



Data Validation (DV) Report
for TESS ID 159742538
Sectors 26 - 26

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

24-Jul-2020 23:37:42 Z

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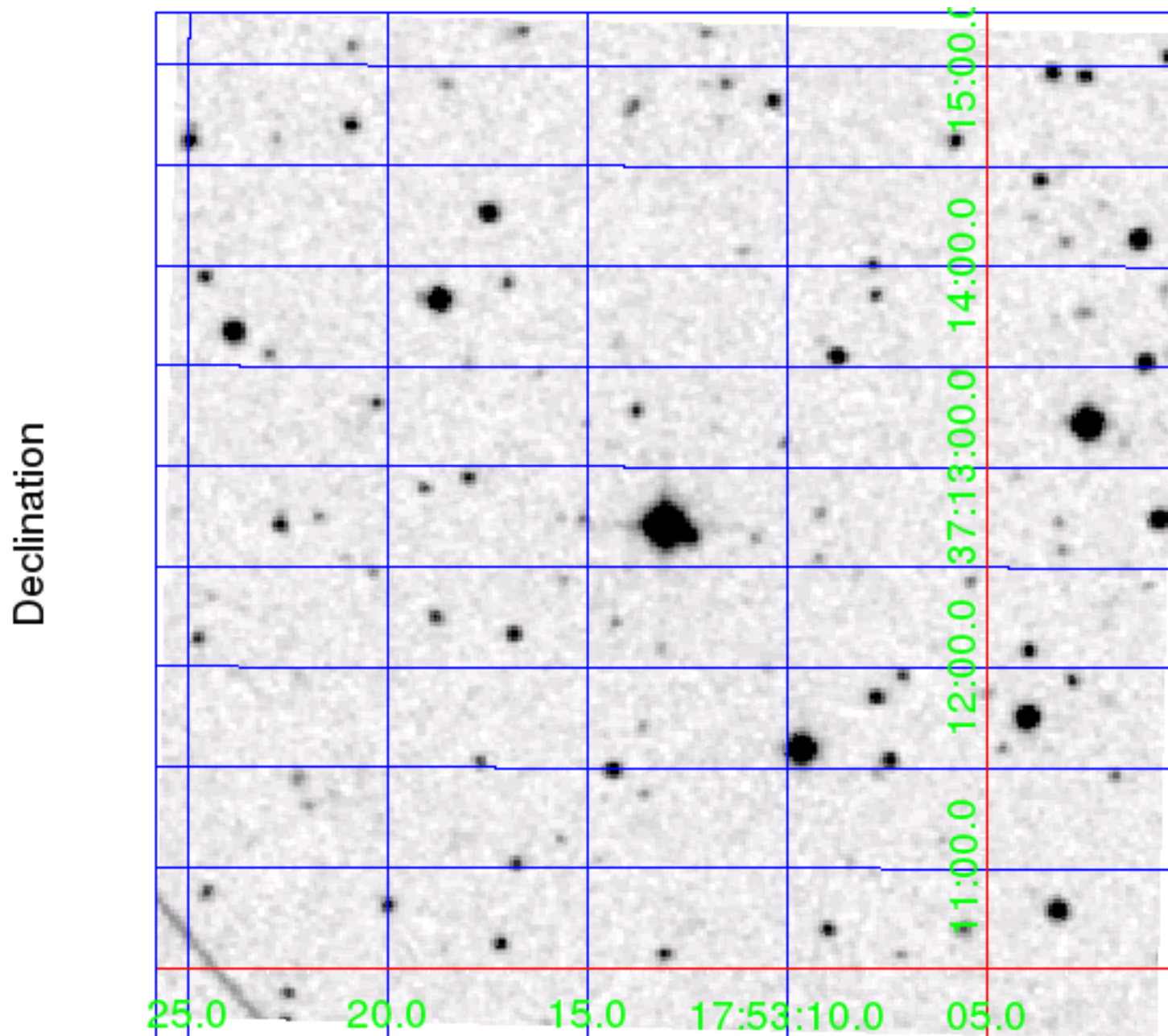
1 Summary

Target Properties	Value	Uncertainty	Units	Provenance
Catalog ID	159742538			
TOI ID	-			
TESS Name	-			
RA	268.30437116	0	degrees	TIC8
Dec	37.21182947	0	degrees	TIC8
Magnitude	11.1116	0.0062		TIC8
Radius	2.009	0.105	Solar radii	TIC8
Effective Temperature	6184	138	Kelvin	TIC8
log(g)	3.904	0.087317	cm/sec ²	TIC8
[M/H]	0.260	0.1	Solar metallicity	TIC8
Stellar Density	0.146	0.030	Solar density	TIC8-Derived
Limb Darkening Coefficient 1	0.54859			
Limb Darkening Coefficient 2	0.17594			
Limb Darkening Coefficient 3	-0.032984			
Limb Darkening Coefficient 4	-0.040067			
Number of Planet Candidates	1			
TOI Model	csv-file-toi-catalog-07-16-20-edited.csv			
TESS Names Model	-			
External TCE Model	-			
Software Revision	spoc-5.0.3-20200718			
Date Report Generated	24-Jul-2020 23:37:42 Z			

Sector	Target Table	Camera/ CCD	Crowding Metric	Flux Fraction
26	254	1:2	0.9779	0.8912

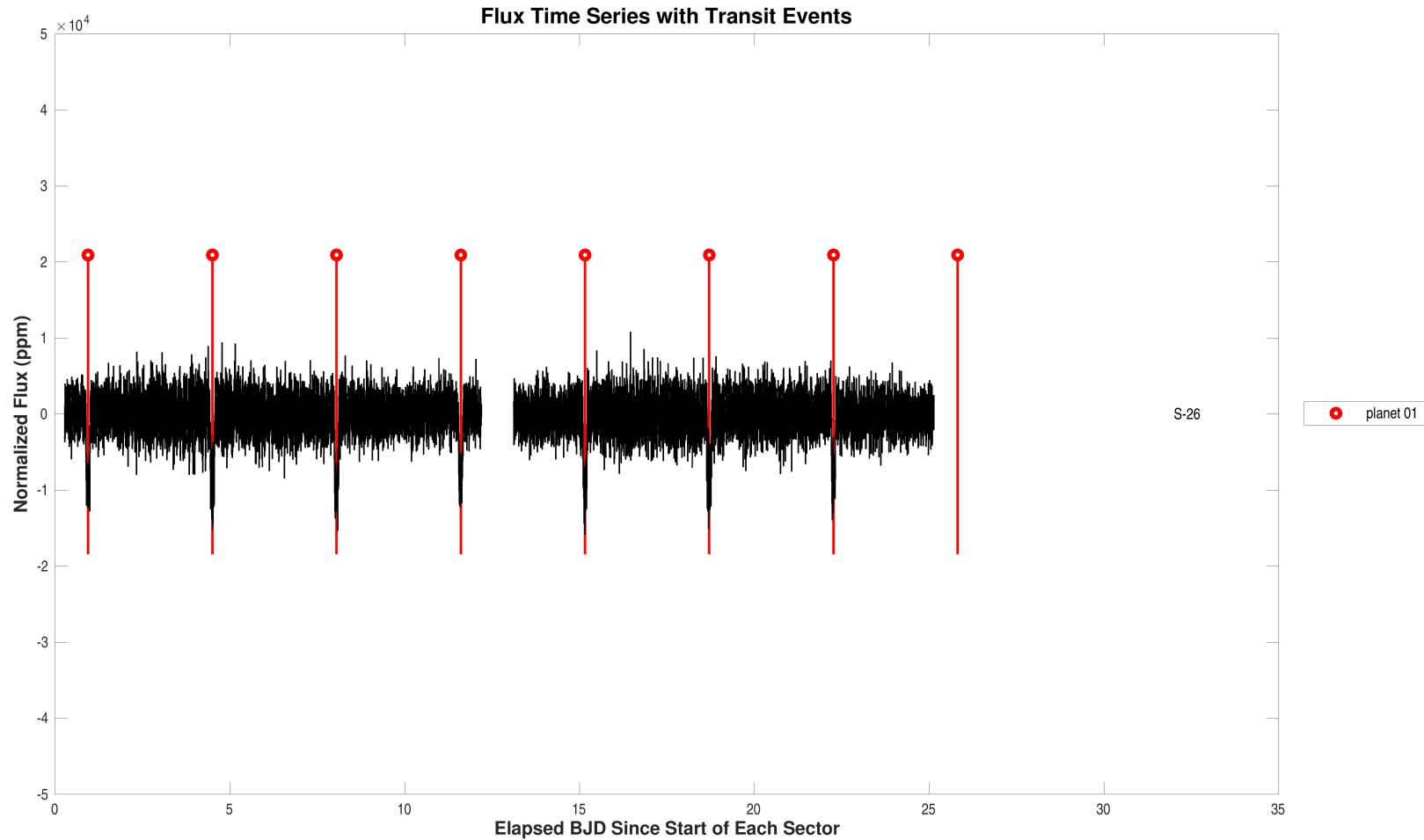
Planet Candidate	TOI ID	TESS Name	TOI Correlation	Period (days)	Period Ratio	Epoch (BTJD)	Semi-major Axis (AU)	Radius (Re)	Seff	Teq (K)	False Alarm	Suspected EB
1	-	-	-	3.554	1.00	2010.941	0.05	21.2	2276.3	1762	0.00e+00	false

2 Survey Image

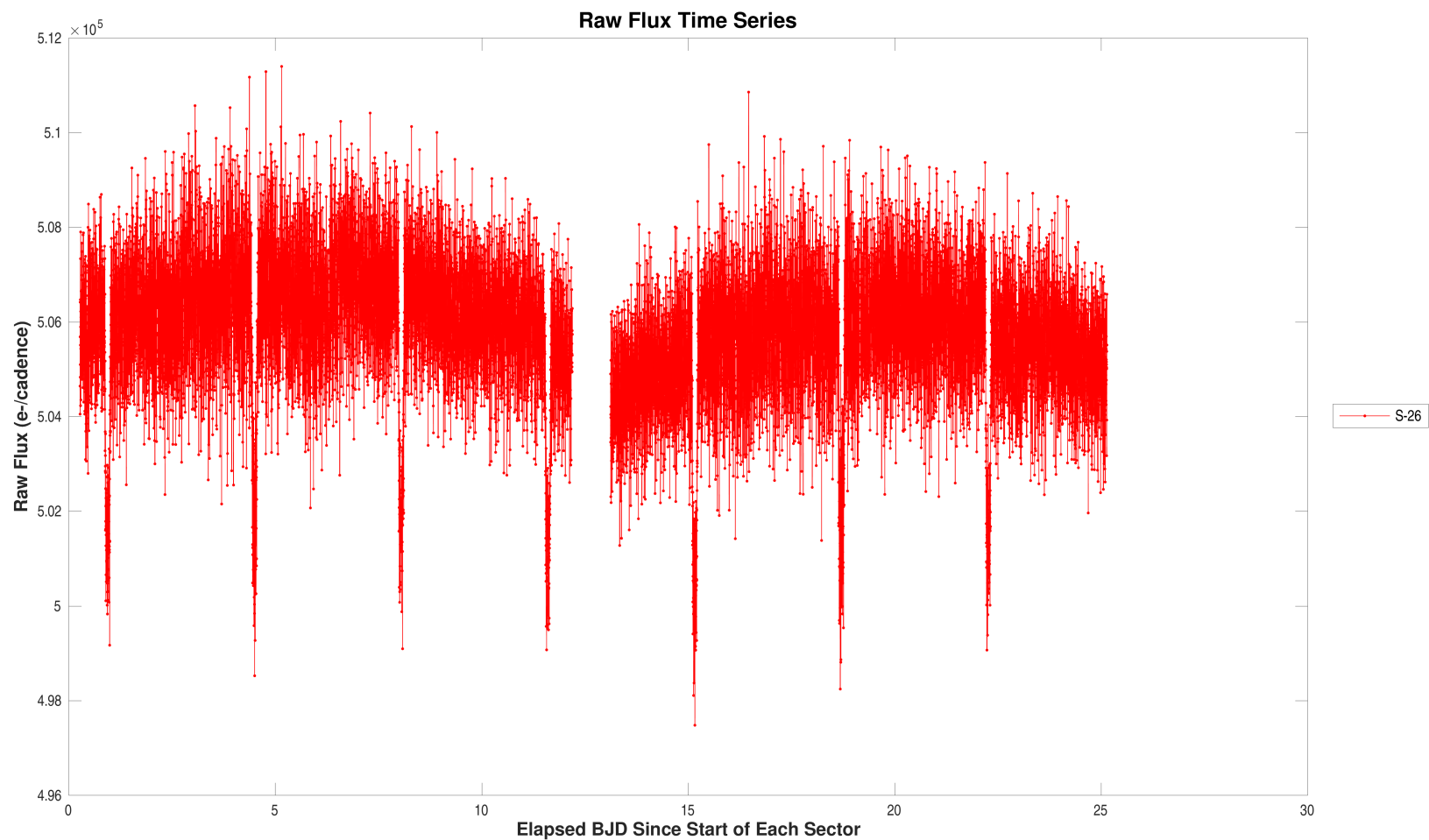


Digitized Sky Survey (DSS) red image. The 5' x 5' image is centered on the J2000 coordinates of target (159742538).

3 Flux Time Series



Summary plot of sector-stitched flux time series and transits for target 159742538, 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 26, target table 254, start BJD is 2459010. Open `./summary-plots/0000000159742538-00-flux-dv-fit-26-254.fig`



Summary plot of raw flux time series. For the data of sector 26, target table 254, start BJD is 2459010.

Open `./summary-plots/0000000159742538-00-raw-flux-26-254.fig`

4 Dashboards

Planet Candidate 1

Model Fitter	Stellar Radius 2.0 ± 0.1 Solar units		Core Aperture Correlation Statistic Value = 51.38 Significance = 100.00%		Ghost Diagnostic Test	
	Period = 3.6 ± 0.0 days Depth = 9471 ± 122 ppm Planet Radius = 21.2 ± 1.1 Earth radii Semi-major Axis = 0.0 ± 0.0 AU Effective Stellar Flux = 2276.3 ± 375.3 Equilibrium Temperature = 1762 ± 73 Kelvin Chi-squared/DoF = 0.8 SNR = 80.4		Halo Aperture Correlation Statistic Value = 6.08 Significance = 100.00% Core/Halo Ratio Ratio = 8.45			
Eclipsing Binary Discrimination Test	Odd-Even Depth Comparison Statistic Value = 1.09e+00 Significance = 29.66%		Offsets Relative to Out of Transit Centroid Source RA Offset = 5.35e-01 ± 2.51e+00 arcsec (0.21 σ) Source Dec Offset = 3.48e-01 ± 2.51e+00 arcsec (0.14 σ) Source Offset Distance = 6.38e-01 ± 2.51e+00 arcsec (0.25 σ) Offsets Relative to TIC Position Source RA Offset = 3.69e-01 ± 2.51e+00 arcsec (0.15 σ) Source Dec Offset = -1.42e-01 ± 2.51e+00 arcsec (-0.06 σ) Source Offset Distance = 3.95e-01 ± 2.51e+00 arcsec (0.16 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 = 7 Max Multiple Event Statistic = 62.8		Bootstrap Test	

Summary of model fitter results and validation test results for target 159742538, 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

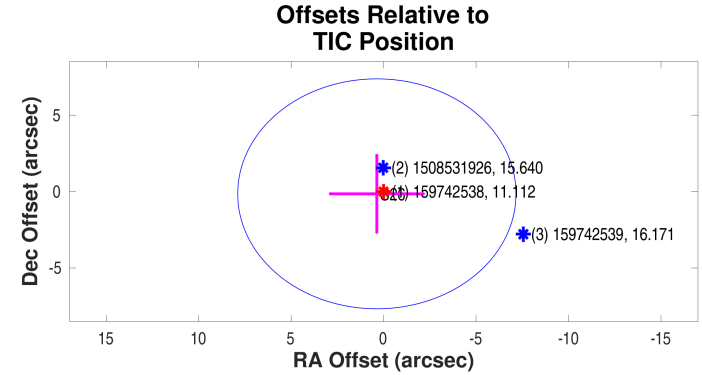
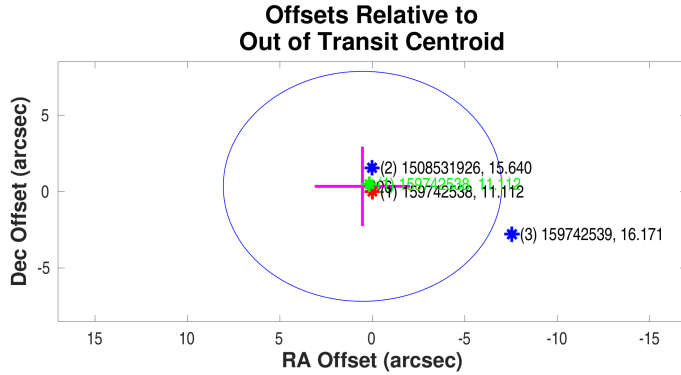
Mean offset from the PRF fit to the out of transit image

	RA	Dec	Units
Offset	$0.5346 \pm 2.51e + 00$	$0.3480 \pm 2.51e + 00$	arcseconds
Offset/ σ	0.21	0.14	
Offset Distance	$0.6379 \pm 2.51e + 00$		arcseconds
Offset Distance/ σ	0.25		
3σ Radius	7.5287		arcseconds

Mean offset from the TIC RA and Dec

	RA	Dec	Units
Offset	$0.3686 \pm 2.51e + 00$	$-0.1418 \pm 2.51e + 00$	arcseconds
Offset/ σ	0.15	-0.06	
Offset Distance	$0.3950 \pm 2.51e + 00$		arcseconds
Offset Distance/ σ	0.16		
3σ Radius	7.5277		arcseconds

Planet Candidate 1



Difference image centroid offsets for target 159742538, 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 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 (out-of-transit centroid in left panel and TIC position in right panel); green asterisk: TIC location of target star with respect to out-of-transit centroid; 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/0000000159742538-01-difference-image-centroid-offsets.fig`

Planet Candidate 1



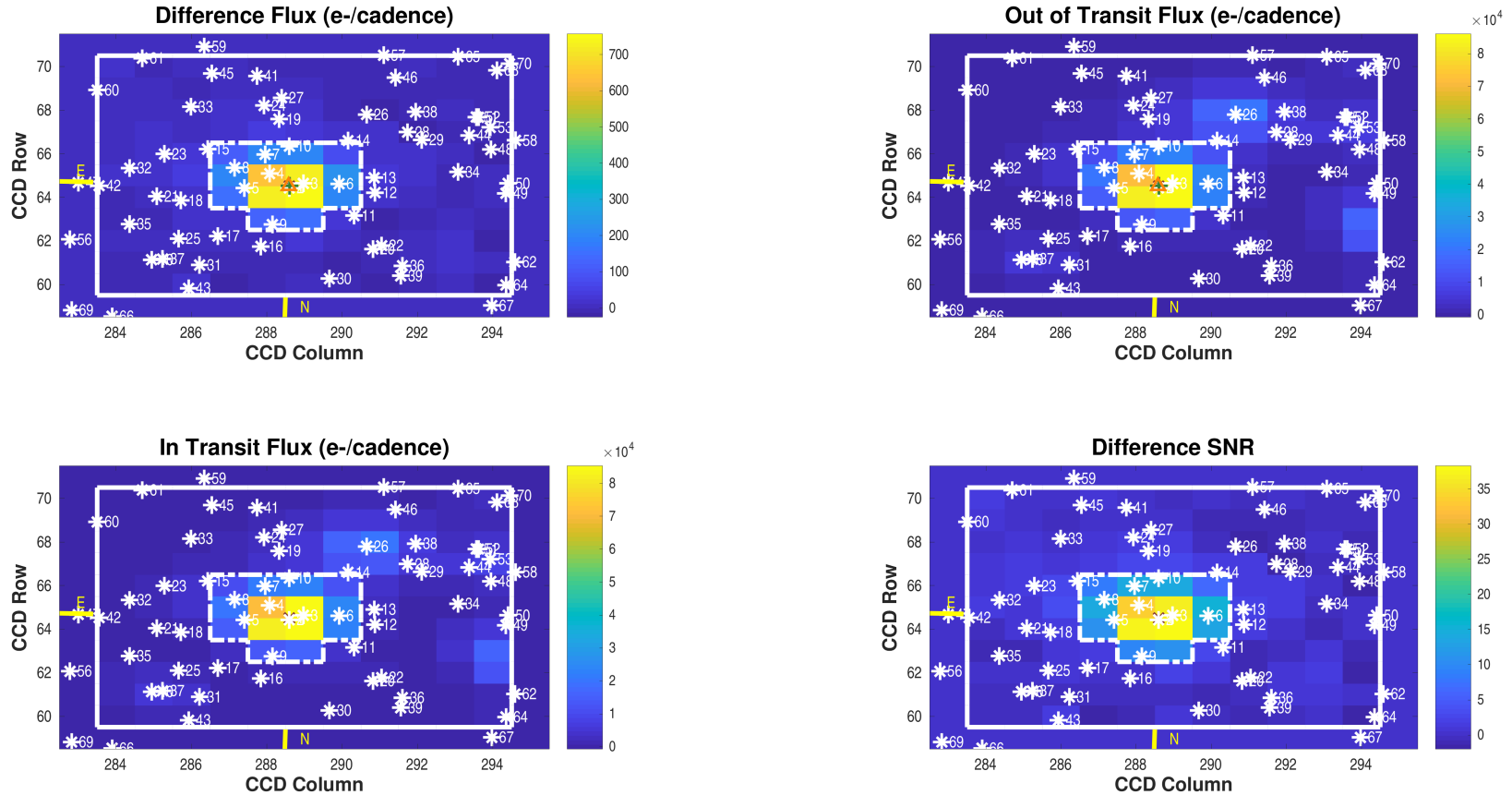
Difference image centroid offsets for target 159742538, planet candidate 1, displayed on survey image for given target. Left: difference image PRF centroid offsets in RA and Dec with respect to the per sector out-of-transit centroids for the given target. Right: difference image PRF centroid offsets 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 (out-of-transit centroid in left panel and TIC position in right panel); green asterisk: TIC location of target star with respect to out-of-transit centroid; 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/0000000159742538-01-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 26 / Target Pixel Table 254



Difference image for target 159742538, planet candidate 1, sector 26, target pixel table 254. 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 = 7; number of valid in-transit cadences = 509; number of in-transit cadence gaps = 8; number of valid out-of-transit cadences = 1527; number of out-of-transit cadence gaps = 26. Difference image quality metric = 1.00 (good).

Open `./planet-01/difference-image/0000000159742538-01-difference-image-26-254.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	$64.53 \pm 4.92e - 05$	$288.61 \pm 5.74e - 05$	pixels	$268.30426700 \pm 1.60e - 06$	$37.21157482 \pm 1.44e - 06$	degrees
Difference Image Centroid	$64.52 \pm 1.12e - 02$	$288.58 \pm 1.30e - 02$	pixels	$268.30445345 \pm 7.41e - 05$	$37.21167149 \pm 6.47e - 05$	degrees
Offset	$-0.0168 \pm 1.12e - 02$	$-0.0264 \pm 1.30e - 02$	pixels	$0.5346 \pm 2.13e - 01$	$0.3480 \pm 2.33e - 01$	arcseconds
Offset/ σ	-1.49	-2.03		2.51	1.49	
Offset Distance	$0.0313 \pm 1.28e - 02$		pixels	$0.6379 \pm 2.29e - 01$		arcseconds
Offset Distance/ σ	2.44			2.79		

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

	Row	Column	Units	RA	Dec	Units
TIC Reference Centroid	$64.51 \pm 2.46e - 04$	$288.60 \pm 2.75e - 04$	pixels	$268.30432488 \pm 0.00e + 00$	$37.21171087 \pm 0.00e + 00$	degrees
Difference Image Centroid	$64.52 \pm 1.12e - 02$	$288.58 \pm 1.30e - 02$	pixels	$268.30445345 \pm 7.41e - 05$	$37.21167149 \pm 6.47e - 05$	degrees
Offset	$0.0079 \pm 1.12e - 02$	$-0.0178 \pm 1.30e - 02$	pixels	$0.3686 \pm 2.13e - 01$	$-0.1418 \pm 2.33e - 01$	arcseconds
Offset/ σ	0.70	-1.37		1.73	-0.61	
Offset Distance	$0.0195 \pm 1.25e - 02$		pixels	$0.3950 \pm 2.08e - 01$		arcseconds
Offset Distance/ σ	1.56			1.90		

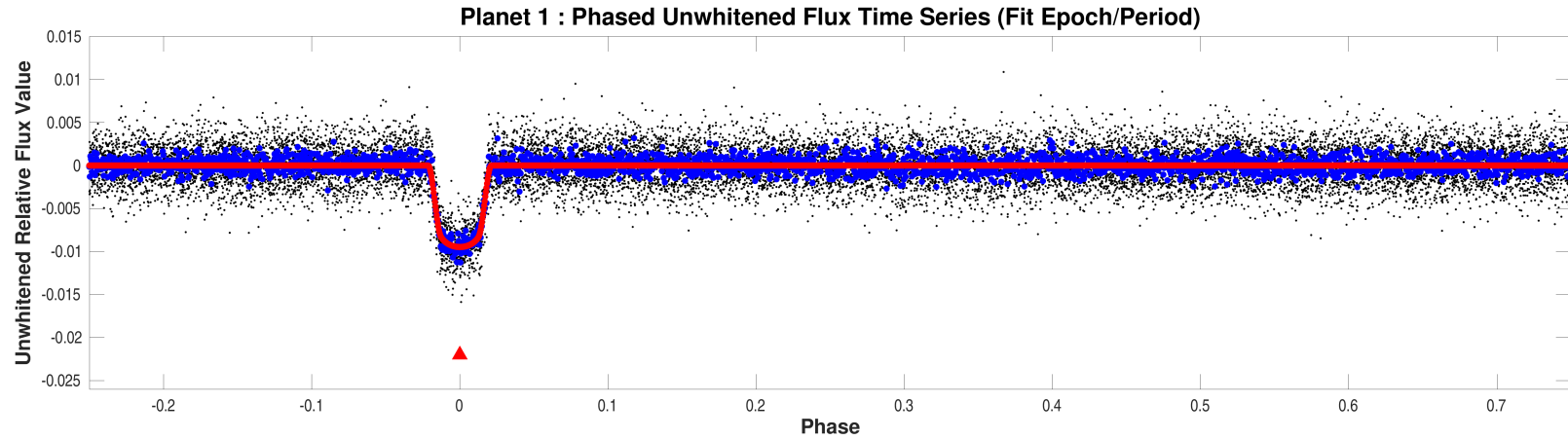
5.2 Difference Image TIC Key

Index	Catalog ID	Mag	RA (degrees)	Dec (degrees)	Distance (arcsec)
1	159742538	11.112	268.30432488	37.21171087	0.00
2	1508531926	15.640	268.30433017	37.21214535	1.56
3	159742539	16.171	268.30169030	37.21093648	8.05
4	1508531919	19.914	268.30815634	37.20863665	15.59
5	1508531920	19.297	268.31283062	37.21240670	24.51
6	1508531924	19.365	268.29492250	37.21084853	27.14
7	159742542	18.218	268.30914617	37.20385888	31.47
8	1508531918	19.705	268.31481768	37.20734598	33.94
9	1508531927	17.905	268.30728560	37.22137542	35.81
10	1508531917	20.053	268.30459250	37.20169776	36.06
11	159742533	18.270	268.29186243	37.21873015	43.76
12	1508531901	19.053	268.28805176	37.21286651	46.84
13	1508531900	19.418	268.28831292	37.20912223	46.84
14	1508531894	19.207	268.29350797	37.19996722	52.43
15	159742543	17.044	268.32007399	37.20286111	55.26
16	1508531928	19.090	268.30932400	37.22693393	56.65
17	1508531922	19.468	268.31755697	37.22456674	59.84
18	1508531923	17.847	268.32479292	37.21583584	60.53
19	159742550	18.343	268.30674426	37.19497156	60.66
20	1508532517	19.799	268.28806189	37.22700099	72.14
21	1508531906	18.489	268.32938628	37.21494825	72.79
22	159742529	15.791	268.28642617	37.22609452	72.90
23	1508531907	17.956	268.32822291	37.20429222	73.54
24	159742554	16.418	268.30967762	37.19164023	73.87
25	1508531930	19.909	268.32498132	37.22538909	77.02
26	159742551	12.962	268.29017397	37.19336884	77.50
27	1508531884	19.468	268.30639192	37.18962922	79.71
28	159742547	16.320	268.28229811	37.19755741	81.14
29	1508531899	17.988	268.27955923	37.19942178	83.66
30	1508532518	18.608	268.29610669	37.23461730	85.76
31	1508531933	18.106	268.32080808	37.23189908	86.69
32	1508531905	19.226	268.33473746	37.20800738	88.21
33	159742553	17.936	268.32353017	37.19234115	88.85
34	1508532493	18.946	268.27246986	37.20725383	92.73
35	1508531929	18.217	268.33437867	37.22202043	93.82
36	1508532515	18.274	268.28234396	37.23102918	93.85
37	159742526	14.340	268.32787146	37.23057344	95.75
38	159742552	17.008	268.28090342	37.19243126	96.57

Index	Catalog ID	Mag	RA (degrees)	Dec (degrees)	Distance (arcsec)
39	1508532516	17.876	268.28260859	37.23353683	100.25
40	1508531931	19.834	268.32993681	37.23083768	100.66
41	1508531885	19.170	268.31123752	37.18425687	100.80
42	159742534	18.200	268.34040050	37.21260796	103.48
43	159742523	15.813	268.32272841	37.23779973	107.73
44	1508531897	19.734	268.27057319	37.19804148	108.56
45	159742559	17.863	268.31977836	37.18385521	109.63
46	1508531892	19.599	268.28494344	37.18397542	114.27
47	159742537	16.967	268.34436522	37.21192177	114.80
48	159742544	16.408	268.26637526	37.20144452	114.91
49	159742536	17.057	268.26322525	37.21234248	117.86
50	1508532491	19.018	268.26288966	37.20985402	118.99
51	1508531895	19.436	268.26936737	37.19342102	119.92
52	1508531896	19.118	268.26894112	37.19343579	120.91
53	159742549	14.167	268.26664098	37.19591751	122.09
54	1508532519	19.353	268.29848857	37.24547391	122.69
55	1508532523	18.894	268.30800262	37.24621984	124.68
56	1508531915	18.845	268.34556418	37.22615552	129.17
57	159742562	17.460	268.28734992	37.17841916	129.35
58	1508532490	17.998	268.26178335	37.19902632	130.24
59	1508531878	17.779	268.32138343	37.17720296	133.51
60	1508531904	18.926	268.34143873	37.18863513	135.00
61	159742560	17.498	268.33307987	37.18043851	139.54
62	1508532498	19.861	268.26105663	37.22949260	139.60
63	159742519	16.758	268.27405613	37.24372367	144.27
64	1508532497	18.878	268.26258654	37.23530621	146.75
65	159742563	18.093	268.27323100	37.17837100	149.51
66	159742518	16.592	268.33706257	37.24520763	152.81
67	159742522	17.403	268.26512612	37.24048396	152.84
68	1508531890	19.847	268.26578597	37.18160995	154.76
69	1508531932	19.801	268.34477131	37.24385871	163.83
70	159742561	15.273	268.26341862	37.17986388	164.01

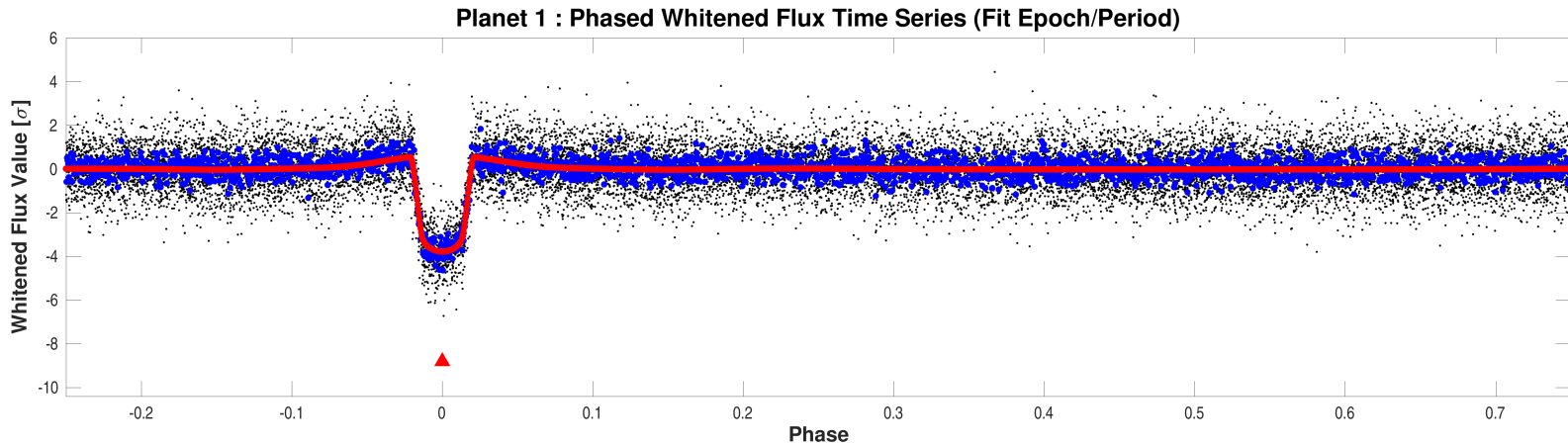
RA, Dec and Distances are corrected for proper motion. This table may not contain all of the objects shown.

6 Phased Light Curves



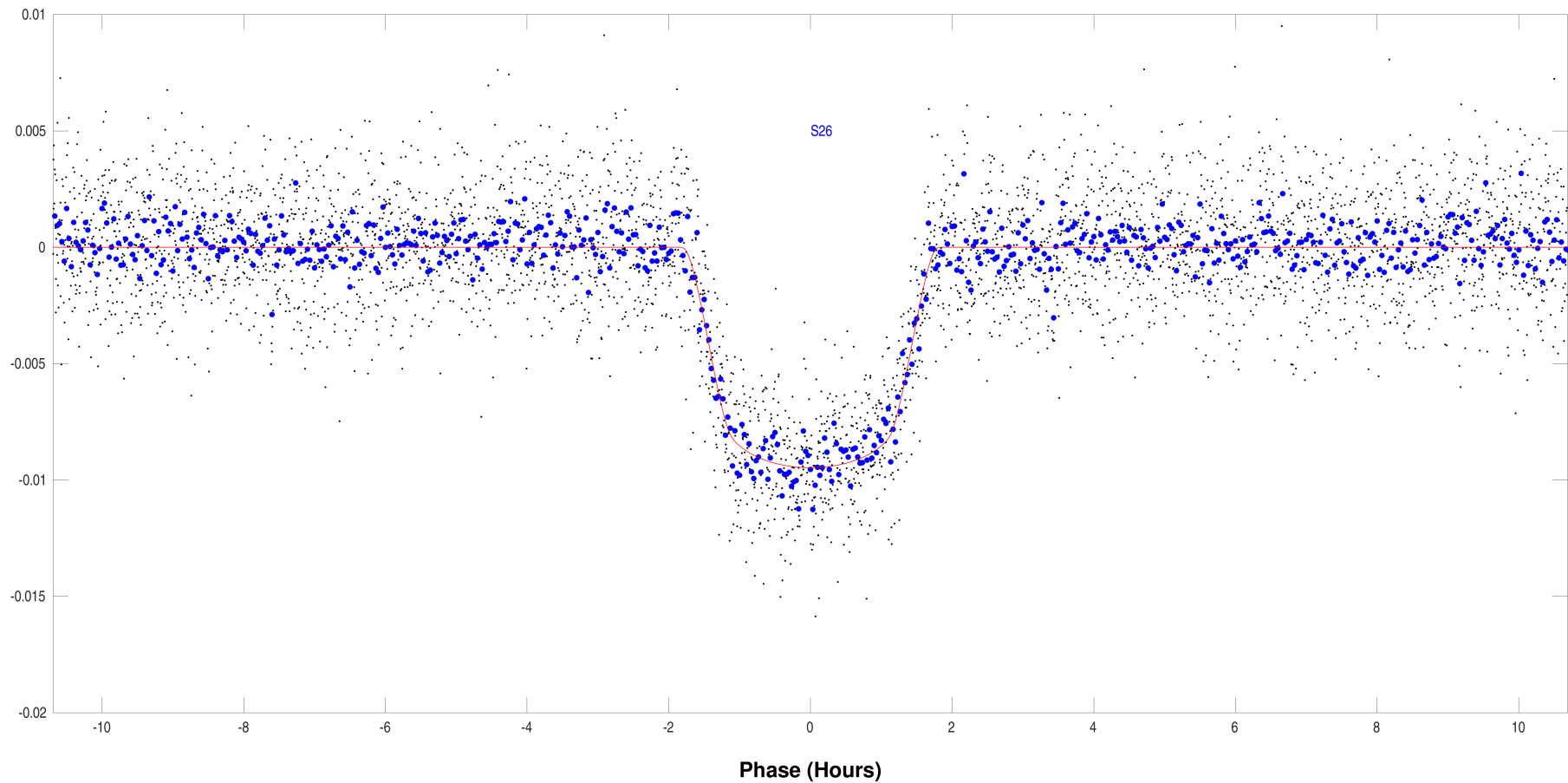
Phased unwhitened flux time series is plotted in black dots. When all transits fit completed with full or secondary convergence, the phase is determined with the fitted epoch and period; otherwise, the phase is determined with the TPS epoch and period. The values of the phased unwhitened flux time series 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/0000000159742538-01-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/0000000159742538-01-phased-whitened-flux-time-series.fig`

Planet: 1 Phased Unwhitened Flux Time Series by Sector

Phased unwhitened flux time series by sector for target 159742538, planet candidate 1. Period = 3.5539 days; transit epoch = 2010.9408 BTJD.
Open `./summary-plots/0000000159742538-01-phased-unwhitened-flux-time-series-by-sector.fig`

7 Planet Candidate 1

7.1 Model Fitter: All Transits

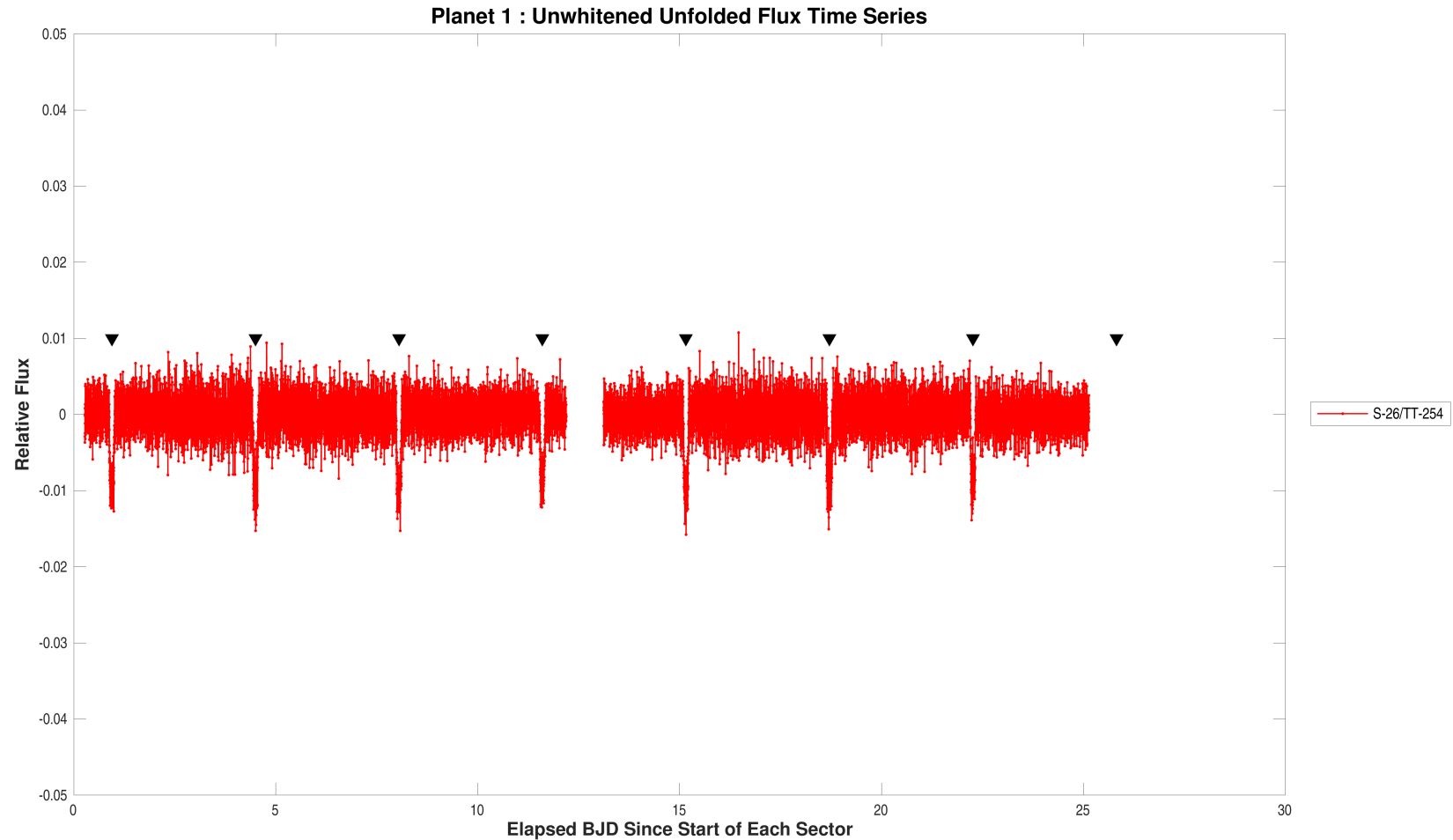
Model Characteristic	Name
Transit Model	mandel-agol_geometric_transit_model
Limb Darkening Model	claret_tess_nonlinear_limb_darkening_model

TCE Parameter	Value	Units
Trial Transit Pulse Duration	3.0	hours
Transit Epoch	2010.9364211	TJD
Orbital Period	3.5541651	days
Maximum SES	27.6	
Maximum MES	62.8	
Robust Statistic	73.5	
Chi Square Goodness of Fit Statistic (DoF)	523.9 (529)	
Chi Square2 Statistic (DoF)	17.1 (506.8)	
Threshold for Desired PFA		

DoF: Degrees of Freedom

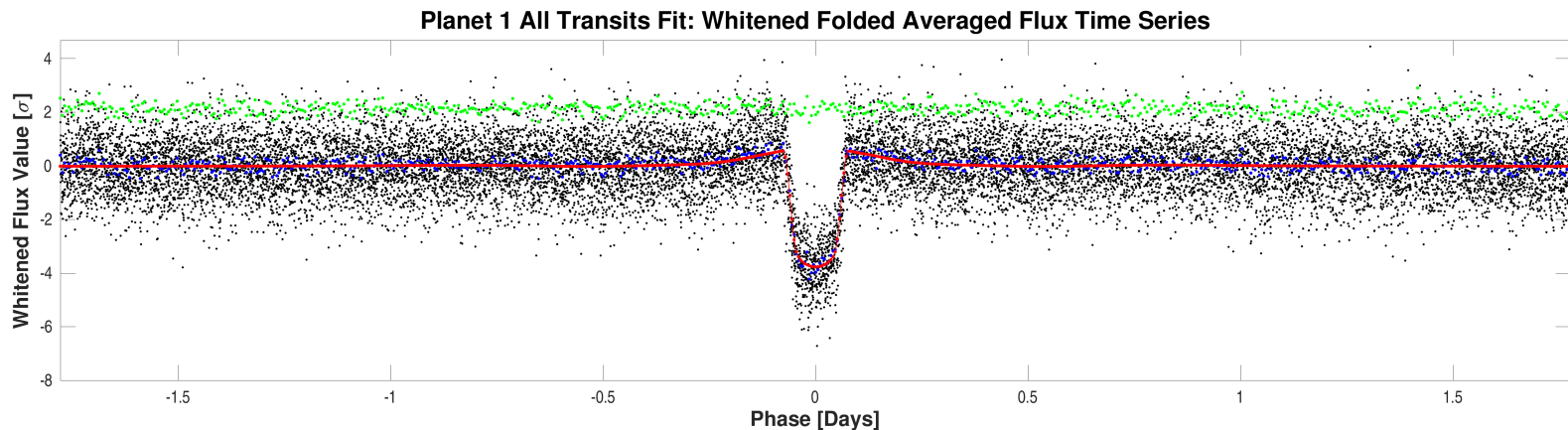
Parameter	Value	Uncertainty	Units
SNR	80.4		
Orbital Period	3.5539147	2.2119e-04	days
Transit Epoch	2010.9407530	7.9656e-04	BTJD
Impact Parameter	0.7447	2.5300e-02	
Planet Radius to Star Radius Ratio	0.0967964	1.0159e-03	
Semi-major Axis to Star Radius Ratio	6.1975	2.5119e-01	
Planet Radius	21.2245	1.1269e+00	Earth radii
Semi-major Axis	0.0482	3.6367e-03	AU
Effective Stellar Flux	2276.3067	3.7529e+02	Goldilocks
Equilibrium Temperature	1762	7.2611e+01	Kelvin
Stellar Density	0.2532	3.0787e-02	Solar density
Transit Depth	9471	1.2240e+02	ppm
Transit Duration	3.5634	5.4659e-02	hours
Transit Ingress Duration	0.6528	6.2459e-02	hours
Eccentricity	0.0000	0.0000e+00	
Peri Longitude	0.0000	0.0000e+00	degrees
Model Chi Square Statistic (DoF)	2743.3 (3424.7)		
Model Chi Square Goodness of Fit Statistic (DoF)	420.9 (770)		
Model Chi Square2 Statistic (DoF)	4.7 (6)		

DoF: Degrees of Freedom



Flux time series for CatId 159742538, Planet candidate 1 in the unwhitened domain. For the data of Sector-26/TargetTableId-254, start BJD is 2459010. Transit event markers indicate the location of transits of the given planet candidate. All transits fit completed with full convergence.

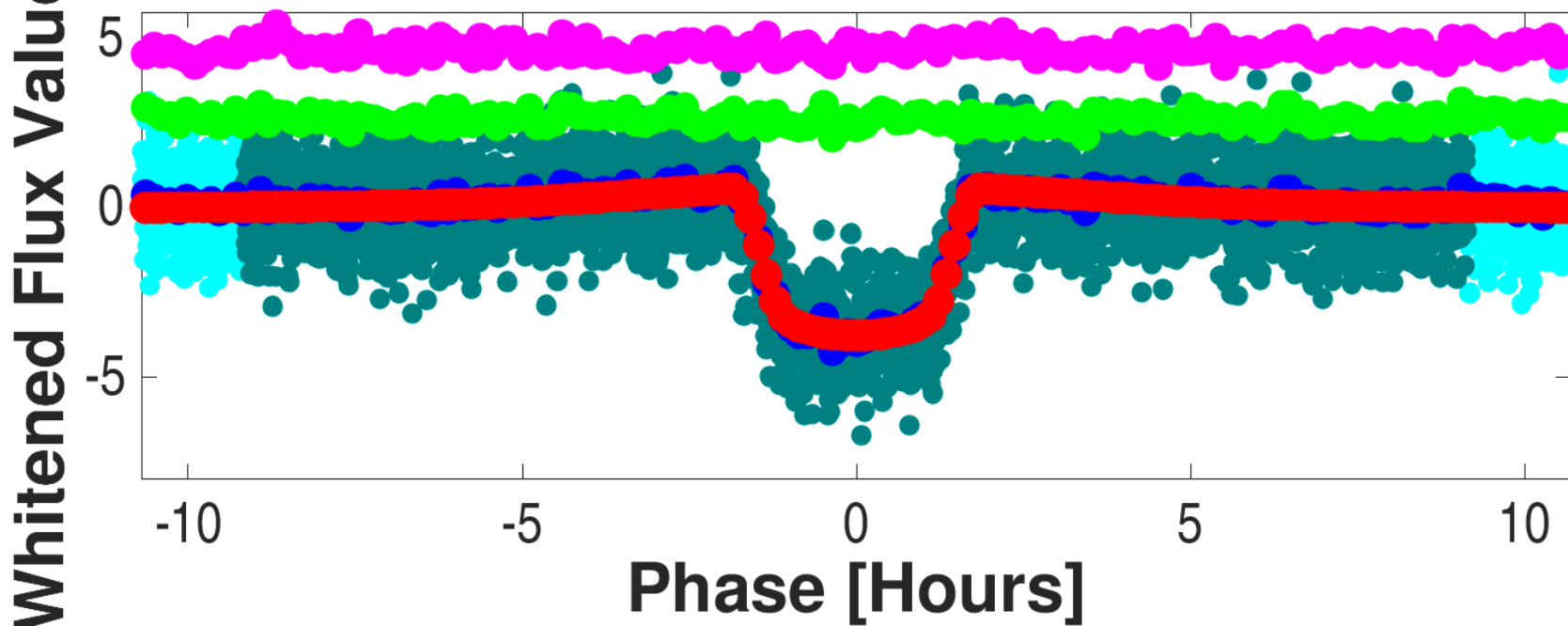
Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000159742538-01-all-unwhitened-26-254.fig`



Folded flux time series for CatId 159742538, 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/0000000159742538-01-all-whitened.fig`

Transits Fit: Whitenened Folded Averaged Zoomed F



Folded flux time series for CatId 159742538, 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

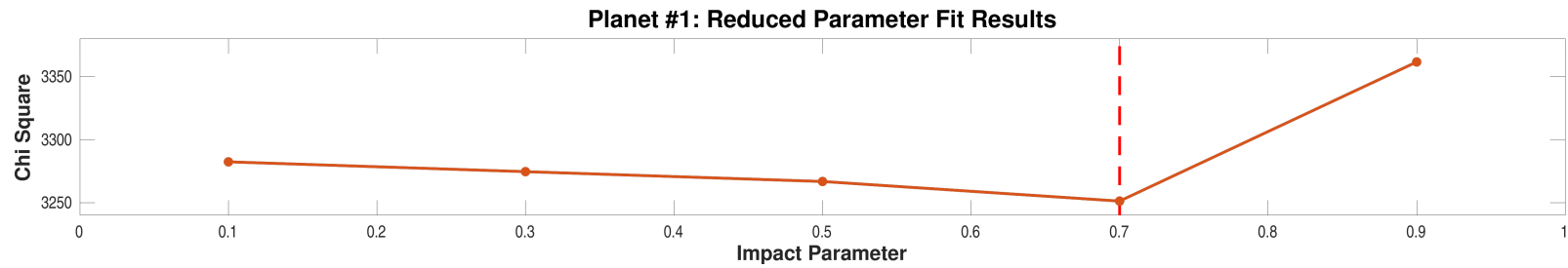
time series; the red dots represent the averaged values of the fitted model light curve of the all transits fit; the green dots are the averaged folded fit residuals, vertically offset for clarity. Magenta dots are the averaged values of the folded flux time series, with a phase shift of 0.5 relative 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/0000000159742538-01-all-whitened-zoomed.fig`

7.2 Model Fitter: Reduced Parameter Fit Results

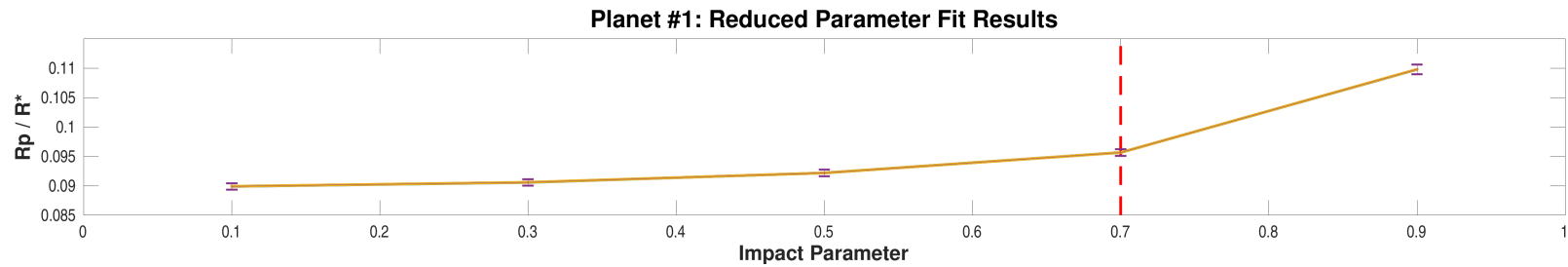
Impact Parameter	SNR	Model Chi Square	Planet Radius to Star Radius	Uncert	Semi-major Axis to Star Radius	Uncert	Transit Depth (ppm)	Uncert	Transit Duration (hours)	Uncert
0.10	83.3	3282.3	0.0899019	5.5183e-04	9.0938	5.1745e-02	9313	1.1368e+02	3.2482	1.8393e-02
0.30	83.8	3274.6	0.0905790	5.5313e-04	8.7187	5.0758e-02	9326	1.1324e+02	3.2749	1.8981e-02
0.50	84.0	3266.8	0.0921900	5.6332e-04	7.9271	4.9137e-02	9361	1.1369e+02	3.3407	2.0637e-02
0.70	84.8	3251.2	0.0956581	5.8501e-04	6.5925	4.7043e-02	9459	1.1482e+02	3.5006	2.4949e-02
0.90	83.3	3361.5	0.1097781	8.4691e-04	4.4141	5.0495e-02	10295	1.3895e+02	4.0950	4.6214e-02

Highlighted row is the best reduced-parameter model fit.



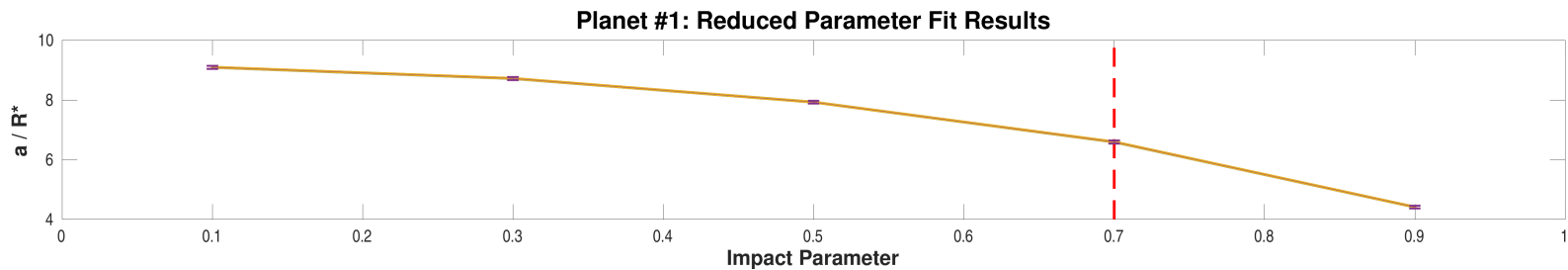
Model chi squares of reduced parameter fits vs. impact parameter for CatId 159742538, Planet candidate 1. The fit result with the minimum chi square is marked with a dashed line in the plot.

Open `./planet-01/planet-search-and-model-fitting-results/reduced-parameter-fits/0000000159742538-01-reduced-fits-chi-square.fig`



Ratios of planet radius to star radius of reduced parameter fits vs. impact parameter for CatId 159742538, 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/0000000159742538-01-reduced-fits-rp-over-rstar.fig`



Ratios of semimajor axis to star radius of reduced parameter fits vs. impact parameter for CatId 159742538, 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/0000000159742538-01-reduced-fits-a-over-rstar.fig`

7.3 Model Fitter: Trapezoidal Fit Results

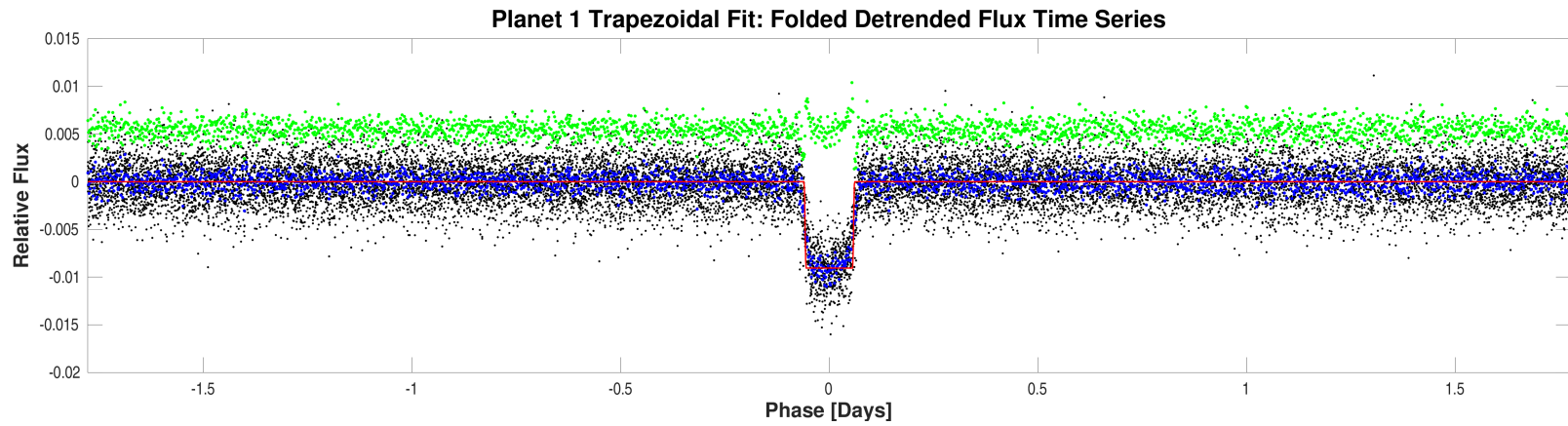
Model Characteristic	Name
Transit Model	trapezoidal_model
Limb Darkening Model	

TCE Parameter	Value	Units
Trial Transit Pulse Duration	3.0	hours
Transit Epoch	2010.9364211	TJD
Orbital Period	3.5541651	days
Maximum SES	27.6	
Maximum MES	62.8	
Robust Statistic	73.5	
Chi Square Goodness of Fit Statistic (DoF)	523.9 (529)	
Chi Square2 Statistic (DoF)	17.1 (506.8)	
Threshold for Desired PFA		

DoF: Degrees of Freedom

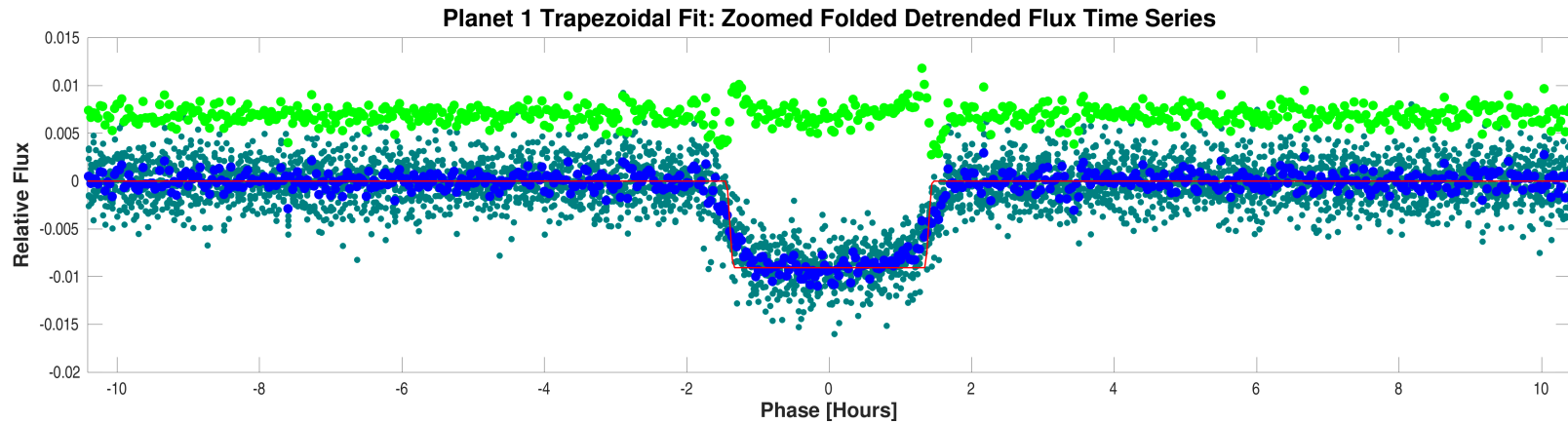
Parameter	Value	Uncertainty	Units
SNR	90.5		
Orbital Period	3.5541651		days
Transit Epoch	2010.9397303		BTJD
Transit Depth	9061		ppm
Transit Duration	3.4708		hours
Transit Ingress Duration	0.6801		hours
Model Chi Square Statistic (DoF)	17404.3 (4949)		

DoF: Degrees of Freedom



Folded detrended flux time series for CatId 159742538, Planet candidate 1 and folded trapezoidal model light curve.

Open `./planet-01/planet-search-and-model-fitting-results/trapezoidal-model-fit/0000000159742538-01-all-trapezoidal.fig`



Zoomed folded detrended flux time series for CatId 159742538, Planet candidate 1 and folded trapezoidal model light curve.

Open `./planet-01/planet-search-and-model-fitting-results/trapezoidal-model-fit/0000000159742538-01-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	3.5542		days		
Transit Duration	3		hours		
Maximum MES	62.8				
Secondary Phase	1.3292		days		
Secondary MES	2.1				
Minimum Phase	0.42778		days		
Minimum MES	-2.8				
Median MES	-0.2				
MAD MES	0.75473				
Robust Statistic	2.0				
Secondary Depth	249.0	1.1593e+02	ppm		
Geometric Albedo	0.7	3.4331e-01		-0.8562	80.41
Planet Effective Temperature	2497	2.9626e+02	Kelvin	2.4099	0.80

7.4.2 Eclipsing Binary Discrimination Test

Result	Value	Value in Sigmas	Significance (%)
Odd Even Transit Depth Comparison Statistic	1.0894e+00	1.0438	29.66

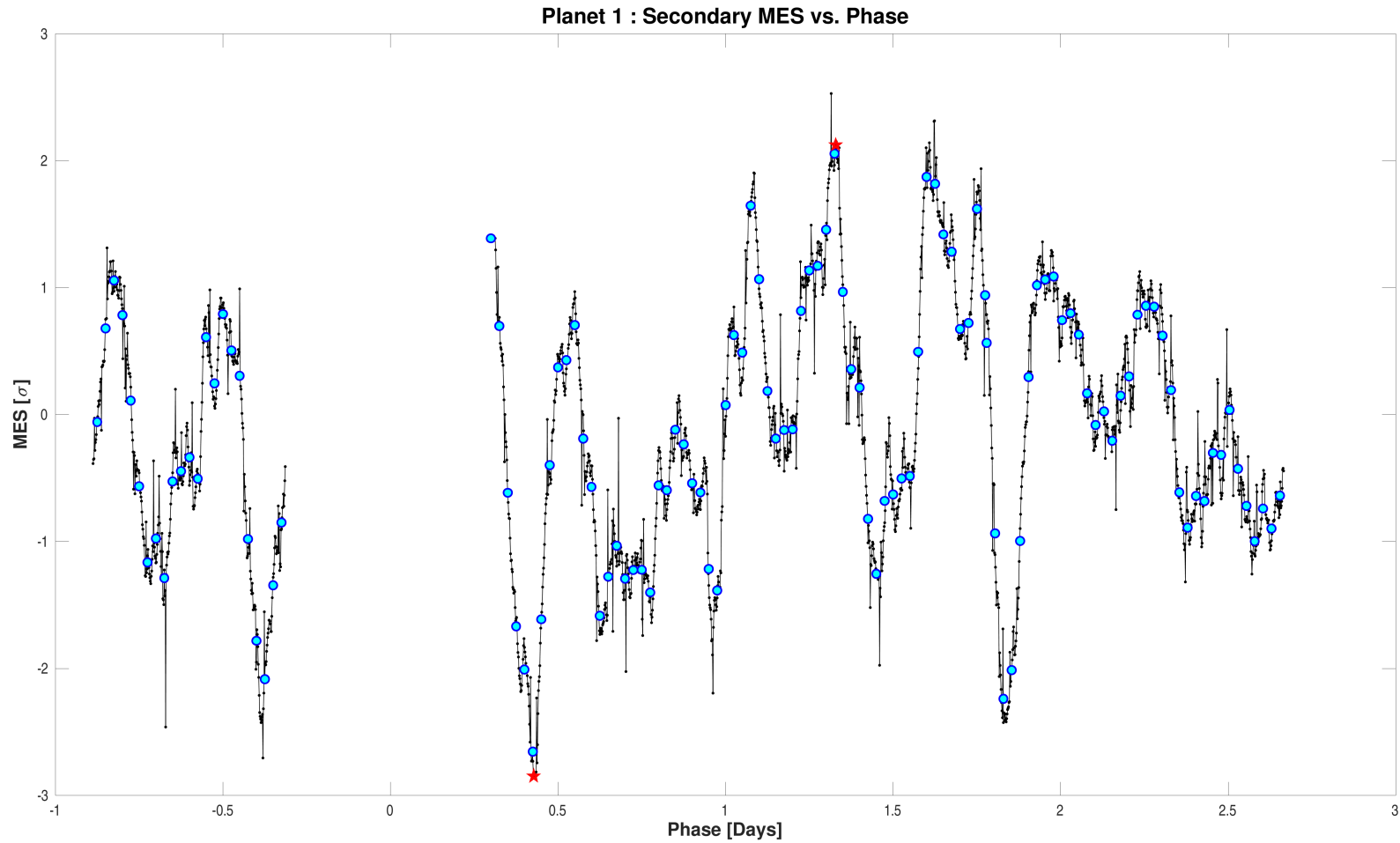
7.4.3 Bootstrap Test

Result	Value
False Alarm Probability	0.0000e+00
Bootstrap Threshold for Desired PFA	6.8
MES Mean	0.46
MES Standard Deviation	0.90
Transit Count	7

7.4.4 Ghost Diagnostic Test

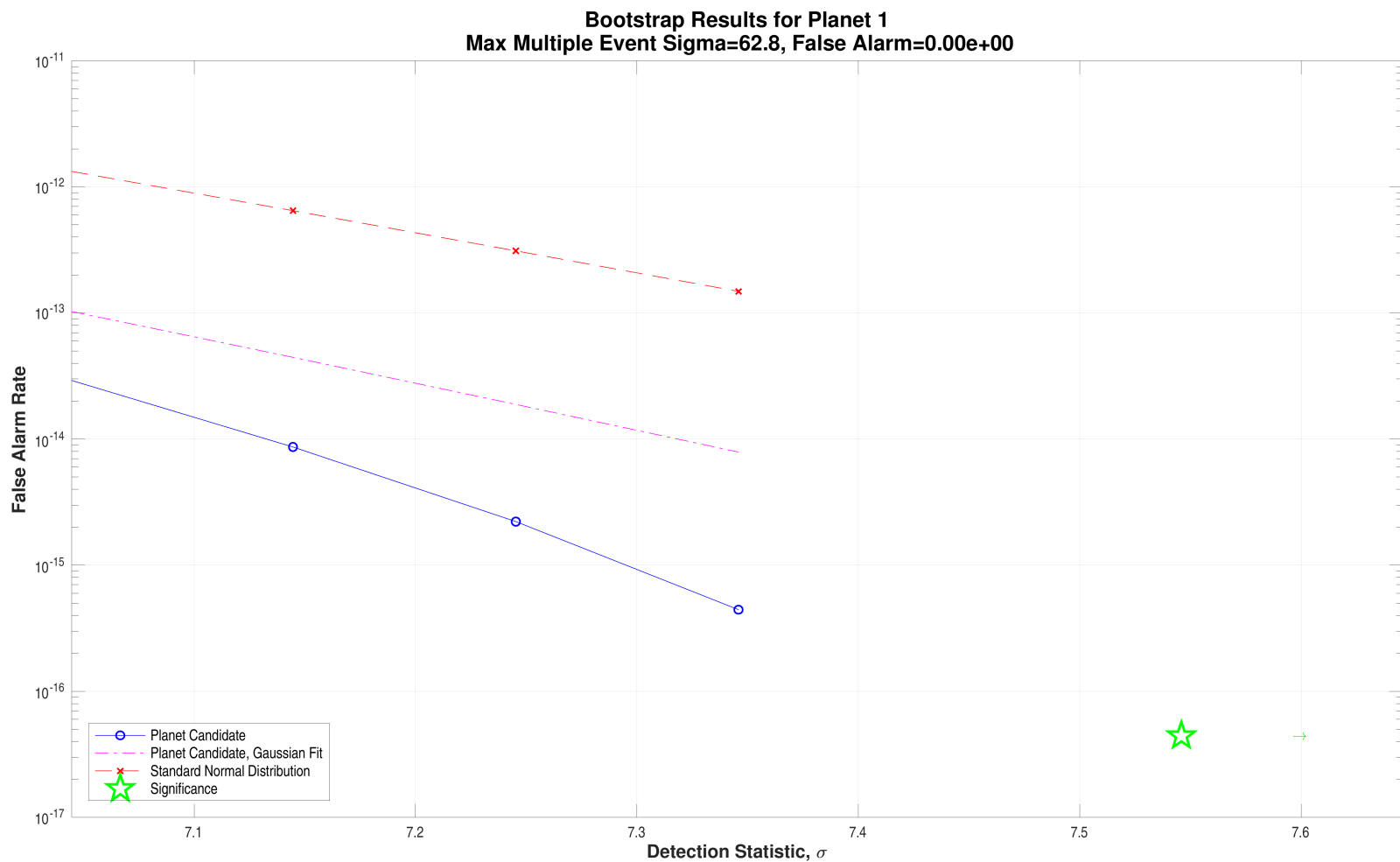
Result	Value	Significance (%)
Maximum MES	62.8	
SNR	80.4	
Core Aperture Statistic	5.1378e+01	100.00
Halo Aperture Statistic	6.0794e+00	100.00
Ratio of Core/Halo Aperture Statistics	8.4512e+00	

7.4.5 Validation Test Figures



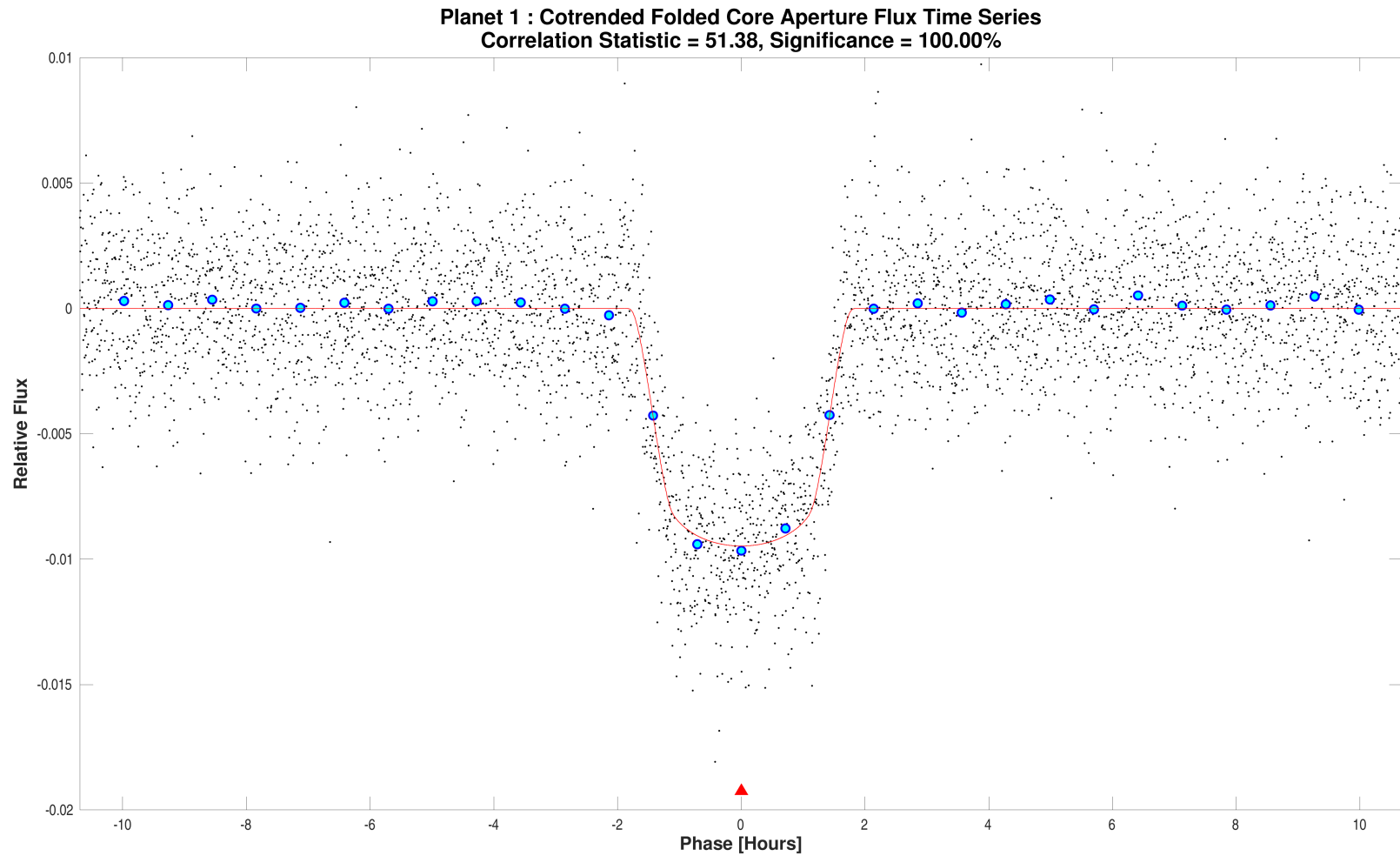
The primary event has been set to zero and both the max and min of the resulting MES vs. Phase are marked with a red star. The best matched pulse duration in hours is 3. The maximum secondary MES and corresponding phase are 2.1253 and 1.3292 days respectively. The minimum secondary MES and corresponding phase are -2.848 and 0.42778 days respectively.

Open `./planet-01/report-summary/0000000159742538-01-weak-secondary-diagnostic.fig`



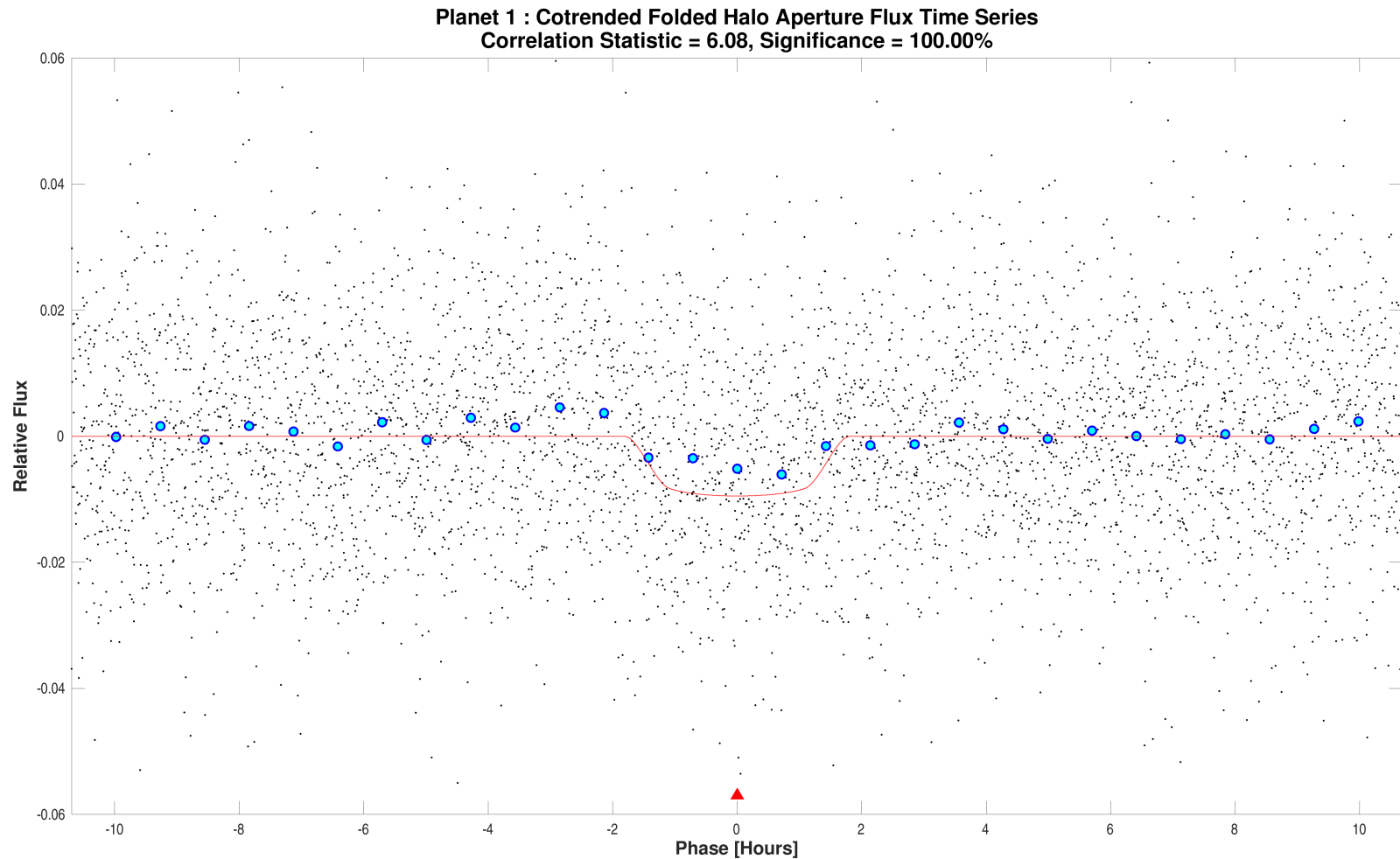
Bootstrap results for target 159742538, planet 1. Cumulative sum of the probabilities (derived from the histogram of counts) from upper tail to the search transit threshold; false alarm probability is indicated by the star. The Gaussian equivalent threshold for this false alarm probability is Inf. The threshold on this distribution that achieves the same false alarm rate as a 7.1 sigma threshold on a Gaussian distribution is 6.766.

Open `./planet-01/bootstrap-results/0000000159742538-01-bootstrap-false-alarm.fig`



Optical ghost diagnostic core aperture flux time series for target 159742538, 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/0000000159742538-01-core-unwhitened-cotrended-zoomed-model.fig`

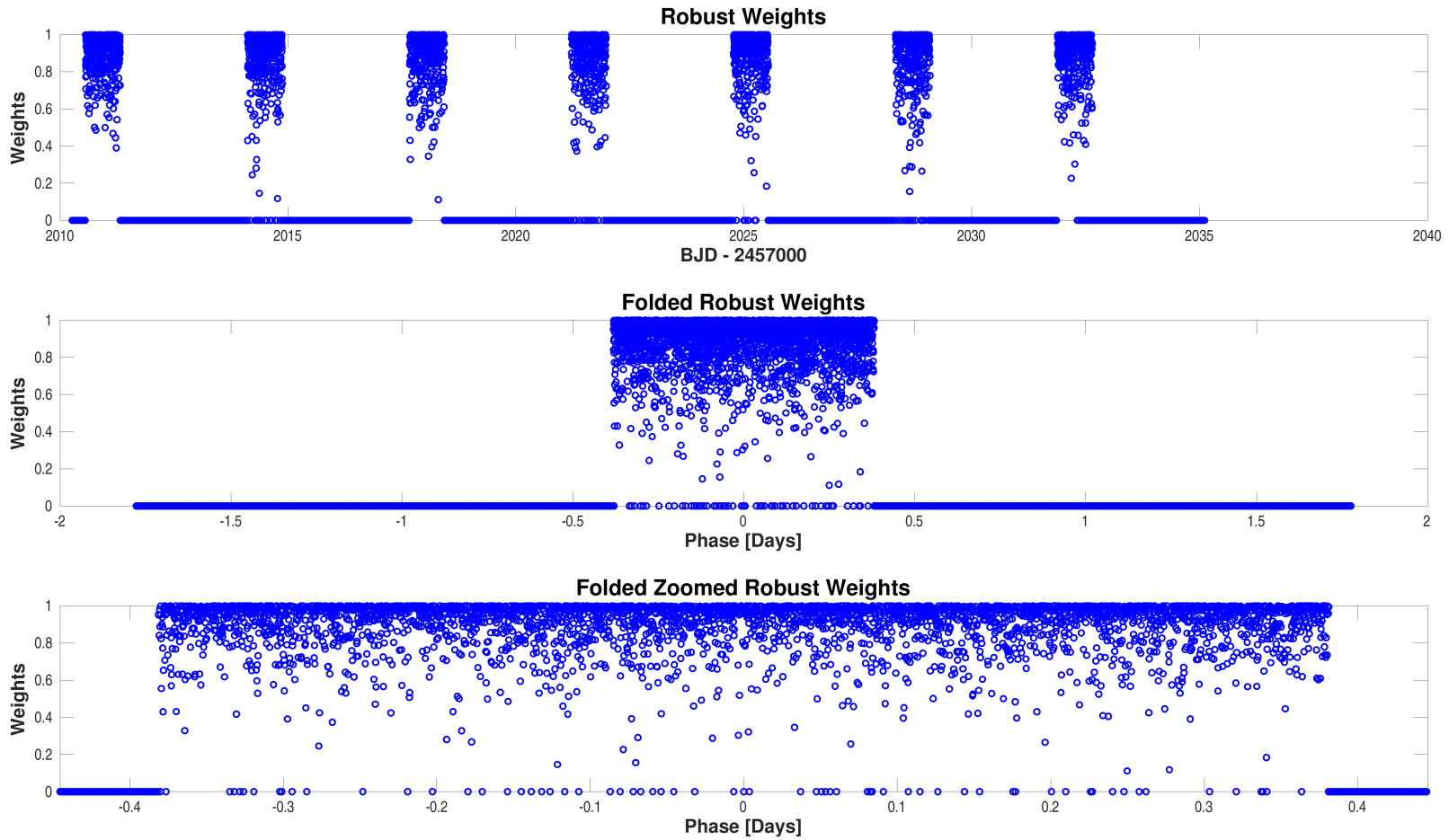


Optical ghost diagnostic halo aperture flux time series for target 159742538, planet candidate 1. The unwhitened time series is phase folded at the orbital period associated with the planet candidate and centered on the epoch of the first transit. The time series was first cotrended against spacecraft 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/000000159742538-01-halo-unwhitened-cotrended-zoomed-model.fig`

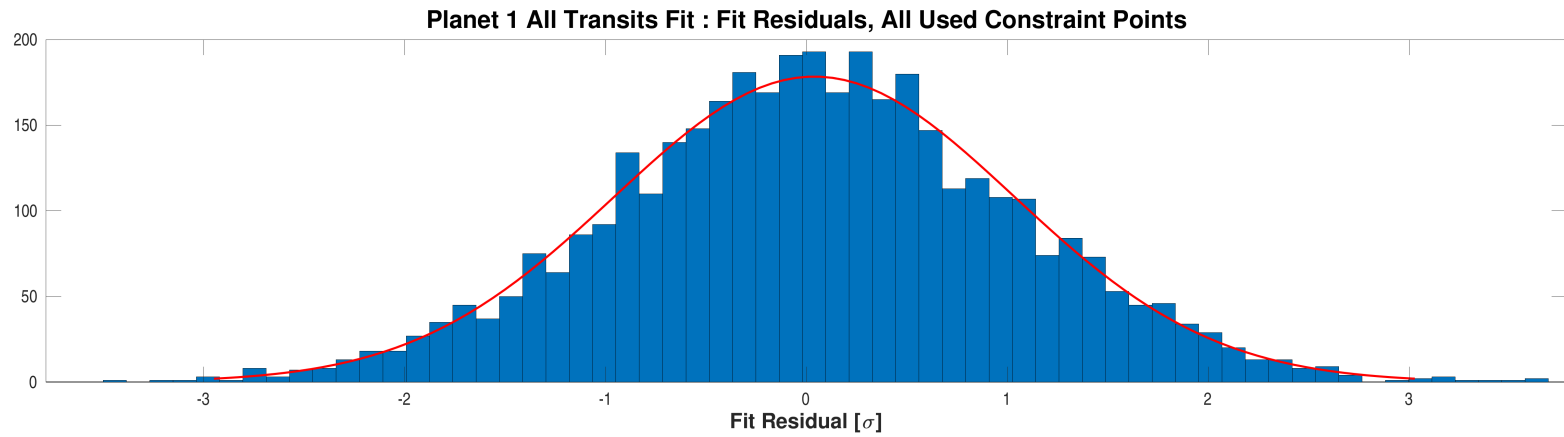
Appendix A Planet Candidate 1

A.1 Model Fitter: All Transits



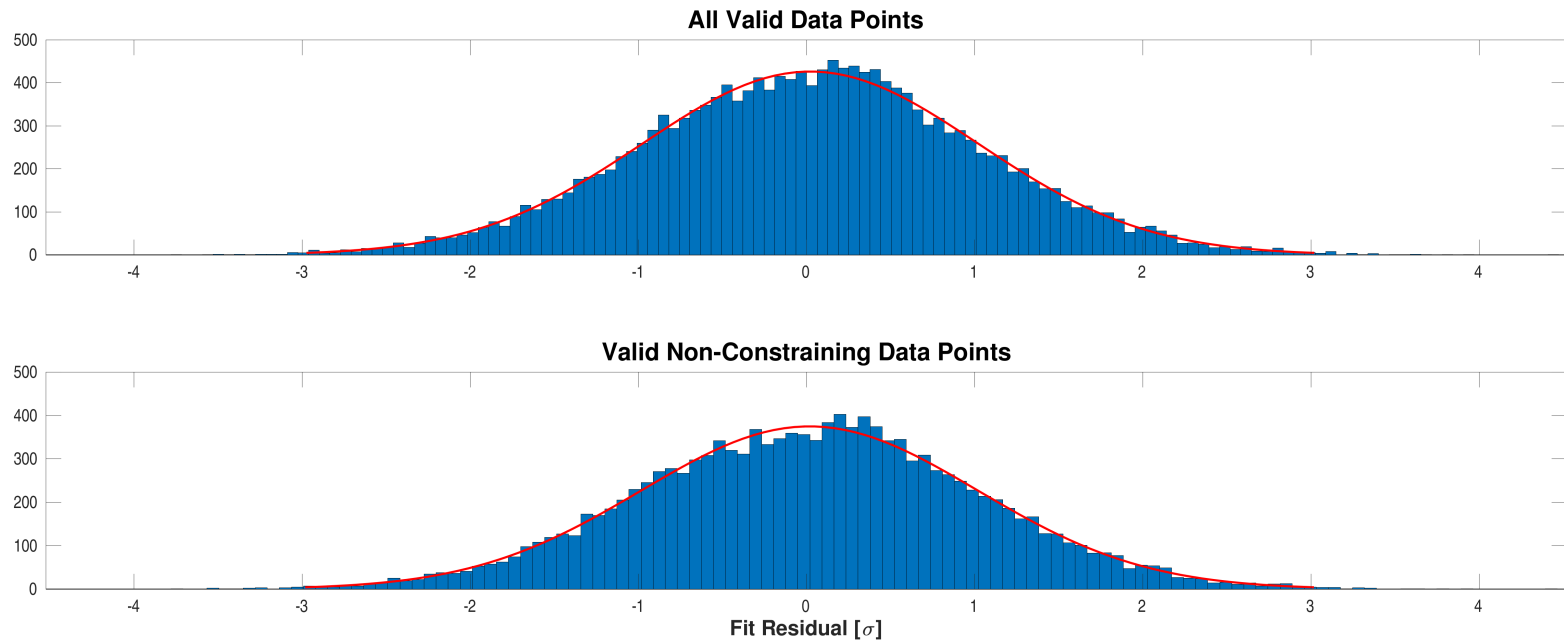
Robust weights distribution for CatId 159742538, Planet candidate 1. Top plot: all data points. Middle plot: all data points, folded per the fitted period and epoch. Bottom plot: all data points, folded and zoomed.

Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000159742538-01-all-robust-weights.fig`



Fit residuals distribution for CatId 159742538, 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/0000000159742538-01-all-histo-used.fig`



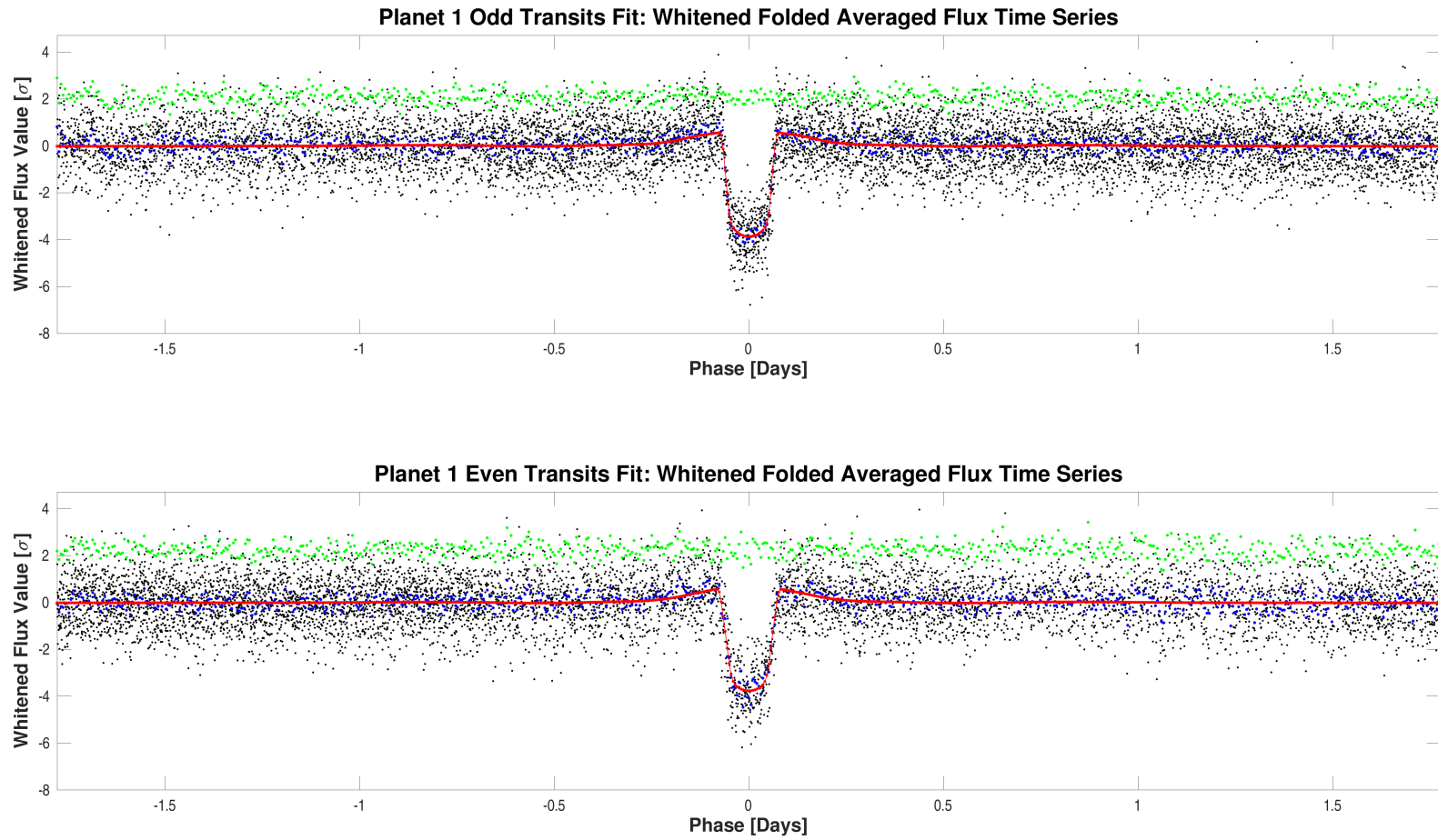
Fit residuals distribution for CatId 159742538, Planet candidate 1. Top plot: all valid data. Bottom plot: valid data not used to constrain fit (due to distance from a transit). Gaussian fits to the histograms are shown in red.

Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000159742538-01-all-histo-all-and-unused.fig`

A.2 Model Fitter: Odd & Even Transits

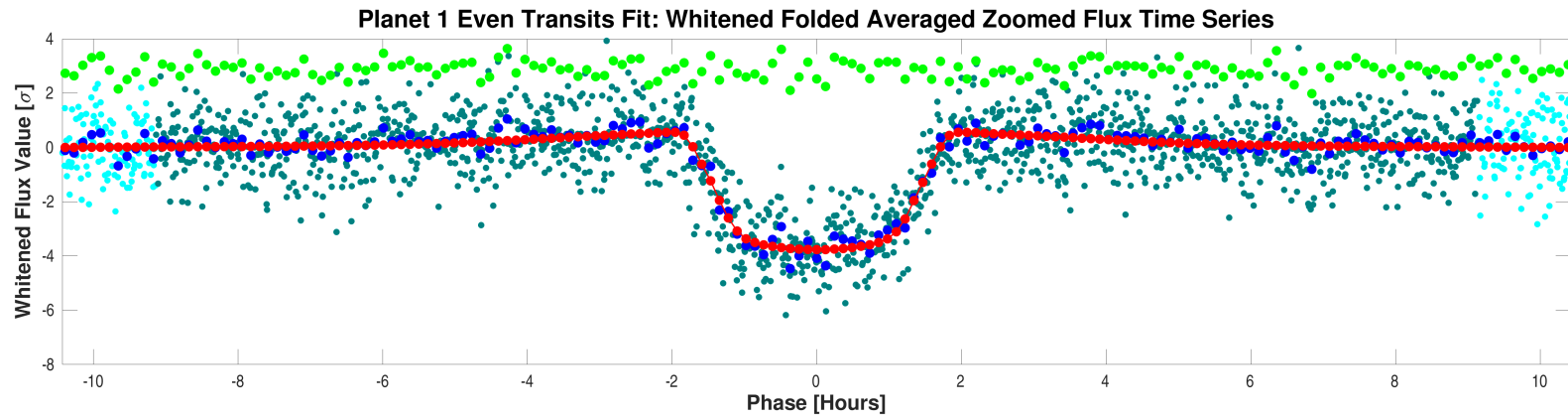
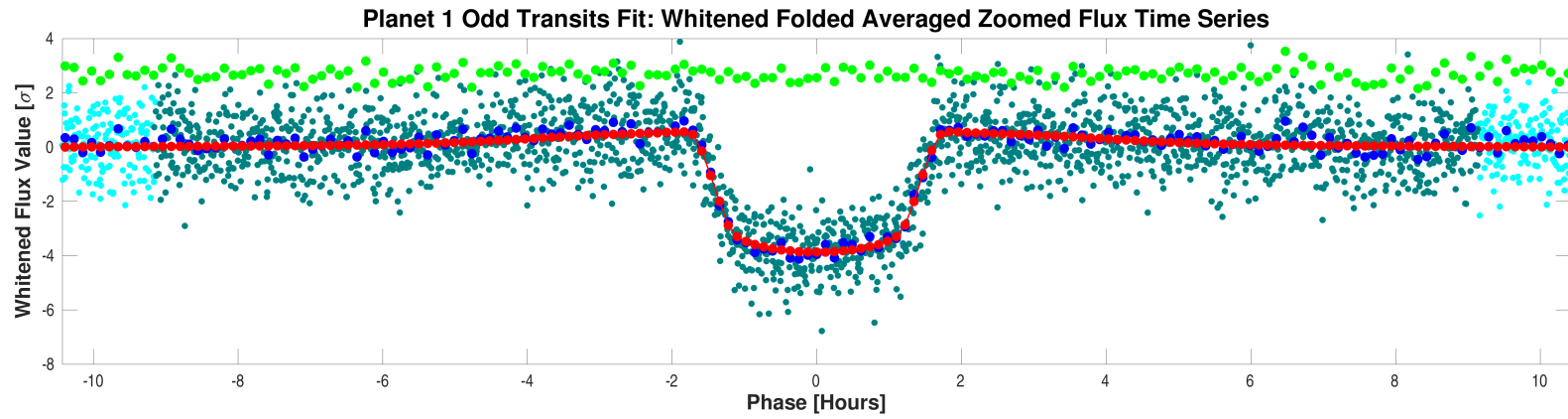
Parameter	Odd Transits Value	Odd Transits Uncertainty	Even Transits Value	Even Transits Uncertainty	Units	$\frac{\text{Difference}}{\ \text{Uncertainty}\ }$
SNR	62.9		51.9			
Orbital Period	3.5540425	2.4377e-04	3.5536393	4.5708e-04	days	7.7830e-01
Transit Epoch	2010.9402669	9.1517e-04	2014.4950578	1.1795e-03	BTJD	5.8690e-01
Impact Parameter	0.7083	4.1734e-02	0.8076	2.3407e-02		2.0755e+00
Planet Radius to Star Radius Ratio	0.0965632	1.3483e-03	0.0981275	1.5316e-03		7.6662e-01
Semi-major Axis to Star Radius Ratio	6.5945	3.7649e-01	5.4205	2.7641e-01		2.5136e+00
Planet Radius	21.1734	1.1410e+00	21.5164	1.1691e+00	Earth radii	2.0997e-01
Semi-major Axis	0.0482	3.6367e-03	0.0482	3.6365e-03	AU	7.0865e-04
Effective Stellar Flux	2276.1976	3.7527e+02	2276.5419	3.7533e+02	Goldilocks	6.4875e-04
Equilibrium Temperature	1762	7.2611e+01	1762	7.2613e+01	Kelvin	6.4875e-04
Stellar Density	0.3050	5.2242e-02	0.1694	2.5920e-02	Solar density	2.3250e+00
Transit Depth	9602	1.5826e+02	9341	1.9356e+02	ppm	1.0438e+00
Transit Duration	3.4762	6.8664e-02	3.7810	8.8548e-02	hours	2.7201e+00
Transit Ingress Duration	0.5754	7.6328e-02	0.8729	1.1168e-01	hours	2.1990e+00
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)	2747.6 (3422.0)		2747.6 (3422.0)			

DoF: Degrees of Freedom



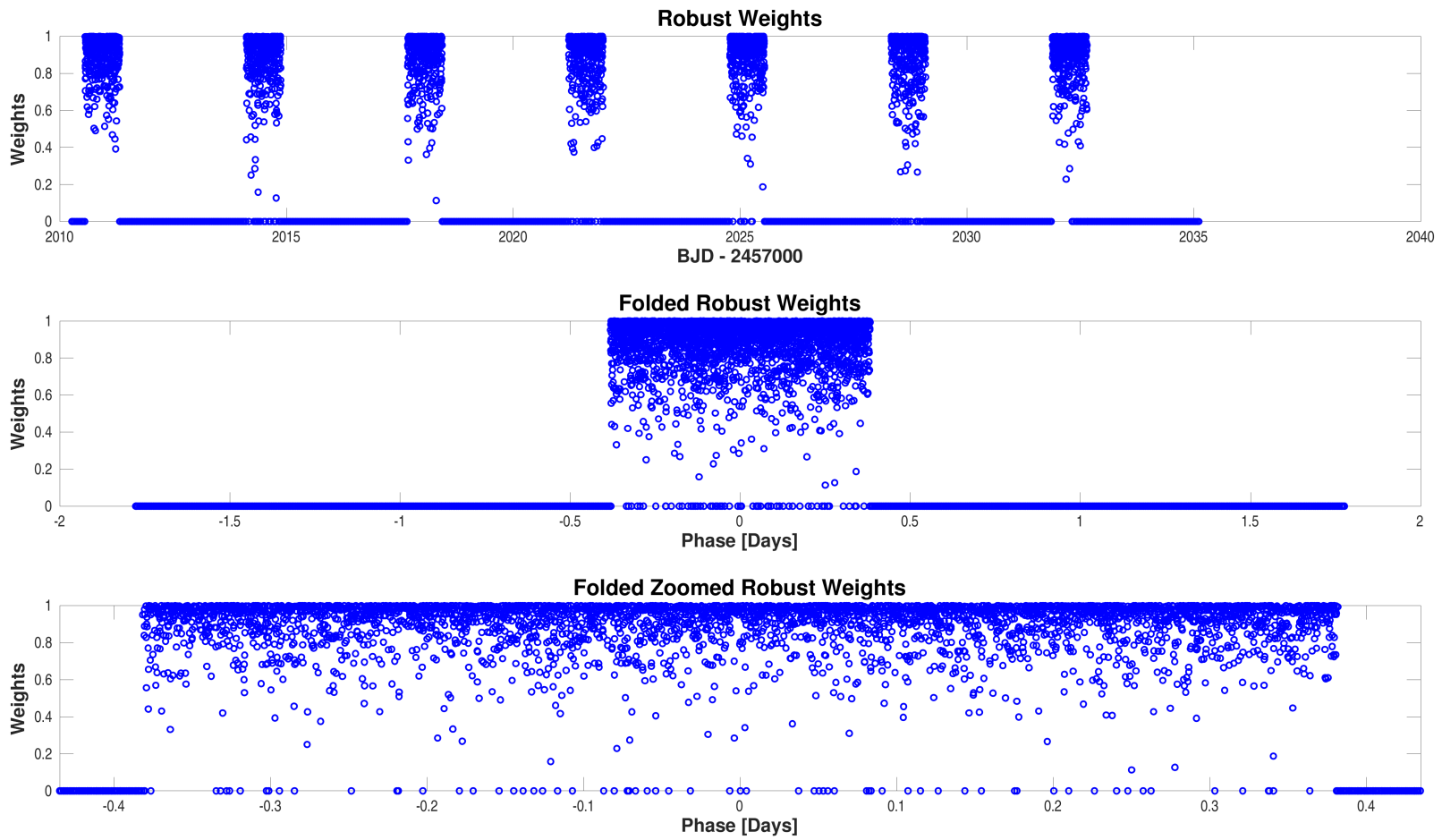
Folded flux time series for CatId 159742538, Planet candidate 1 in the whitened domain is plotted in black dots. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged values of the folded flux time series; the red dots represent the averaged values of the folded model light 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/000000159742538-01-odd-even-whitened.fig`



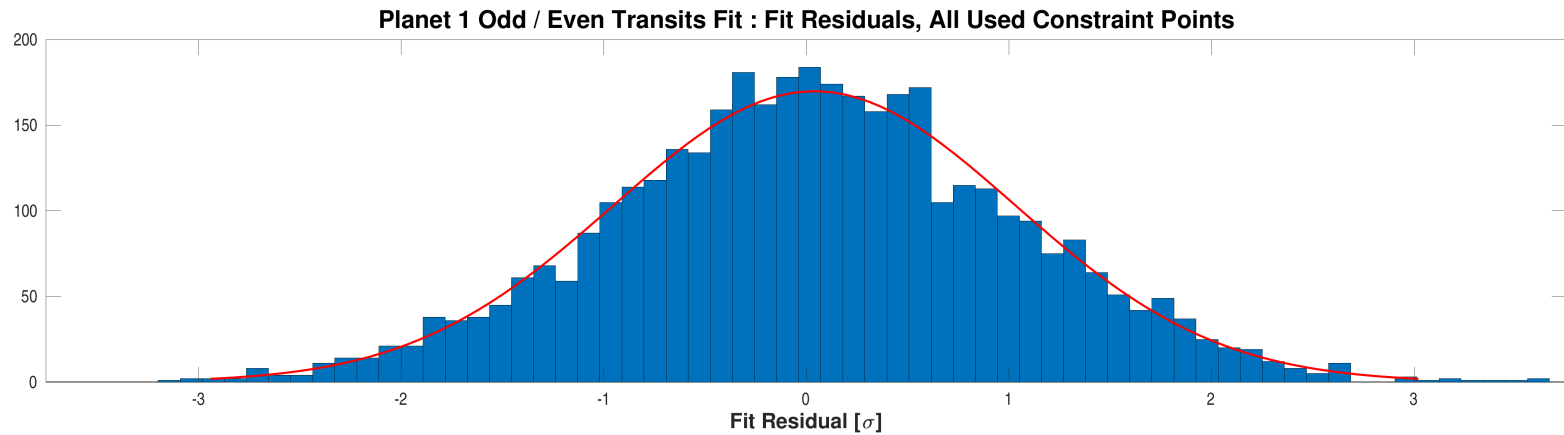
Folded flux time series for CatId 159742538, Planet candidate 1 in the whitened domain, zoomed on the transit. The flux data whose robust weights are larger/smaller than 0.1 are plotted in dark green/cyan dots, respectively. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged 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/0000000159742538-01-odd-even-whitened-zoomed.fig`



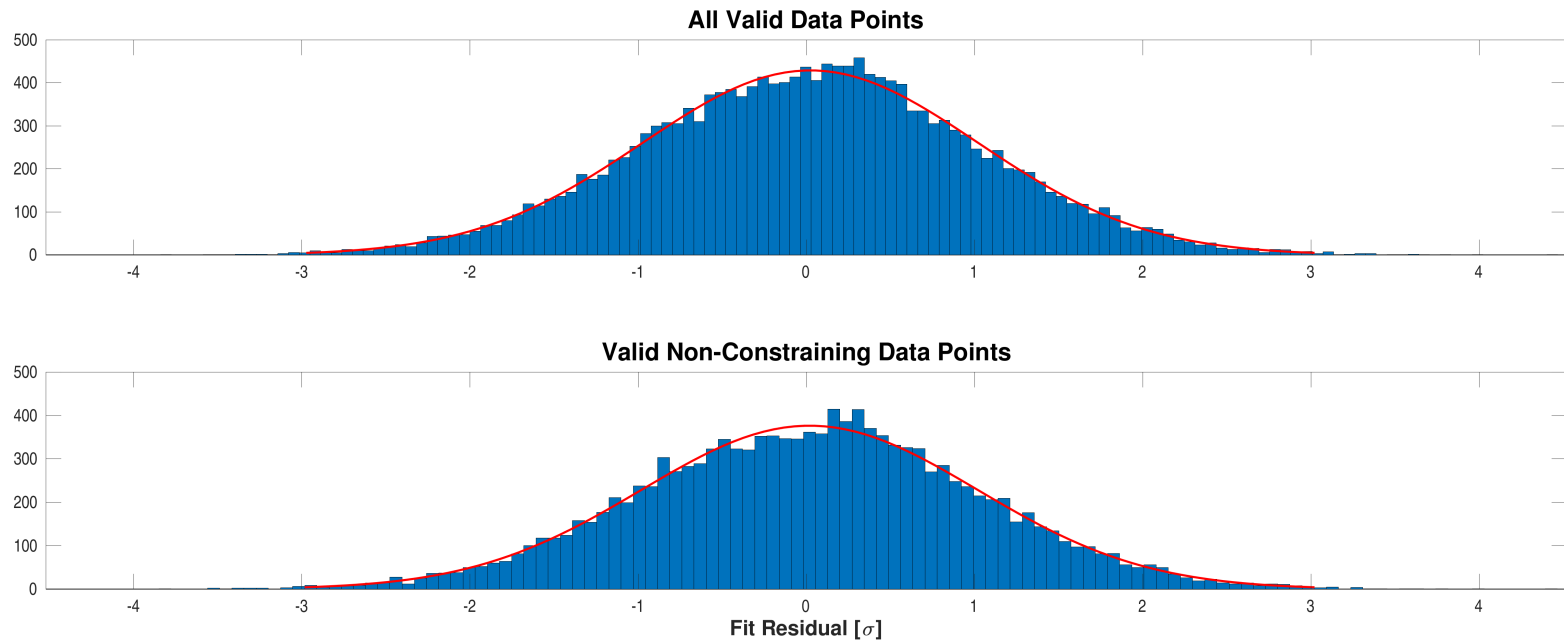
Robust weights distribution for CatId 159742538, Planet candidate 1. Top plot: all data points. Middle plot: all data points, folded per the fitted period and epoch. Bottom plot: all data points, folded and zoomed.

Open `./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000159742538-01-odd-even-robust-weights.fig`



Fit residuals distribution for CatId 159742538, 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.

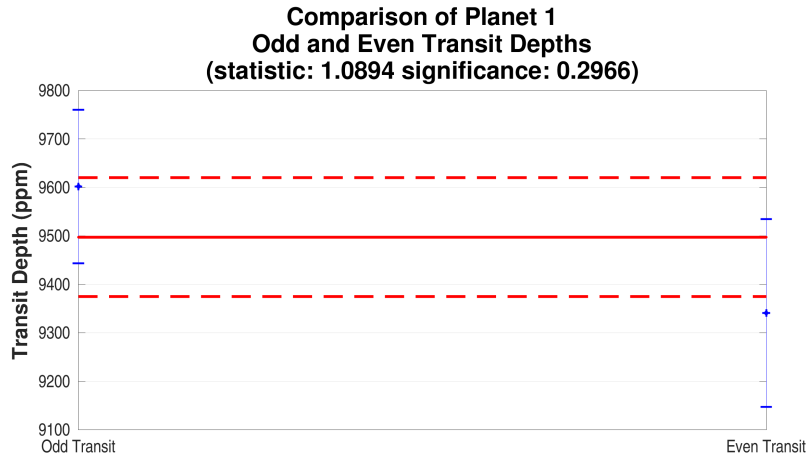
Open `./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000159742538-01-odd-even-histo-used.fig`



Fit residuals distribution for CatId 159742538, 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/0000000159742538-01-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 159742538, planet 1. A significance level close to 1/0 favors a transiting planet/an eclipsing binary. Open `./planet-01/binary-discrimination-test-results/0000000159742538-01-eclipsing-binary-discrimination-tests.fig`

Appendix B Alerts

This target did not trigger any alerts.