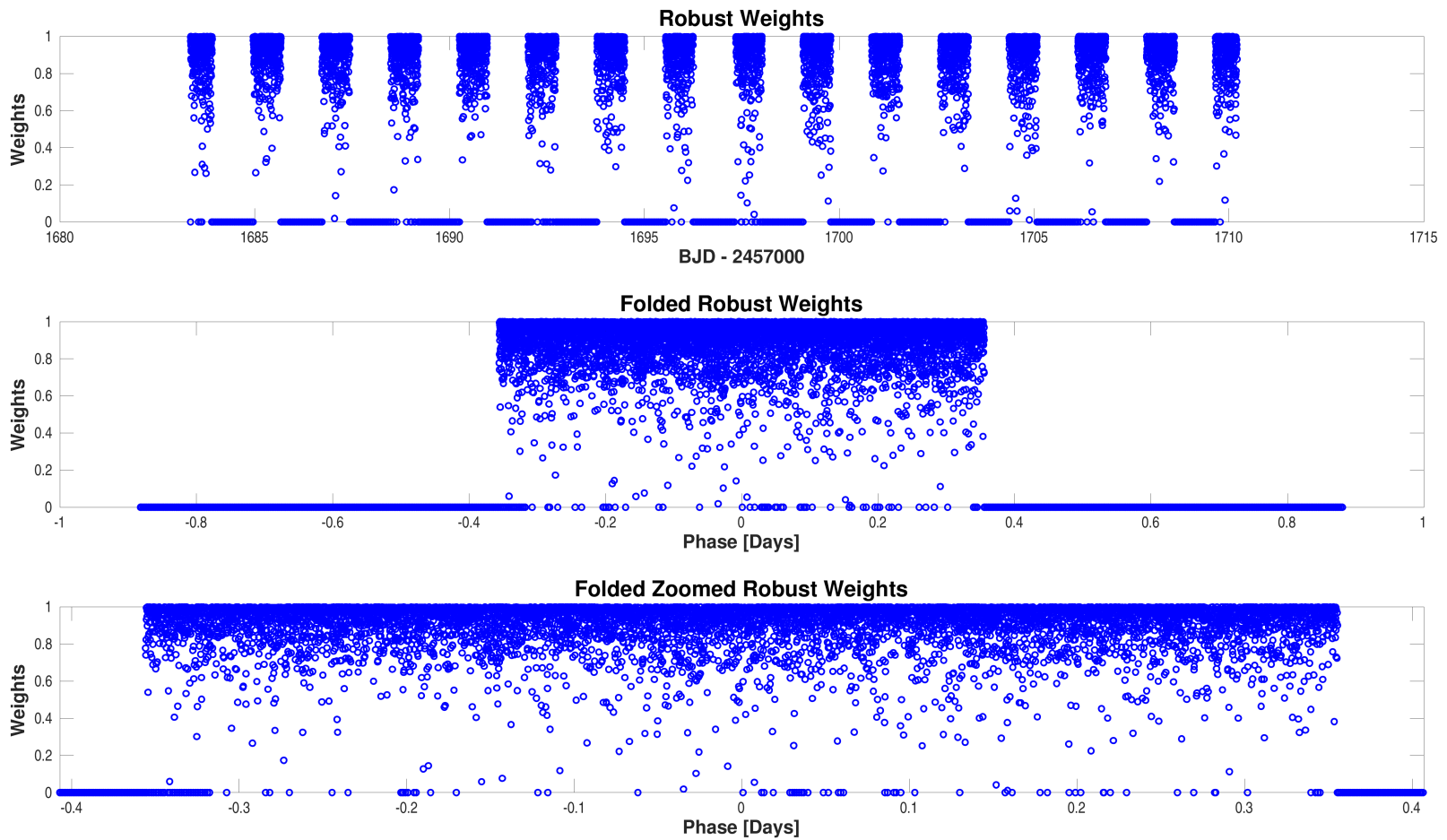
Folded flux time series for CatId 158324245, Planet candidate 1 in the whitened domain is plotted in black dots. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged values of the folded flux time series; the red dots represent the averaged values of the folded model light 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/000000158324245-01-odd-even-whitened.fig`



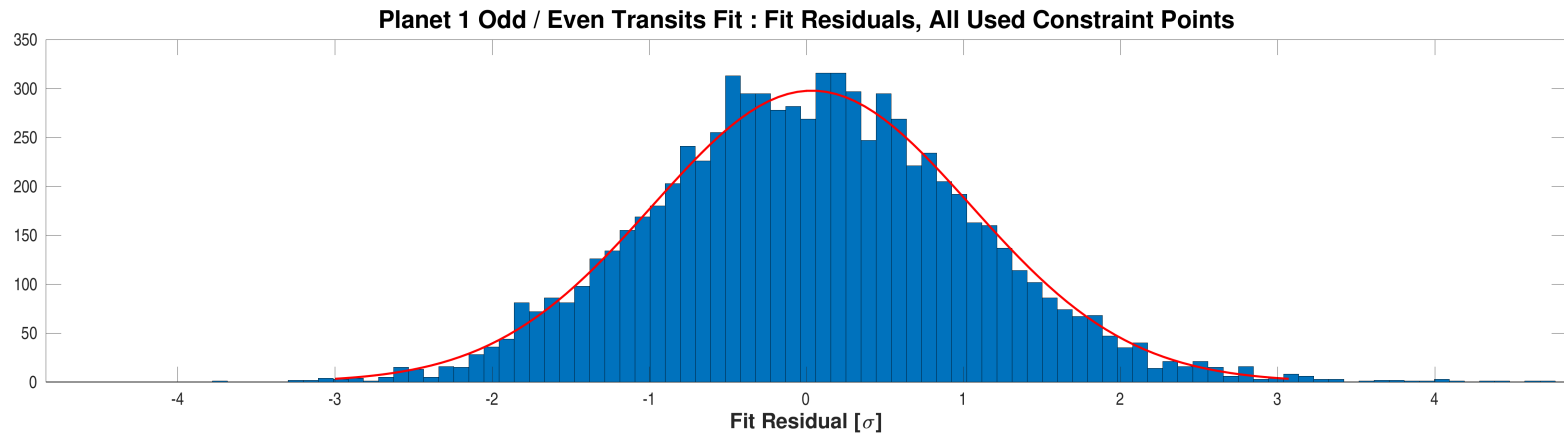
Folded flux time series for CatId 158324245, Planet candidate 1 in the whitened domain, zoomed on the transit. The flux data whose robust weights are larger/smaller than 0.1 are plotted in dark green/cyan dots, respectively. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged 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/0000000158324245-01-odd-even-whitened-zoomed.fig`



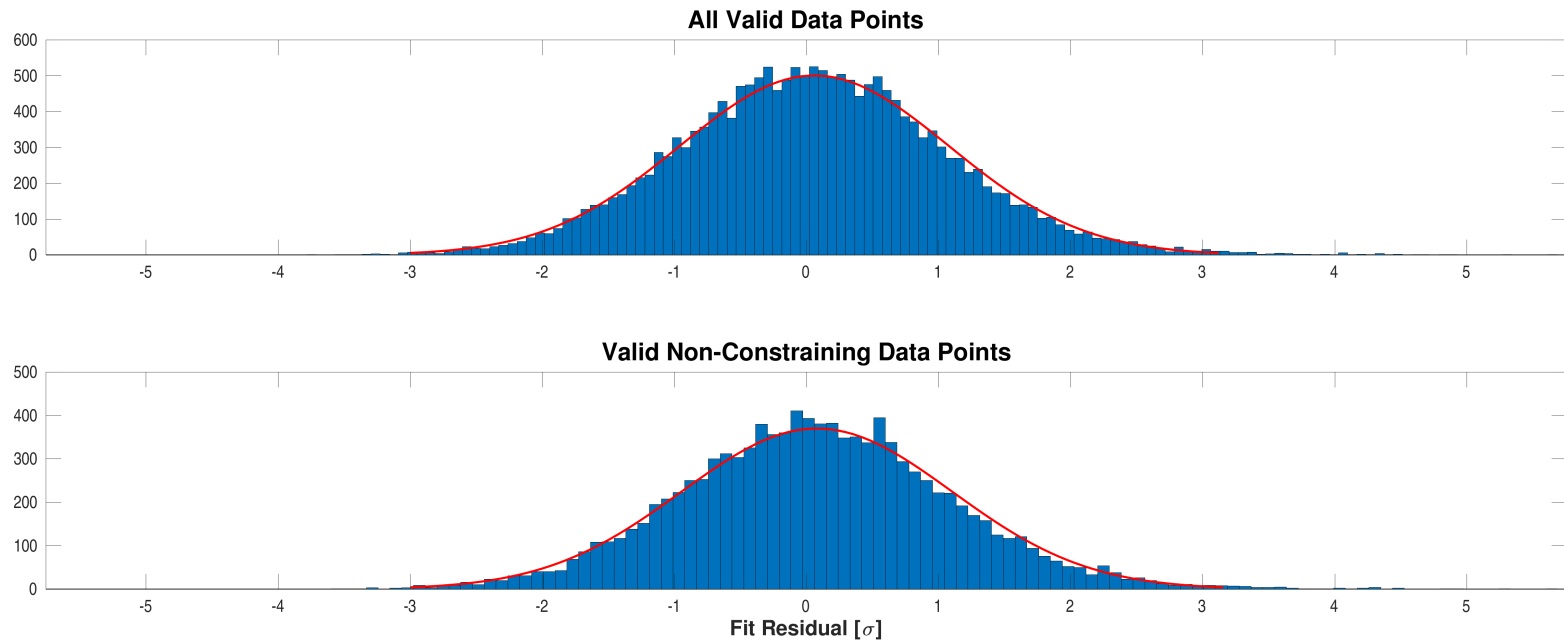
Robust weights distribution for CatId 158324245, Planet candidate 1. Top plot: all data points. Middle plot: all data points, folded per the fitted period and epoch. Bottom plot: all data points, folded and zoomed.

Open `./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000158324245-01-odd-even-robust-weights.fig`



Fit residuals distribution for CatId 158324245, 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.

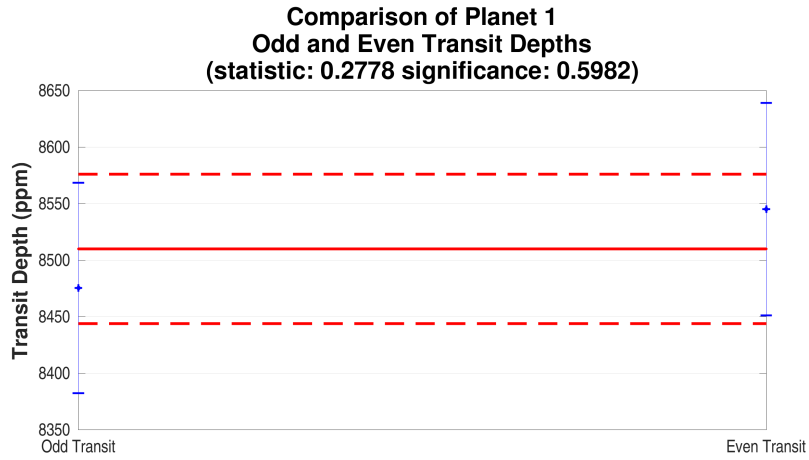
Open `./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000158324245-01-odd-even-histo-used.fig`



Fit residuals distribution for CatId 158324245, 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/0000000158324245-01-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 158324245, planet 1. A significance level close to 1/0 favors a transiting planet/an eclipsing binary. Open `./planet-01/binary-discrimination-test-results/0000000158324245-01-eclipsing-binary-discrimination-tests.fig`

Appendix B Alerts

This target did not trigger any alerts.