Data Validation (DV) Report
for TESS ID 101955023
Sectors 9 - 10

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

05-Aug-2019 20:42:57 Z

Contents

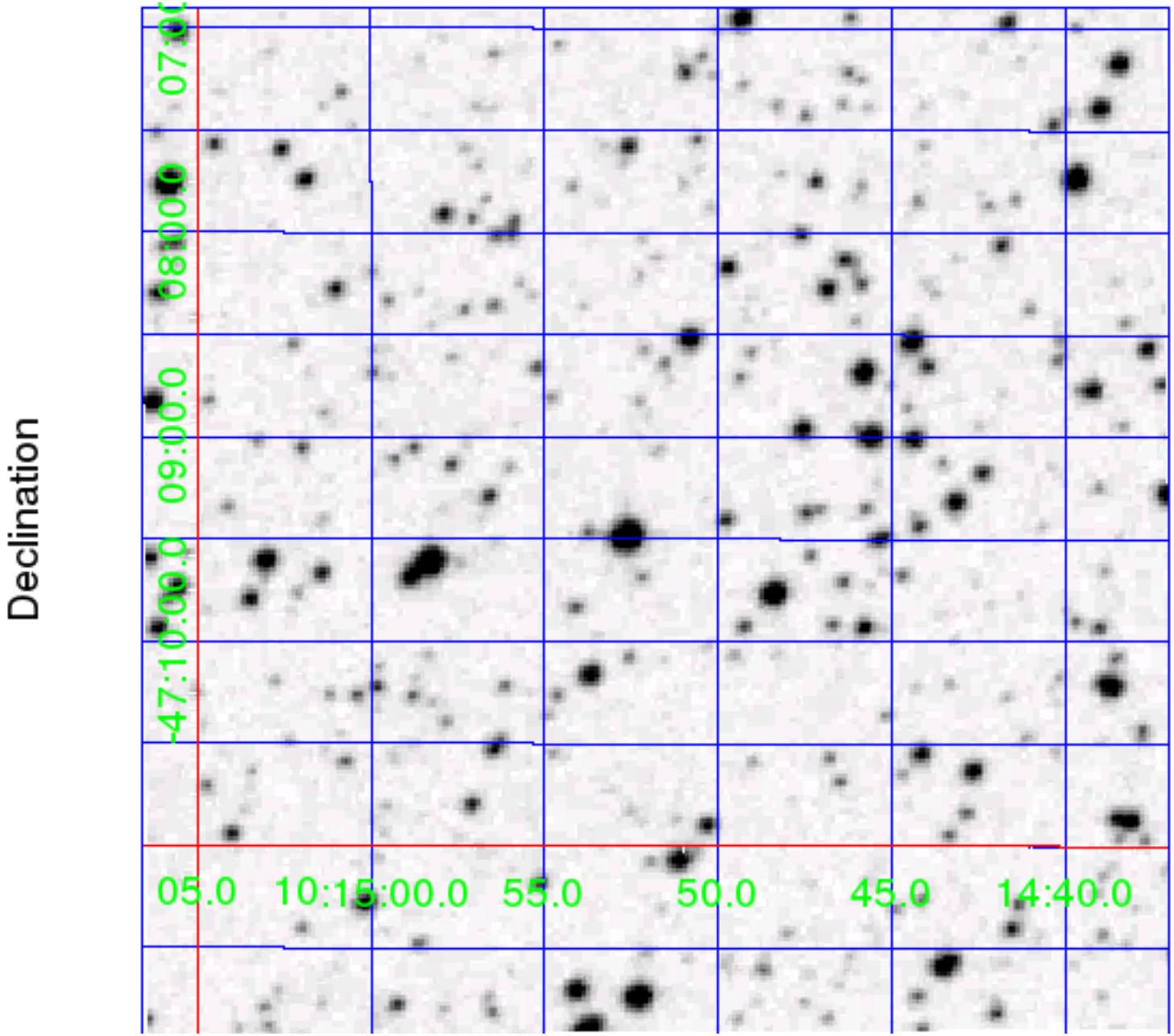
1 Summary

Target Properties	Value	Uncertainty	Units	Provenance
Catalog ID	101955023			
TOI ID	667			
TESS Name	-			
RA	153.71570000	0	degrees	TIC7
Dec	-47.15670000	0	degrees	TIC7
Magnitude	10.938	0.059		TIC7
Radius	0.260	0.000	Solar radii	TIC7
Effective Temperature	3202	0	Kelvin	TIC7
log(g)	4.864	0	cm/sec^2	TIC7
[M/H]	0.000	0	Solar metallicity	Solar
Stellar Density	10.251	0.000	Solar density	TIC7-Derived
Limb Darkening Coefficient 1	0.6684			
Limb Darkening Coefficient 2	0.26365			
Limb Darkening Coefficient 3	-0.20519			
Limb Darkening Coefficient 4	0.038216			
Number of Planet Candidates	1			
TOI Model	toi-plus-2019-08-02.csv			
TESS Names Model	-			
External TCE Model	-			
Software Revision	spoc-3.3.75-20190724			
Date Report Generated	05-Aug-2019 20:42:57 Z			

Sector	Target Table	Camera/ CCD	Crowding Metric	Flux Fraction
9	152	2:2	0.8590	0.8202
10	154	2:1	0.8959	0.8792

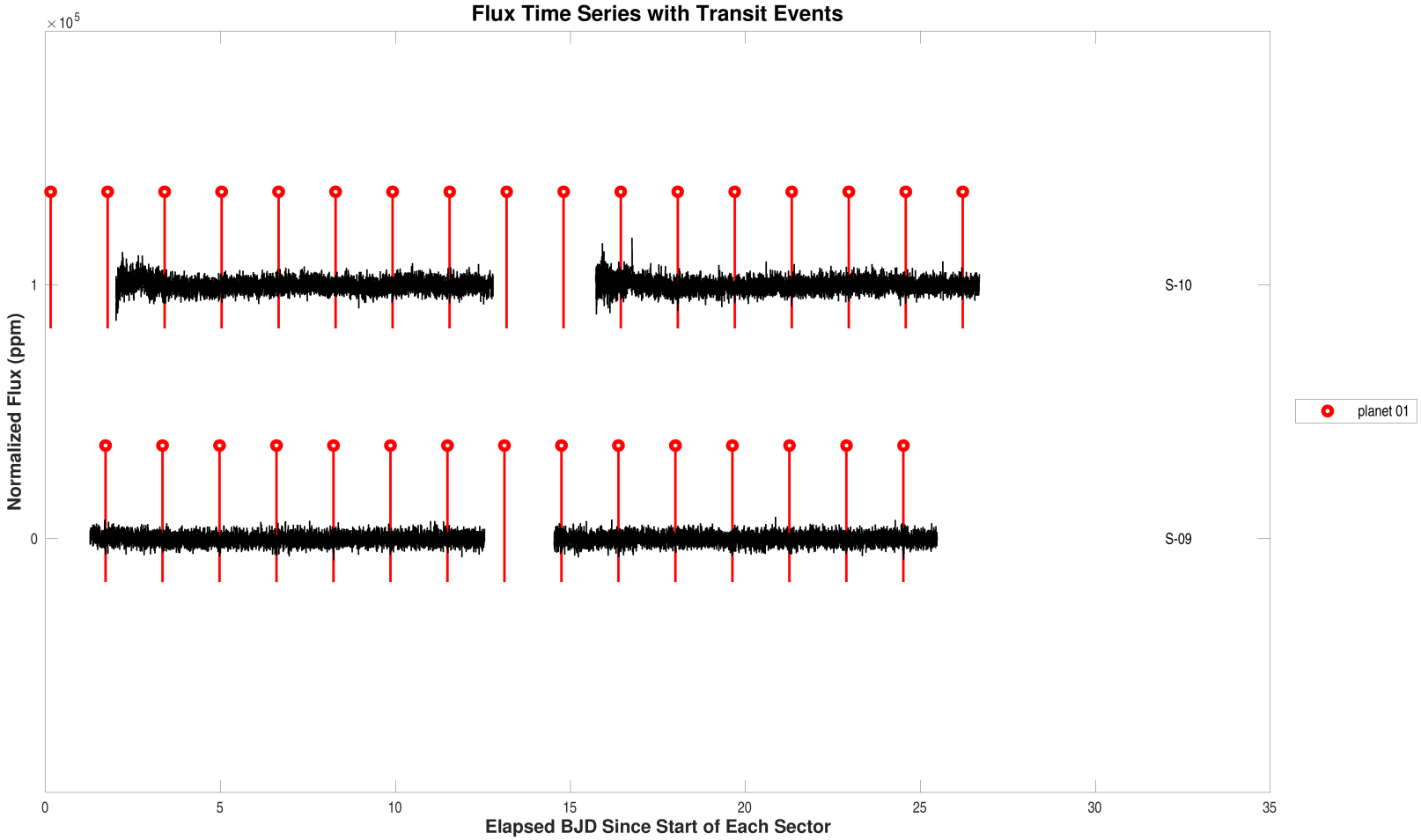
Planet Candidate	TOI ID	TESS Name	TOI Correlation	Period (days)	Period Ratio	Epoch (BTJD)	Semi-major Axis (AU)	Radius (Re)	Seff	Teq (K)	False Alarm	Suspected EB
1	667.01	-	0.94	1.629	1.00	1544.715	0.02	1.4	27.2	582	3.30e-77	false

2 Survey Image

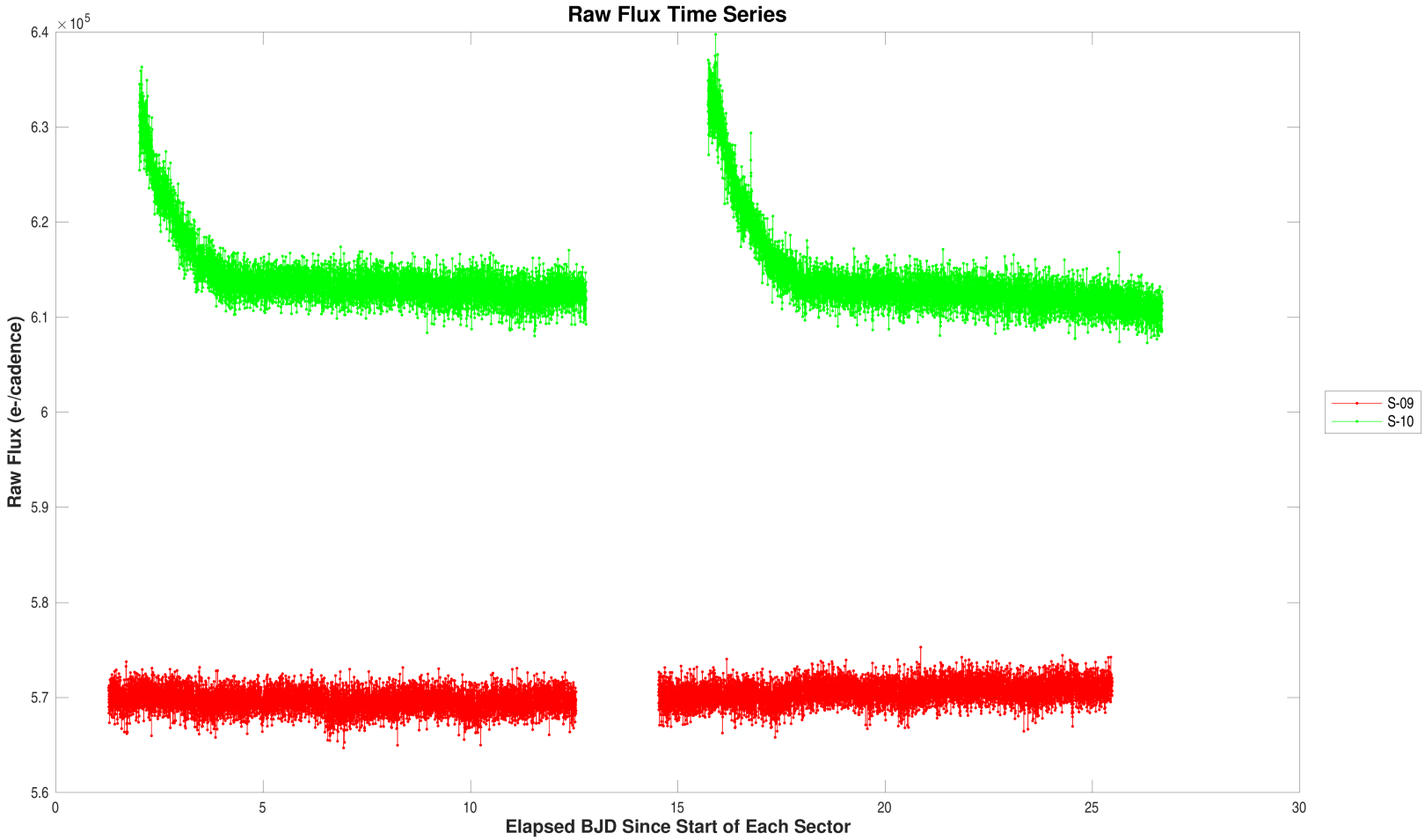


Digitized Sky Survey (DSS) red image. The 5' x 5' image is centered on the J2000 coordinates of target (101955023).

3 Flux Time Series



Summary plot of sector-stitched flux time series and transits for target 101955023, 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 9, target table 152, start BJD is 2458543 and the vertical offset is 0 ppm. For the data of sector 10, target table 154, start BJD is 2458569 and the vertical offset is 100000 ppm.
Open `./summary-plots/0000000101955023-00-flux-dv-fit-09-152.fig`



Summary plot of raw flux time series. For the data of sector 9, target table 152, start BJD is 2458543 and the vertical offset is 0 electrons/cadence. For the data of sector 10, target table 154, start BJD is 2458569 and the vertical offset is 43000 electrons/cadence.
Open `./summary-plots/0000000101955023-00-raw-flux-09-152.fig`

4 Dashboards

Planet Candidate 1

<table>
<tr>
<td rowspan="2">Model Fitter</td>
<td colspan="2">Stellar Radius
0.3 ± 0.0 Solar units</td>
<td rowspan="2">Core Aperture Correlation Statistic
Value = 9.25
Significance = 100.00%
Halo Aperture Correlation Statistic
Value = -1.81
Significance = 3.51%
Core/Halo Ratio
Ratio = -5.11</td>
<td rowspan="2">Ghost Diagnostic Test</td>
</tr>
<tr>
<td colspan="2">Period = 1.6 ± 0.0 days
Depth = 2693 ± 133 ppm
Planet Radius = 1.4 ± 0.6 Earth radii
Semi-major Axis = 0.0 ± 0.0 AU
Effective Stellar Flux = 27.2 ± 0.0
Equilibrium Temperature = 582 ± 0 Kelvin
Chi-squared/DoF = 0.8
SNR = 24.9</td>
</tr>
<tr>
<td rowspan="2">Eclipsing Binary Discrimination Test</td>
<td colspan="2">Odd-Even Depth Comparison Statistic
Value = 1.20e-02
Significance = 91.28%</td>
<td>Offsets Relative to Out of Transit Centroid
Source RA Offset = 2.12e+00 ± 2.60e+00 arcsec (0.81 σ)
Source Dec Offset = 1.14e+00 ± 2.50e+00 arcsec (0.45 σ)
Source Offset Distance = 2.40e+00 ± 2.58e+00 arcsec (0.93 σ)
Offsets Relative to TIC Position
Source RA Offset = -3.32e-01 ± 2.64e+00 arcsec (-0.13 σ)
Source Dec Offset = -1.52e+00 ± 3.17e+00 arcsec (-0.48 σ)
Source Offset Distance = 1.55e+00 ± 3.15e+00 arcsec (0.49 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 = 3.30e-77
Transit Count = 32
Max Multiple Event Statistic = 20.8</td>
<td>Bootstrap Test</td>
</tr>
</table>

Summary of model fitter results and validation test results for target 101955023, 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

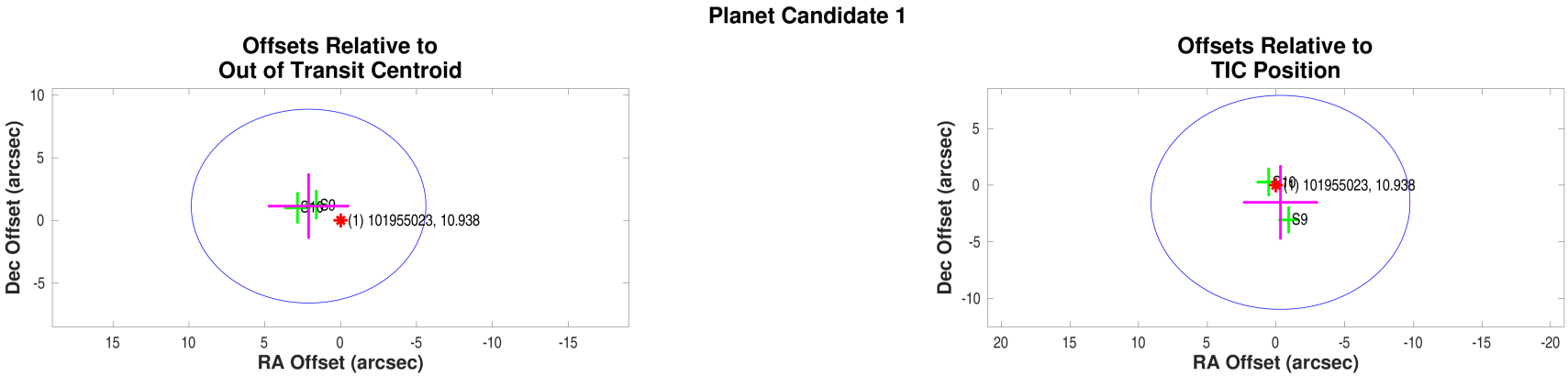
Multi-Sector Average PRF Fit of the Difference Images

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

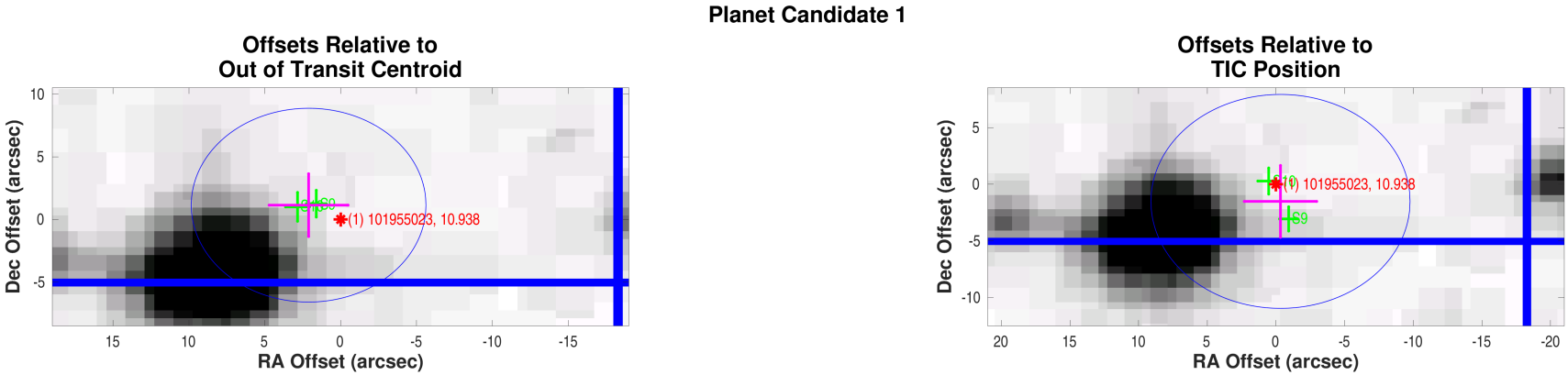
	RA	Dec	Units
Offset	$2.1154 \pm 2.60e+00$	$1.1390 \pm 2.50e+00$	arcseconds
Offset/σ	0.81	0.45	
Offset Distance	$2.4025 \pm 2.58e+00$		arcseconds
Offset Distance/σ	0.93		
3σ Radius	7.7336		arcseconds

Mean offset from the TIC RA and Dec

	RA	Dec	Units
Offset	$-0.3324 \pm 2.64e+00$	$-1.5152 \pm 3.17e+00$	arcseconds
Offset/σ	-0.13	-0.48	
Offset Distance	$1.5512 \pm 3.15e+00$		arcseconds
Offset Distance/σ	0.49		
3σ Radius	9.4366		arcseconds



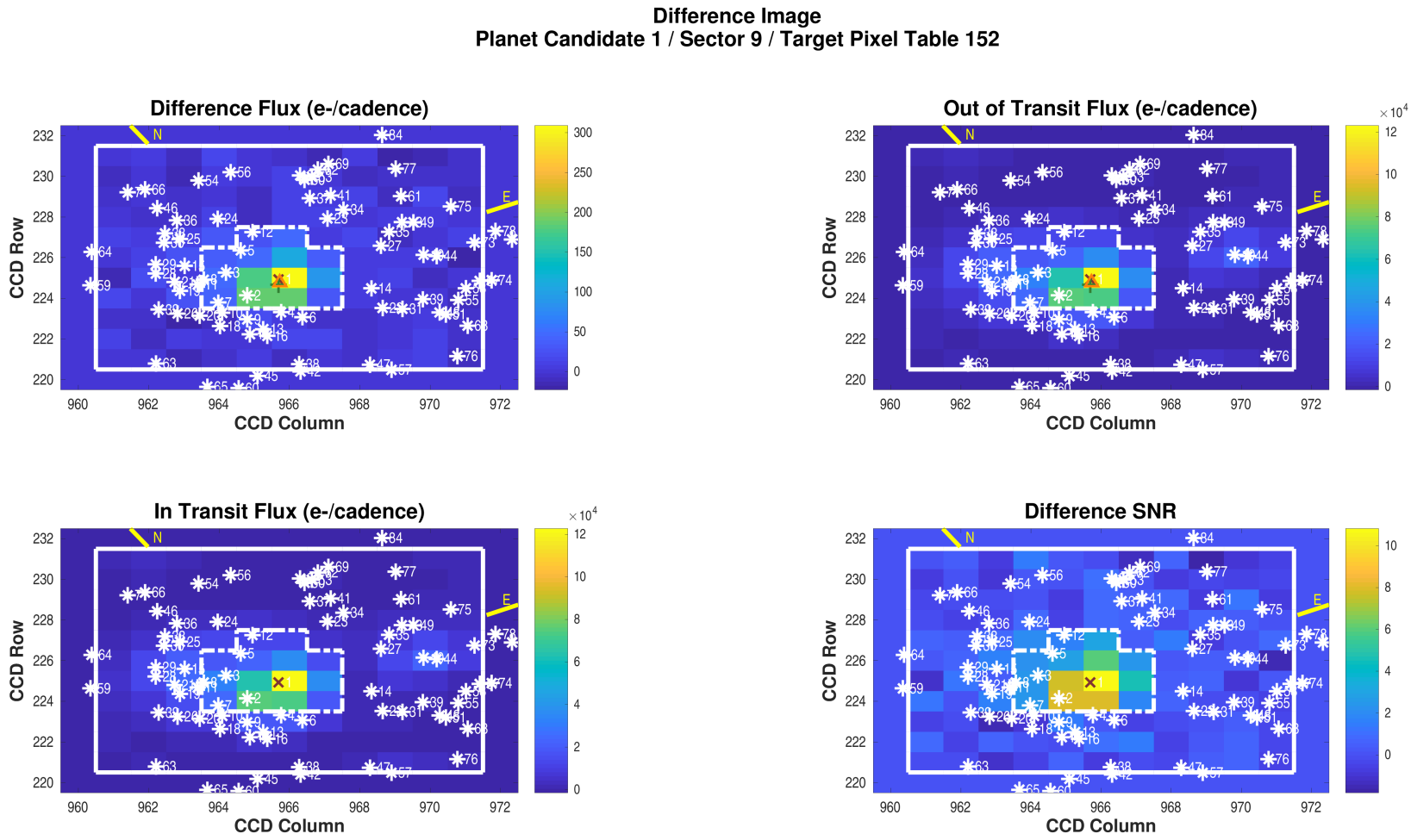
Difference image centroid offsets for target 101955023, planet candidate 1. Left: difference image PRF centroid offsets in RA and Dec with respect to the per sector out-of-transit centroids for the given target. Right: difference image PRF centroid offsets in RA and Dec with respect to the TC coordinates 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/0000000101955023-01-difference-image-centroid-offsets.fig`



Difference image centroid offsets for target 101955023, 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/0000000101955023-01-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
2	2	2	1.0000	0.70



Difference image for target 101955023, planet candidate 1, sector 9, target pixel table 152. 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 = 14; number of valid in-transit cadences = 266; number of in-transit cadence gaps = 0; number of valid out-of-transit cadences = 773; number of out-of-transit cadence gaps = 4. Difference image quality metric = 0.97 (good).
Open `./planet-01/difference-image/0000000101955023-01-difference-image-09-152.fig`

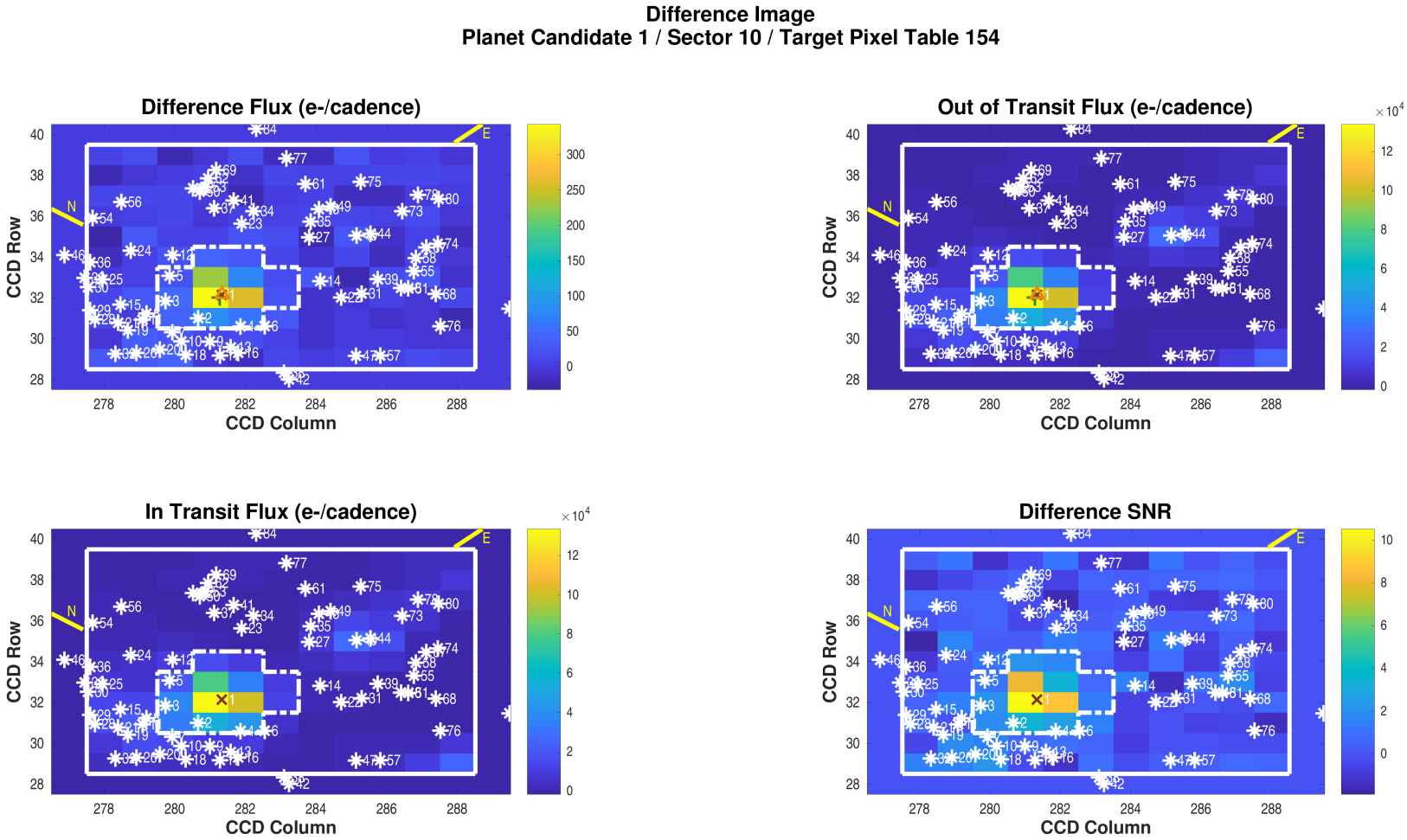
PRF Fit of the Difference Image

Offset from the PRF fit to the out of transit image

	Row	Column	Units	RA	Dec	Units
Out of Transit Image Centroid	$224.68 \pm 6.24e-05$	$965.69 \pm 5.96e-05$	pixels	$153.70640286 \pm 9.20e-07$	$-47.15568965 \pm 9.45e-07$	degrees
Difference Image Centroid	$224.77 \pm 5.05e-02$	$965.73 \pm 4.87e-02$	pixels	$153.70706040 \pm 2.69e-04$	$-47.15534041 \pm 2.96e-04$	degrees
Offset	$0.0947 \pm 5.05e-02$	$0.0373 \pm 4.87e-02$	pixels	$1.6097 \pm 6.58e-01$	$1.2572 \pm 1.07e+00$	arcseconds
Offset/σ	1.87	0.77		2.44	1.18	
Offset Distance	$0.1018 \pm 4.83e-02$		pixels	$2.0425 \pm 8.27e-01$		arcseconds
Offset Distance/σ	2.11			2.47		

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

	Row	Column	Units	RA	Dec	Units
TIC Reference Centroid	$224.93 \pm 1.56e-04$	$965.69 \pm 1.47e-04$	pixels	$153.70743951 \pm 0.00e+00$	$-47.15449016 \pm 0.00e+00$	degrees
Difference Image Centroid	$224.77 \pm 5.05e-02$	$965.73 \pm 4.87e-02$	pixels	$153.70706040 \pm 2.69e-04$	$-47.15534041 \pm 2.96e-04$	degrees
Offset	$-0.1592 \pm 5.05e-02$	$0.0367 \pm 4.87e-02$	pixels	$-0.9281 \pm 6.58e-01$	$-3.0609 \pm 1.07e+00$	arcseconds
Offset/σ	−3.15	0.75		−1.41	−2.87	
Offset Distance	$0.1634 \pm 5.17e-02$		pixels	$3.1985 \pm 1.03e+00$		arcseconds
Offset Distance/σ	3.16			3.09		



Difference image for target 101955023, planet candidate 1, sector 10, target pixel table 154. 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 = 13; number of valid in-transit cadences = 248; number of in-transit cadence gaps = 0; number of valid out-of-transit cadences = 705; number of out-of-transit cadence gaps = 15. Difference image quality metric = 0.94 (good).
Open `./planet-01/difference-image/0000000101955023-01-difference-image-10-154.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	$32.02 \pm 7.12e-05$	$281.27 \pm 6.28e-05$	pixels	$153.70646095 \pm 1.63e-06$	$-47.15468261 \pm 1.68e-06$	degrees
Difference Image Centroid	$32.17 \pm 6.02e-02$	$281.33 \pm 5.18e-02$	pixels	$153.70762296 \pm 3.23e-04$	$-47.15440435 \pm 3.19e-04$	degrees
Offset	$0.1500 \pm 6.02e-02$	$0.0654 \pm 5.18e-02$	pixels	$2.8447 \pm 7.91e-01$	$1.0017 \pm 1.15e+00$	arcseconds
Offset/σ	2.49	1.26		3.60	0.87	
Offset Distance	$0.1637 \pm 6.00e-02$		pixels	$3.0159 \pm 8.88e-01$		arcseconds
Offset Distance/σ	2.73			3.40		

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

	Row	Column	Units	RA	Dec	Units
TIC Reference Centroid	$32.13 \pm 2.95e-04$	$281.32 \pm 2.65e-04$	pixels	$153.70740803 \pm 0.00e+00$	$-47.15448174 \pm 0.00e+00$	degrees
Difference Image Centroid	$32.17 \pm 6.02e-02$	$281.33 \pm 5.18e-02$	pixels	$153.70762296 \pm 3.23e-04$	$-47.15440435 \pm 3.19e-04$	degrees
Offset	$0.0308 \pm 6.02e-02$	$0.0086 \pm 5.18e-02$	pixels	$0.5262 \pm 7.91e-01$	$0.2786 \pm 1.15e+00$	arcseconds
Offset/σ	0.51	0.17		0.67	0.24	
Offset Distance	$0.0320 \pm 6.04e-02$		pixels	$0.5954 \pm 9.45e-01$		arcseconds
Offset Distance/σ	0.53			0.63		

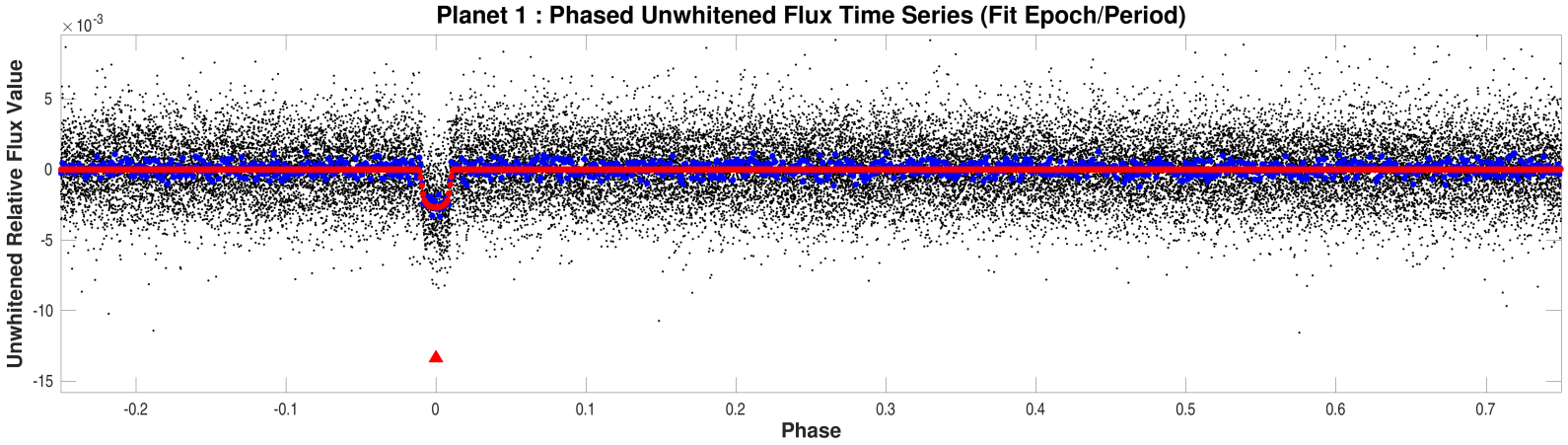
5.2 Difference Image TIC Key

Index	Catalog ID	Mag	RA (degrees)	Dec (degrees)	Distance (arcsec)
1	101955023	10.938	153.70742348	-47.15448588	0.00
2	101955024	16.593	153.69774659	-47.15585419	24.20
3	101955038	14.986	153.69792487	-47.14892288	30.69
4	101955010	13.471	153.70139893	-47.16233215	31.87
5	101955050	17.371	153.70540796	-47.14488183	34.92
6	101955003	16.197	153.70483099	-47.16510445	38.75
7	101955025	17.212	153.69028423	-47.15533394	42.07
8	101955039	17.517	153.69186800	-47.14891800	43.03
9	101955012	16.959	153.69296646	-47.16141842	43.31
10	101955021	15.870	153.68906298	-47.15803201	46.73
11	101955037	13.799	153.68962616	-47.14958002	47.01
12	101955061	14.341	153.71151937	-47.14151556	47.76
13	101955005	16.854	153.69431095	-47.16492450	49.42
14	101955007	16.775	153.72495075	-47.16356929	53.95
15	101955052	13.980	153.69066751	-47.14428362	55.06
16	101954999	17.813	153.69381615	-47.16678166	55.40
17	101955002	15.513	153.69054197	-47.16510721	56.30
18	101955013	16.996	153.68597481	-47.16095623	57.44
19	101955036	14.674	153.68468134	-47.14974252	58.23
20	101955022	16.252	153.68384009	-47.15698861	58.43
21	101955042	17.664	153.68537052	-47.14725721	59.93
22	101954995	14.731	153.72335436	-47.16896093	65.09
23	101955053	16.660	153.72977949	-47.14398424	66.52
24	101955069	15.562	153.70691995	-47.13579050	67.31
25	101955066	15.355	153.69508314	-47.13761420	67.84
26	101955027	14.899	153.67963428	-47.15482577	68.04
27	101955028	16.292	153.73543298	-47.15437911	68.57
28	101955054	16.210	153.68310000	-47.14389400	70.71
29	101955059	14.062	153.68492668	-47.14174820	71.67
30	101955068	16.850	153.69095705	-47.13733039	73.75
31	101954989	17.214	153.72728850	-47.17067011	75.89
32	101955031	15.921	153.67648529	-47.15248828	76.08
33	101955070	16.299	153.69305900	-47.13521600	77.78
34	101955055	18.430	153.73488659	-47.14313138	78.68
35	101955032	16.847	153.73992004	-47.15173573	80.17
36	101955075	16.147	153.69811937	-47.13311203	80.25
37	101955064	17.625	153.73015694	-47.13797203	81.43
38	101954979	16.611	153.69476047	-47.17576439	82.64

Index	Catalog ID	Mag	RA (degrees)	Dec (degrees)	Distance (arcsec)
39	101954992	17.277	153.73346953	-47.16998728	84.73
40	101955017	12.721	153.74251290	-47.15966675	87.90
41	101955063	17.126	153.73504675	-47.13887329	87.93
42	101954975	17.142	153.69360654	-47.17754813	89.65
43	101955035	16.969	153.74450468	-47.15046672	91.92
44	101955014	14.726	153.74498200	-47.16096500	94.86
45	101954980	15.359	153.68377283	-47.17538281	94.93
46	101955084	16.398	153.69645882	-47.12879158	96.32
47	101954969	15.578	153.70937428	-47.18120984	96.32
48	101954983	16.687	153.73429800	-47.17430500	97.05
49	101955033	17.498	153.74688091	-47.15134787	97.25
50	101955077	16.775	153.73273943	-47.13328573	98.31
51	101954982	15.924	153.73519583	-47.17522738	100.99
52	101955079	16.938	153.73272400	-47.13192000	102.16
53	101955076	16.478	153.73486127	-47.13309448	102.19
54	101955091	17.143	153.71056497	-47.12545928	104.78
55	101954988	17.622	153.74070958	-47.17279833	104.82
56	101955089	15.669	153.71893411	-47.12592471	106.61
57	101954965	14.486	153.71282500	-47.18401300	107.12
58	101954991	16.906	153.74460106	-47.17065282	108.03
59	101955058	17.618	153.66717515	-47.14170880	108.74
60	101954978	15.066	153.67738609	-47.17678434	108.86
61	101955051	17.305	153.74953226	-47.14435558	109.35
62	101955080	17.211	153.73755892	-47.13189430	109.81
63	101955006	17.168	153.66516478	-47.16481313	109.93
64	101955073	16.088	153.67413776	-47.13398306	109.95
65	101954985	17.699	153.67117284	-47.17410274	113.41
66	101955094	17.190	153.69770486	-47.12348325	114.12
67	101954993	16.500	153.74893188	-47.16998667	115.93
68	101954973	15.886	153.73748302	-47.17949709	116.29
69	101955081	15.609	153.74090863	-47.13135648	116.85
70	101954972	16.698	153.67804006	-47.18029508	117.50
71	101955095	17.608	153.69352800	-47.12286000	118.83
72	101954966	17.111	153.68051115	-47.18206195	119.15
73	101955015	15.689	153.75554774	-47.16065793	119.89
74	101954990	17.026	153.75157600	-47.17069200	122.83
75	101955034	16.740	153.75786236	-47.15047658	124.32
76	101954964	16.624	153.72930035	-47.18579543	124.79

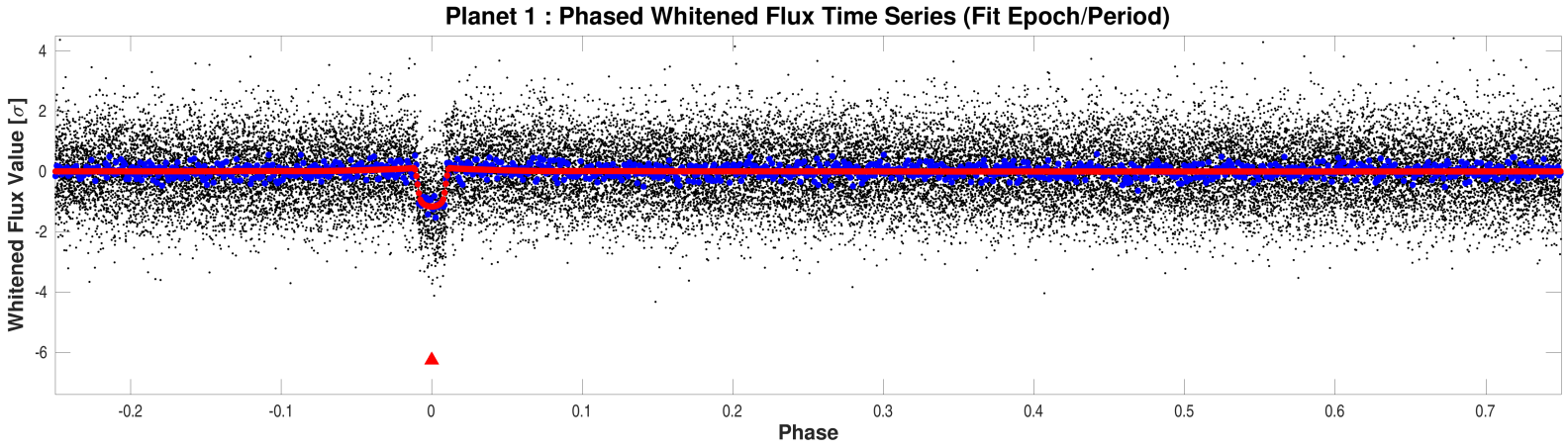
RA, Dec and Distances are corrected for proper motion. This table may not contain all of the objects shown.

6 Phased Light Curves

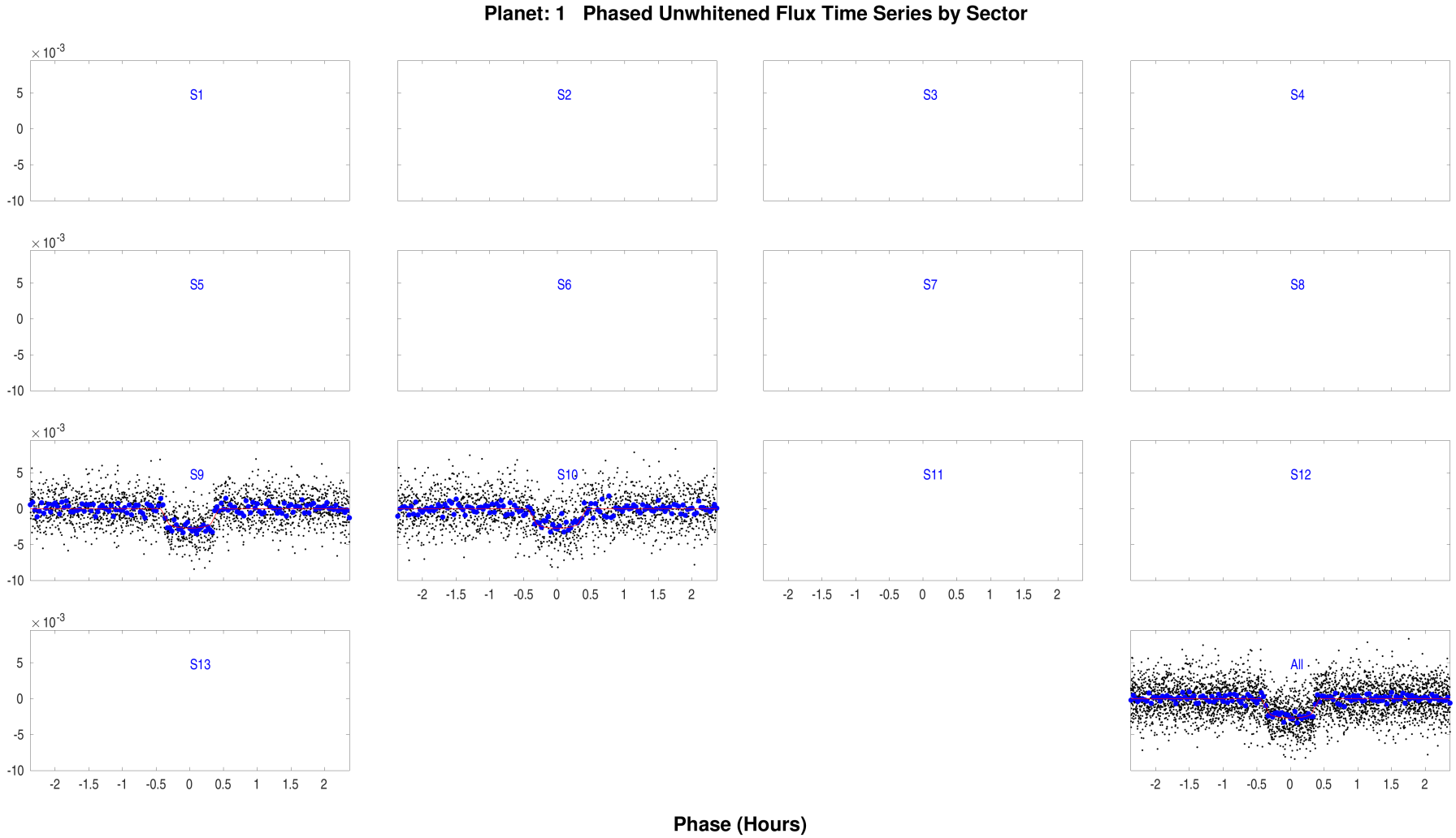


Phased unwhitened flux time series is plotted in black dots. When all transits fit completed with full or secondary convergence, the phase is determined with the fitted epoch and period; otherwise, the phase is determined with the TPS epoch and period. The values of the phased unwhitened flux time series 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/0000000101955023-01-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/0000000101955023-01-phased-whitened-flux-time-series.fig`



Phased unwhitened flux time series by sector for target 101955023, planet candidate 1. Period = 1.6289 days; transit epoch = 1544.7146 BTJD.
Open `./summary-plots/0000000101955023-01-phased-unwhitened-flux-time-series-by-sector.fig`

7 Planet Candidate 1

7.1 Model Fitter: All Transits

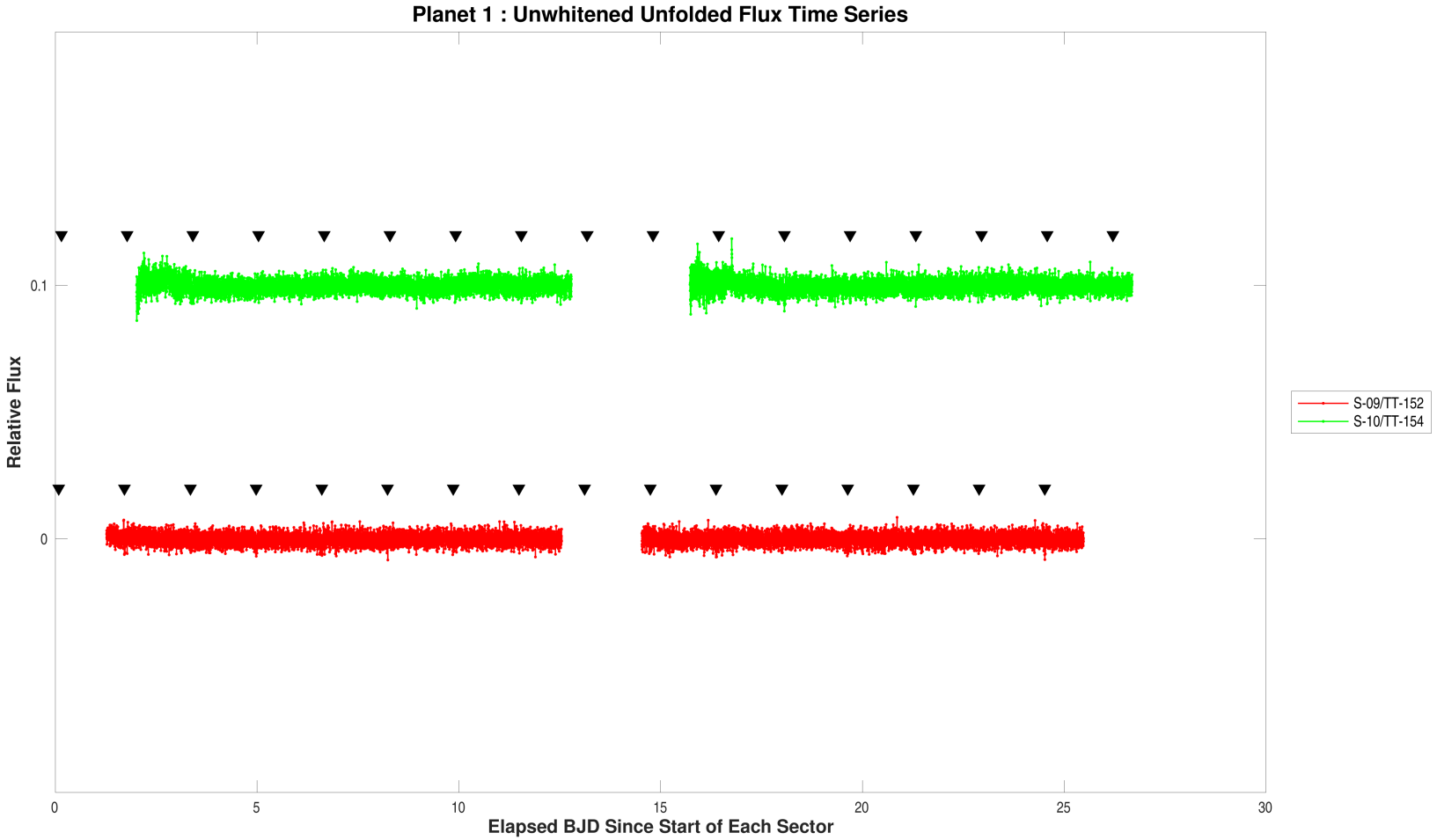
Model Characteristic	Name
Transit Model	mandel-agol_geometric_transit_model
Limb Darkening Model	claret_tess_nonlinear_limb_darkening_model

TCE Parameter	Value	Units
Trial Transit Pulse Duration	1.0	hours
Transit Epoch	1544.7102337	TJD
Orbital Period	1.6289818	days
Maximum SES	7.2	
Maximum MES	20.8	
Robust Statistic	22.0	
Chi Square Goodness of Fit Statistic (DoF)	919.0 (809)	
Chi Square2 Statistic (DoF)	45.6 (69.1)	
Threshold for Desired PFA		

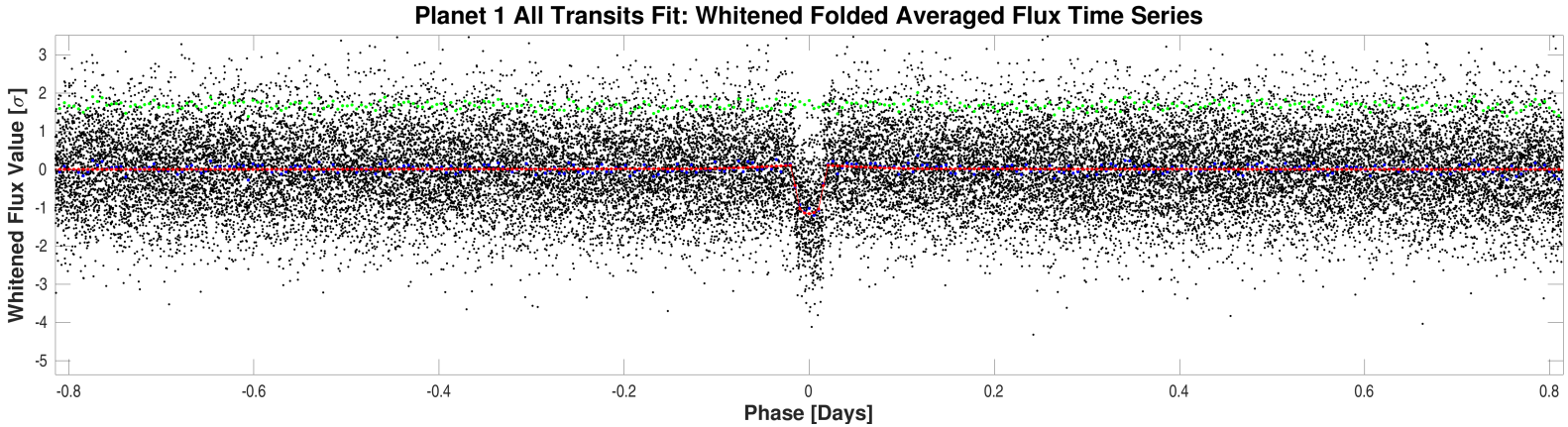
DoF: Degrees of Freedom

Parameter	Value	Uncertainty	Units
SNR	24.9		
Orbital Period	1.6288713	3.7189e-05	days
Transit Epoch	1544.7145975	5.9501e-04	BTJD
Impact Parameter	0.0130	1.9914e+02	
Planet Radius to Star Radius Ratio	0.0478141	2.2896e-02	
Semi-major Axis to Star Radius Ratio	16.5309	4.2386e+01	
Planet Radius	1.3572	6.4987e-01	Earth radii
Semi-major Axis	0.0153	2.3303e-07	AU
Effective Stellar Flux	27.1621	8.2686e-04	Goldilocks
Equilibrium Temperature	582	4.4312e-03	Kelvin
Stellar Density	22.8746	1.7595e+02	Solar density
Transit Depth	2693	1.3334e+02	ppm
Transit Duration	0.7892	1.9523e-01	hours
Transit Ingress Duration	0.0361	2.0329e-01	hours
Eccentricity	0.0000	0.0000e+00	
Peri Longitude	0.0000	0.0000e+00	degrees
Model Chi Square Statistic (DoF)	2911.3 (3449.0)		
Model Chi Square Goodness of Fit Statistic (DoF)	456.1 (729)		
Model Chi Square2 Statistic (DoF)	19.4 (26)		

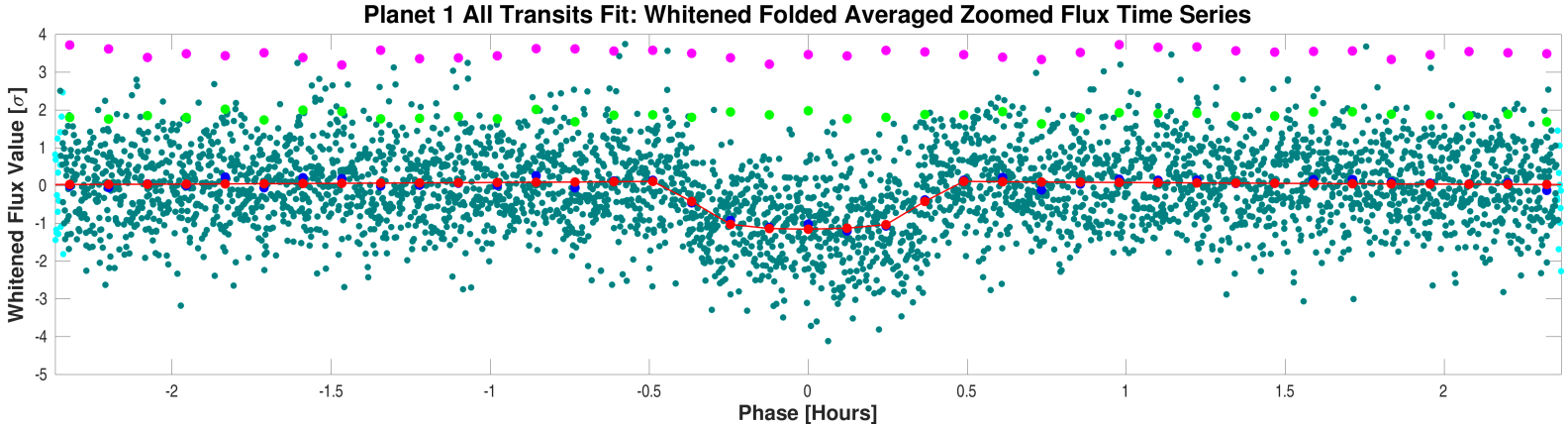
DoF: Degrees of Freedom



Flux time series for CatId 101955023, Planet candidate 1 in the unwhitened domain. For the data of Sector-09/TargetTableId-152, start BJD is 2458543 and the vertical offset is 0. For the data of Sector-10/TargetTableId-154, start BJD is 2458569 and the vertical offset is 0.1. 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/0000000101955023-01-all-unwhitened-09-152.fig`



Folded flux time series for CatId 101955023, 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/0000000101955023-01-all-whitened.fig`

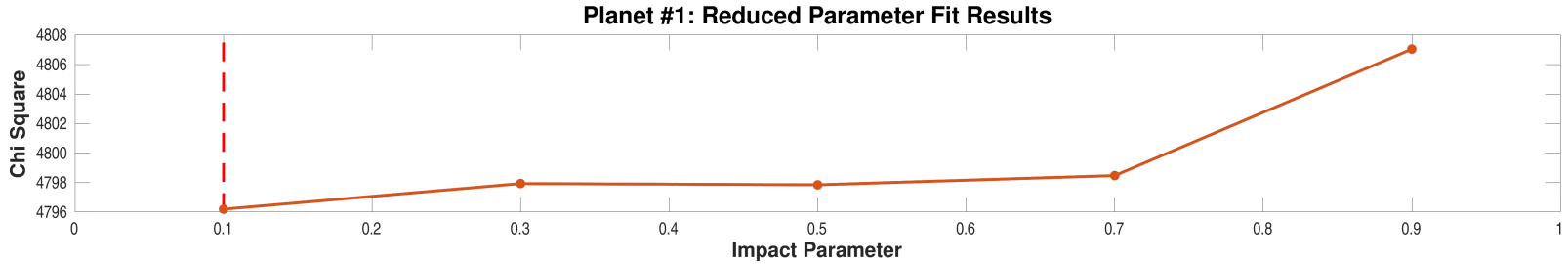


Folded flux time series for CatId 101955023, Planet candidate 1 in the whitened domain, zoomed on the transit. The flux data whose robust weights are larger/smaller than 0.1 are plotted in dark green/cyan dots, respectively. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged 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/0000000101955023-01-all-whitened-zoomed.fig`

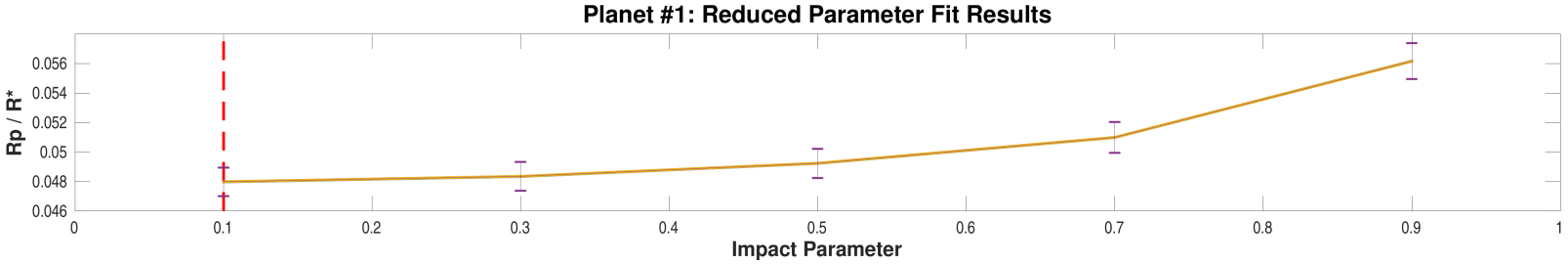
7.2 Model Fitter: Reduced Parameter Fit Results

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	26.1	4796.2	0.0479785	9.6657e-04	16.6006	4.0490e-01	2707	1.0844e+02	0.7825	1.8925e-02
0.30	26.1	4797.9	0.0483445	9.7491e-04	15.9153	3.9082e-01	2706	1.0851e+02	0.7860	1.9131e-02
0.50	26.1	4797.8	0.0492324	9.9480e-04	14.4501	3.5932e-01	2708	1.0879e+02	0.7954	1.9581e-02
0.70	26.1	4798.5	0.0509856	1.0444e-03	11.8468	3.1332e-01	2705	1.1009e+02	0.8255	2.1565e-02
0.90	25.6	4807.0	0.0561576	1.2221e-03	7.4299	2.3817e-01	2729	1.1719e+02	0.9334	2.9289e-02

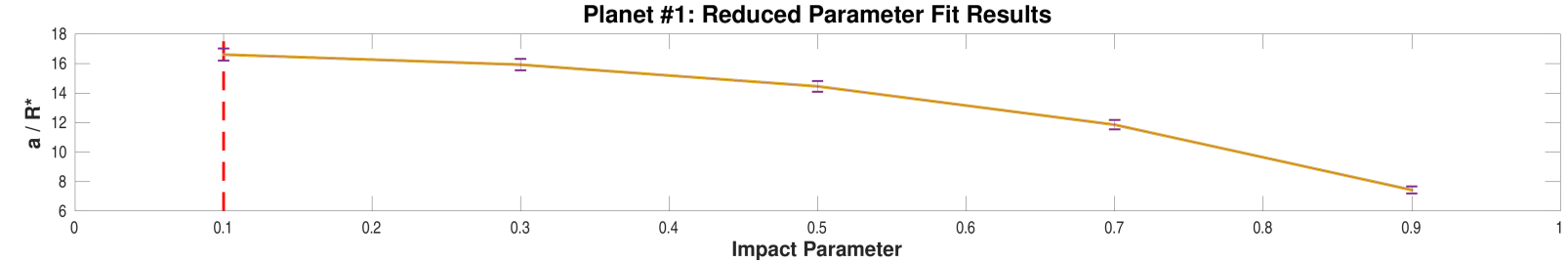
Highlighted row is the best reduced-parameter model fit.



Model chi squares of reduced parameter fits vs. impact parameter for CatId 101955023, 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/0000000101955023-01-reduced-fits-chi-square.fig`



Ratios of planet radius to star radius of reduced parameter fits vs. impact parameter for CatId 101955023, 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/0000000101955023-01-reduced-fits-rp-over-rstar.fig`



Ratios of semimajor axis to star radius of reduced parameter fits vs. impact parameter for CatId 101955023, 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/0000000101955023-01-reduced-fits-a-over-rstar.fig`

7.3 Model Fitter: Trapezoidal Fit Results

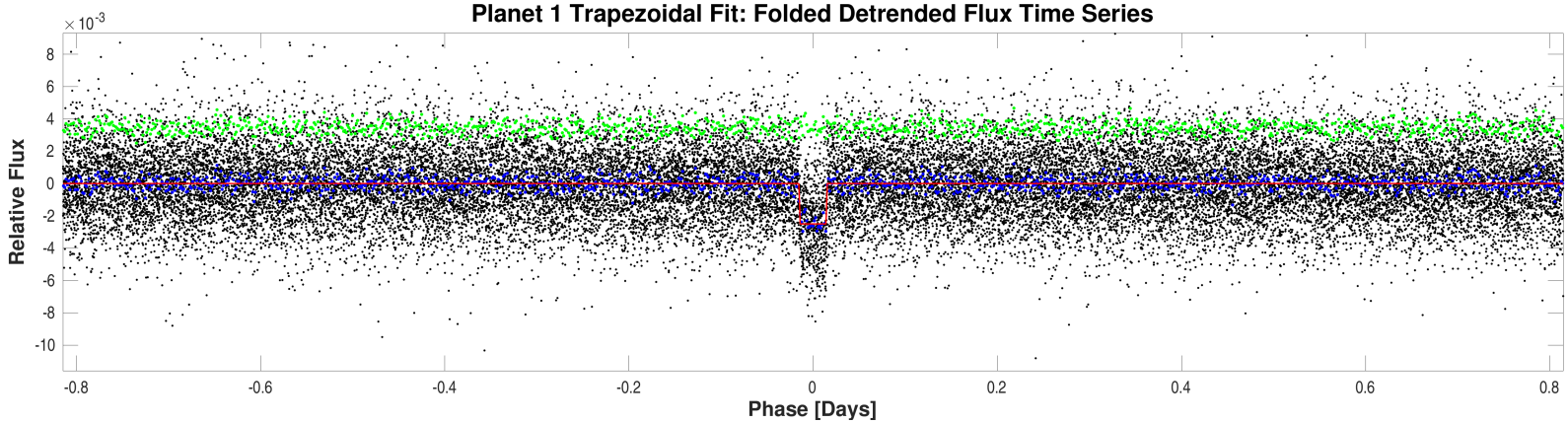
Model Characteristic	Name
Transit Model	trapezoidal_model
Limb Darkening Model	

TCE Parameter	Value	Units
Trial Transit Pulse Duration	1.0	hours
Transit Epoch	1544.7102337	TJD
Orbital Period	1.6289818	days
Maximum SES	7.2	
Maximum MES	20.8	
Robust Statistic	22.0	
Chi Square Goodness of Fit Statistic (DoF)	919.0 (809)	
Chi Square2 Statistic (DoF)	45.6 (69.1)	
Threshold for Desired PFA		

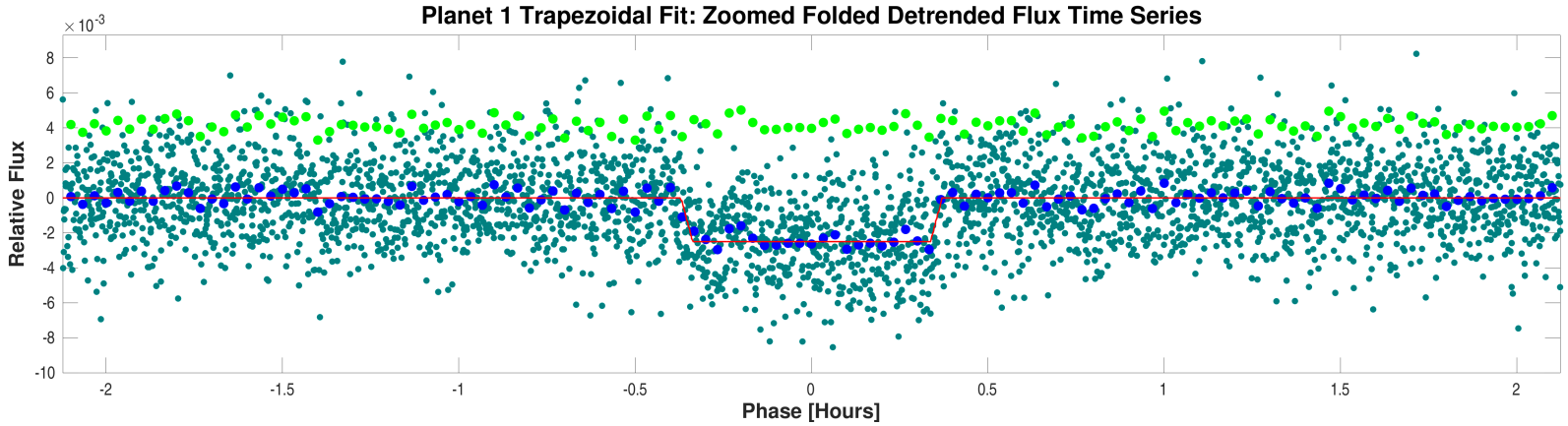
DoF: Degrees of Freedom

Parameter	Value	Uncertainty	Units
SNR	27.8		
Orbital Period	1.6289818		days
Transit Epoch	1544.7131468		BTJD
Transit Depth	2500		ppm
Transit Duration	0.7076		hours
Transit Ingress Duration	0.0001		hours
Model Chi Square Statistic (DoF)	32166.4 (6445)		

DoF: Degrees of Freedom



Folded detrended flux time series for CatId 101955023, Planet candidate 1 and folded trapezoidal model light curve.
Open `./planet-01/planet-search-and-model-fitting-results/trapezoidal-model-fit/0000000101955023-01-all-trapezoidal.fig`



Zoomed folded detrended flux time series for CatId 101955023, Planet candidate 1 and folded trapezoidal model light curve.
Open `./planet-01/planet-search-and-model-fitting-results/trapezoidal-model-fit/0000000101955023-01-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	1.629		days		
Transit Duration	1		hours		
Maximum MES	20.8				
Secondary Phase	0.7512		days		
Secondary MES	2.7				
Minimum Phase	0.12361		days		
Minimum MES	-2.6				
Median MES	0.1				
MAD MES	0.62059				
Robust Statistic	2.8				
Secondary Depth	283.3	9.5756e+01	ppm		
Geometric Albedo	19.8	2.0141e+01		0.9350	17.49
Planet Effective Temperature	1900	4.8234e+02	Kelvin	2.7314	0.32

7.4.2 Eclipsing Binary Discrimination Test

Result	Value	Value in Sigmas	Significance (%)
Odd Even Transit Depth Comparison Statistic	1.1992e-02	0.1095	91.28

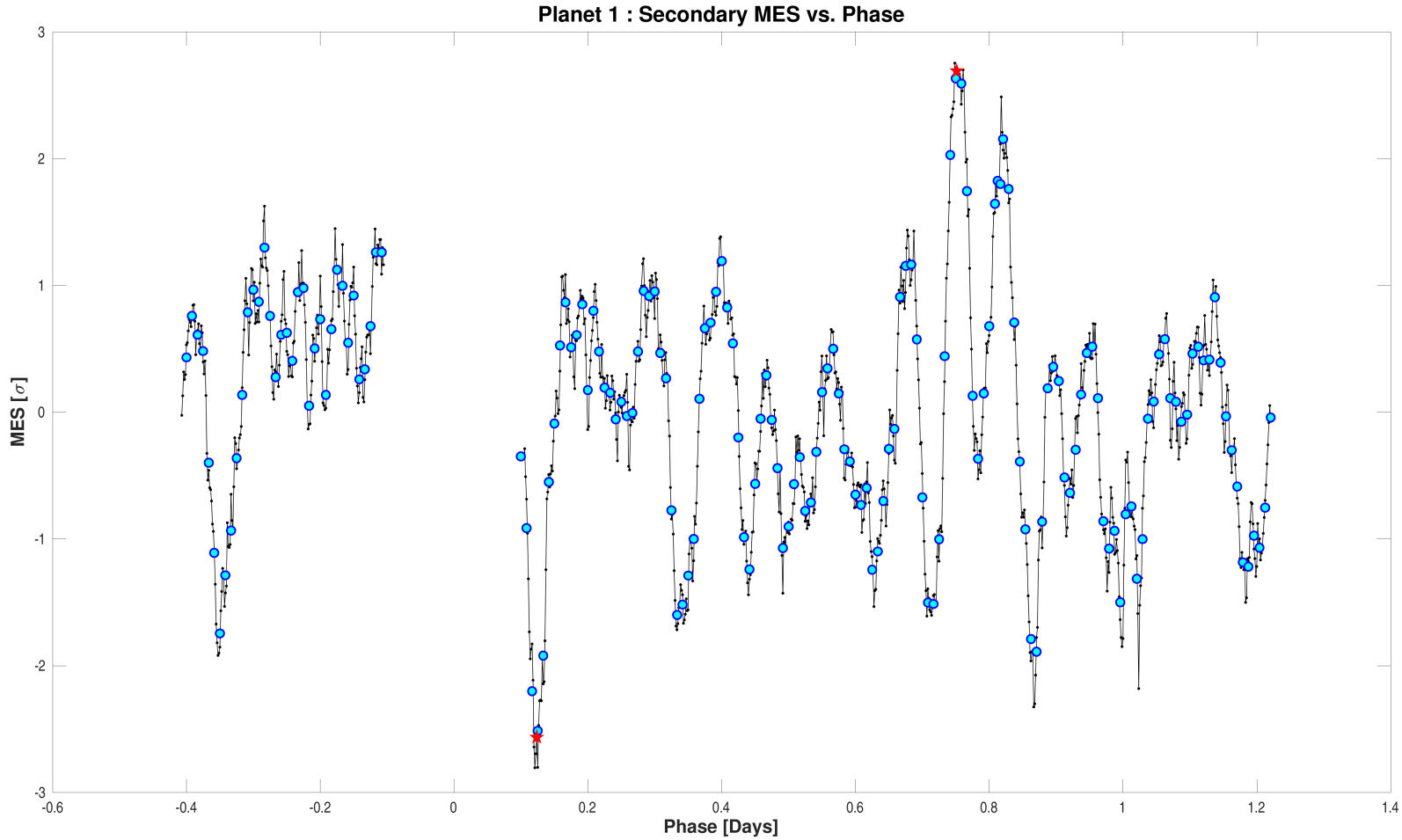
7.4.3 Bootstrap Test

Result	Value
False Alarm Probability	3.2987e-77
Bootstrap Threshold for Desired PFA	7.7
MES Mean	-0.44
MES Standard Deviation	1.14
Transit Count	32

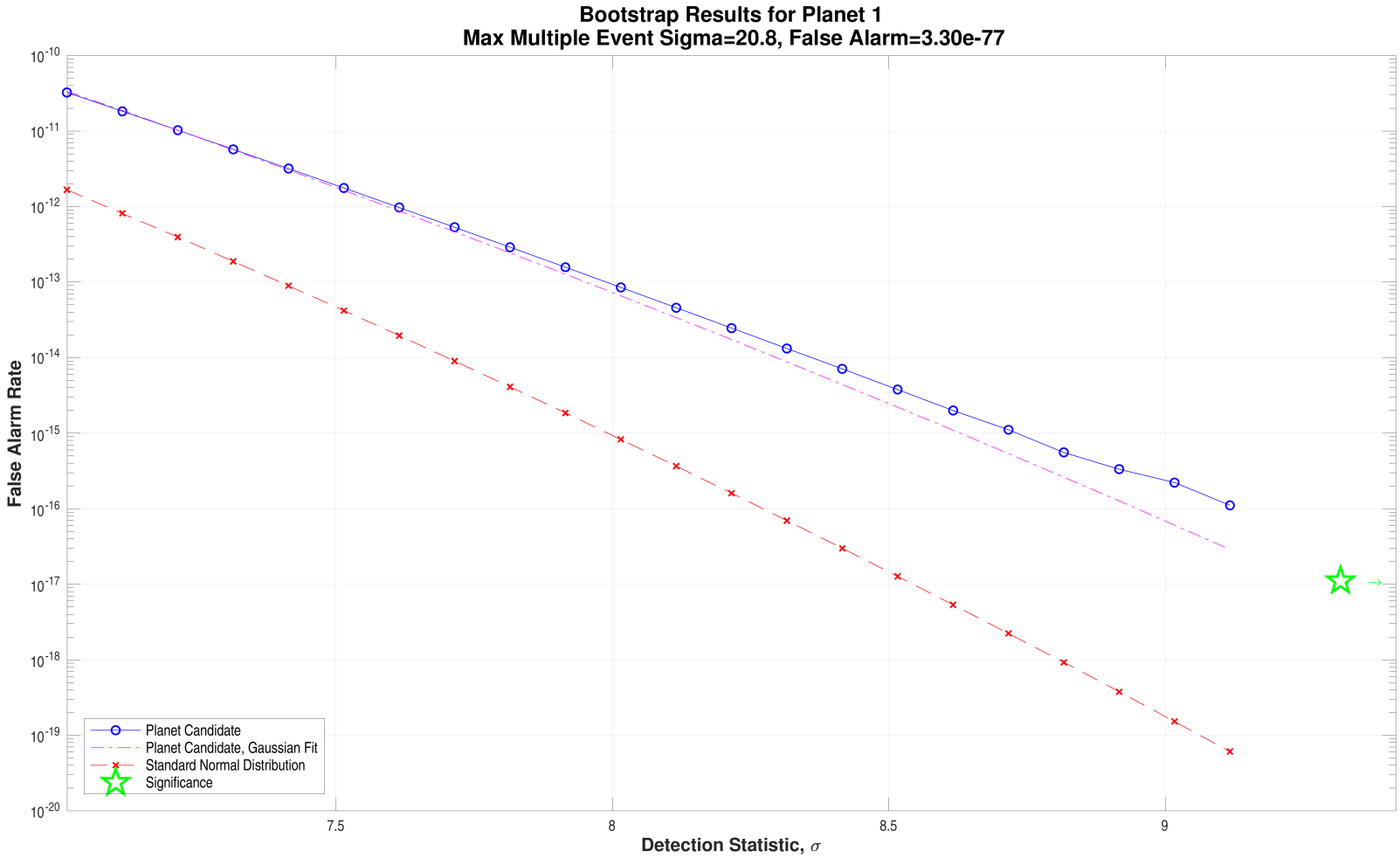
7.4.4 Ghost Diagnostic Test

Result	Value	Significance (%)
Maximum MES	20.8	
SNR	24.9	
Core Aperture Statistic	9.2533e+00	100.00
Halo Aperture Statistic	-1.8110e+00	3.51
Ratio of Core/Halo Aperture Statistics	-5.1096e+00	

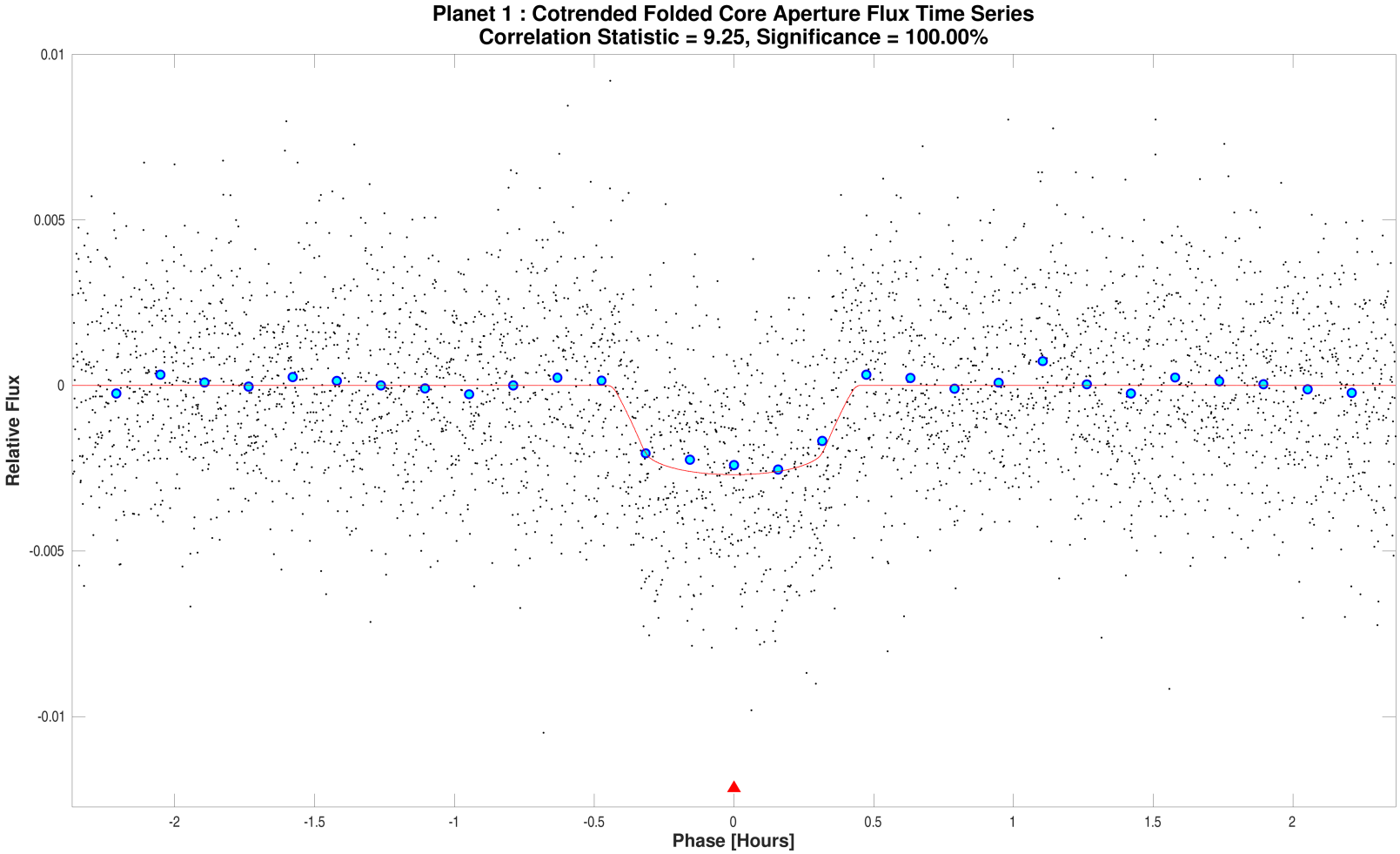
7.4.5 Validation Test Figures



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 1. The maximum secondary MES and corresponding phase are 2.6929 and 0.7512 days respectively. The minimum secondary MES and corresponding phase are -2.5643 and 0.12361 days respectively.
Open `./planet-01/report-summary/0000000101955023-01-weak-secondary-diagnostic.fig`

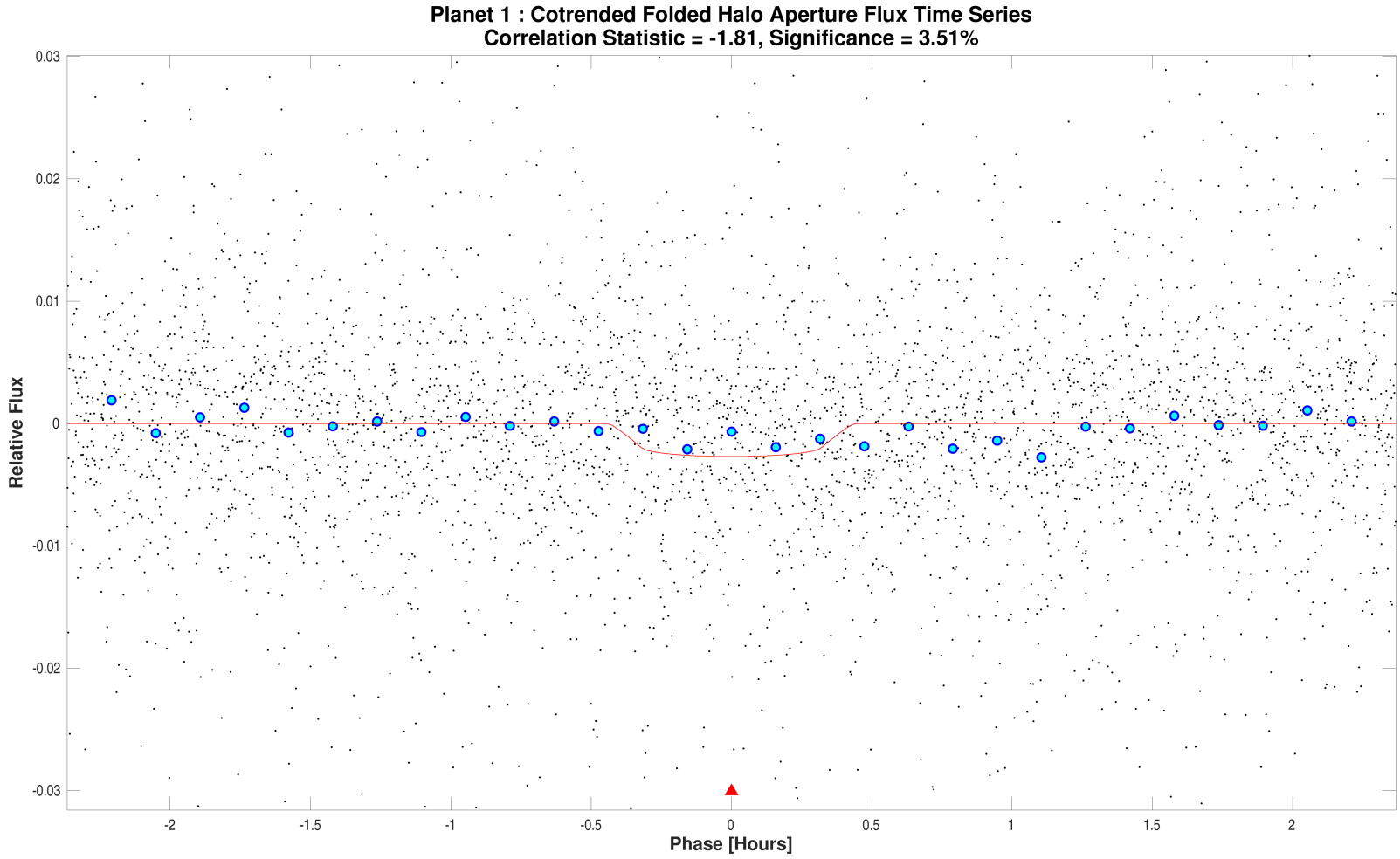


Bootstrap results for target 101955023, planet 1. Cumulative sum of the probabilities (derived from the histogram of counts) from upper tail to the search transit threshold; false alarm probability is indicated by the star. The Gaussian equivalent threshold for this false alarm probability is 18.5614. The threshold on this distribution that achieves the same false alarm rate as a 7.1 sigma threshold on a Gaussian distribution is 7.6932.
Open `./planet-01/bootstrap-results/0000000101955023-01-bootstrap-false-alarm.fig`



Optical ghost diagnostic core aperture flux time series for target 101955023, 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/0000000101955023-01-core-unwhitened-cotrended-zoomed-model.fig`

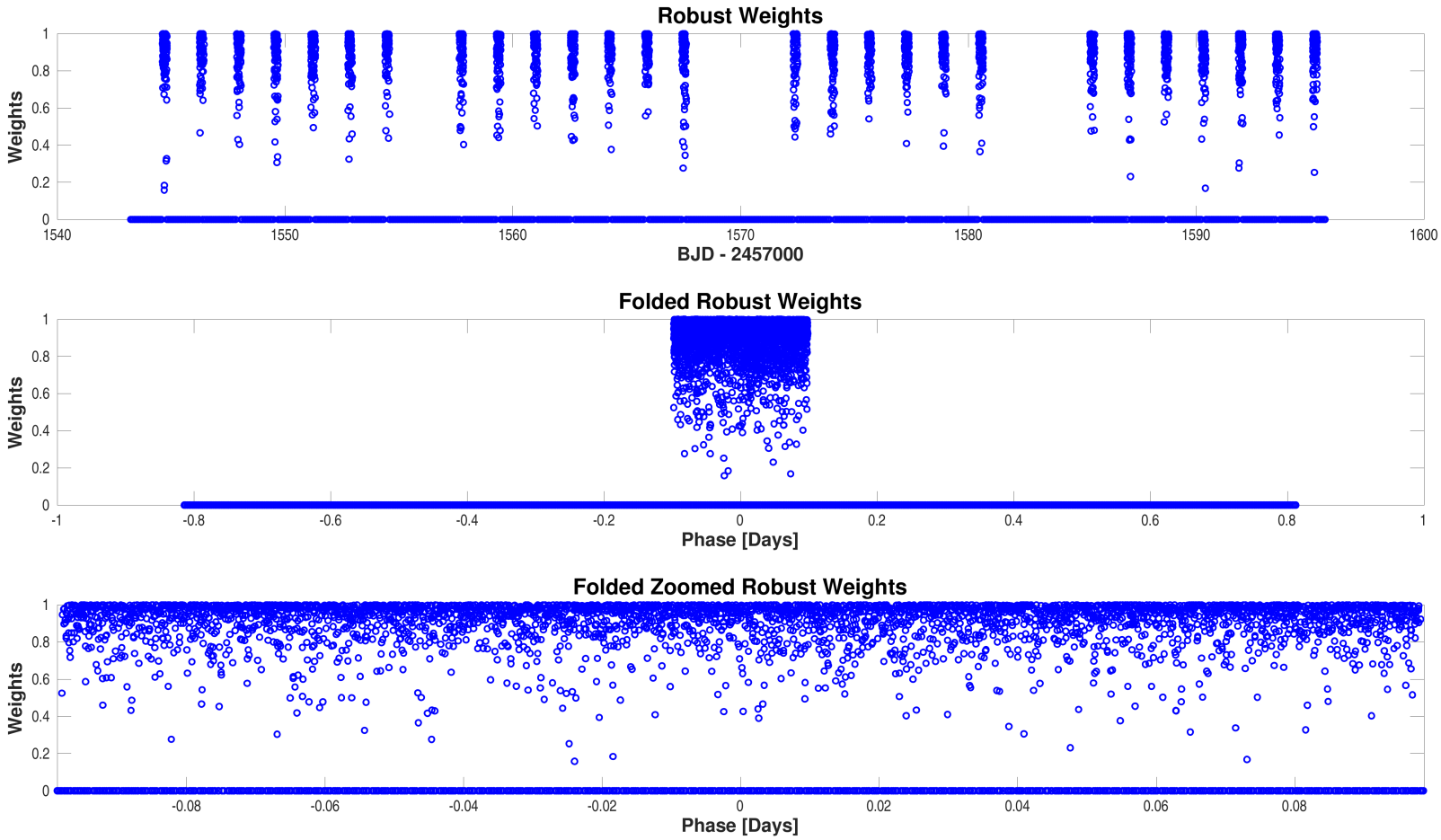


Optical ghost diagnostic halo aperture flux time series for target 101955023, planet candidate 1. The unwhitened time series is phase folded at the orbital period associated with the planet candidate and centered on the epoch of the first transit. The time series was first cotrended against spacecraft 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.

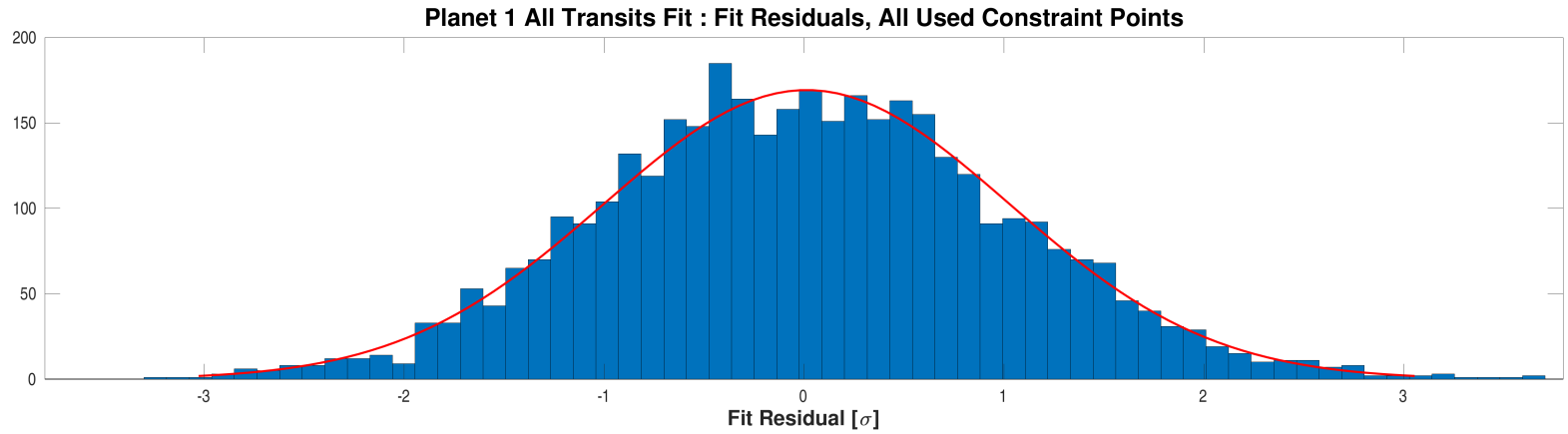
Open `./planet-01/ghost-diagnostic-results/0000000101955023-01-halo-unwhitened-cotrended-zoomed-model.fig`

Appendix A Planet Candidate 1

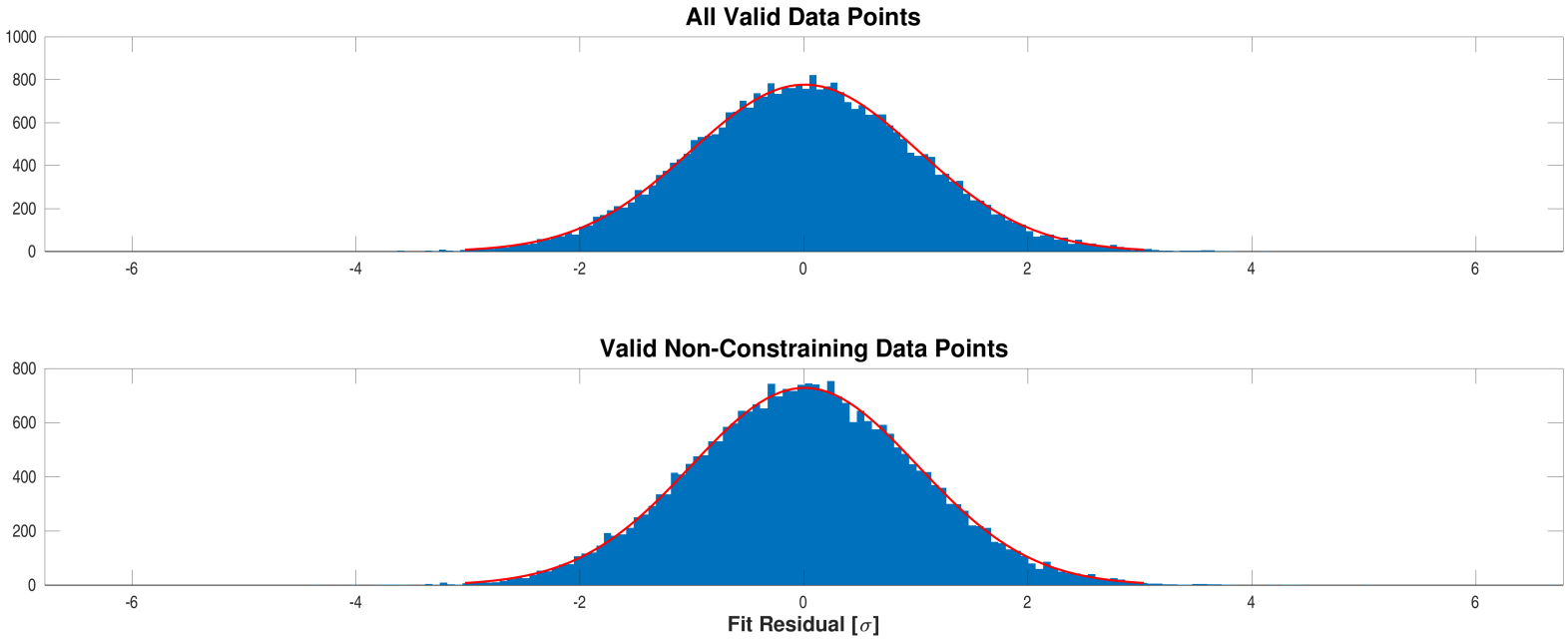
A.1 Model Fitter: All Transits



Robust weights distribution for CatId 101955023, 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/0000000101955023-01-all-robust-weights.fig`



Fit residuals distribution for CatId 101955023, 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/0000000101955023-01-all-histo-used.fig`

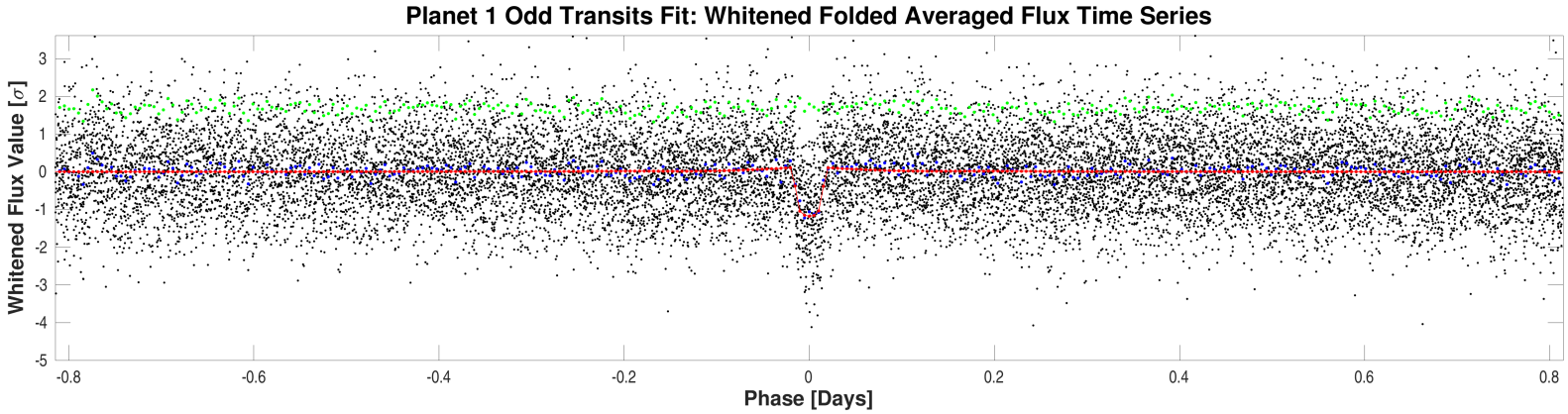


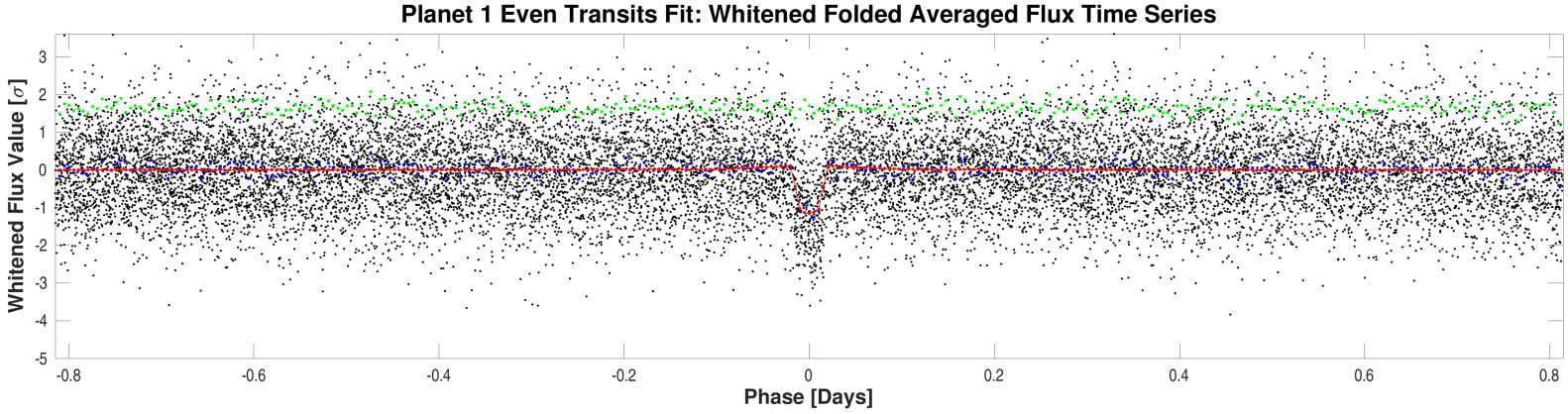
Fit residuals distribution for CatId 101955023, Planet candidate 1. Top plot: all valid data. Bottom plot: valid data not used to constrain fit (due to distance from a transit). Gaussian fits to the histograms are shown in red.
Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000101955023-01-all-histo-all-and-unused.fig`

A.2 Model Fitter: Odd & Even Transits

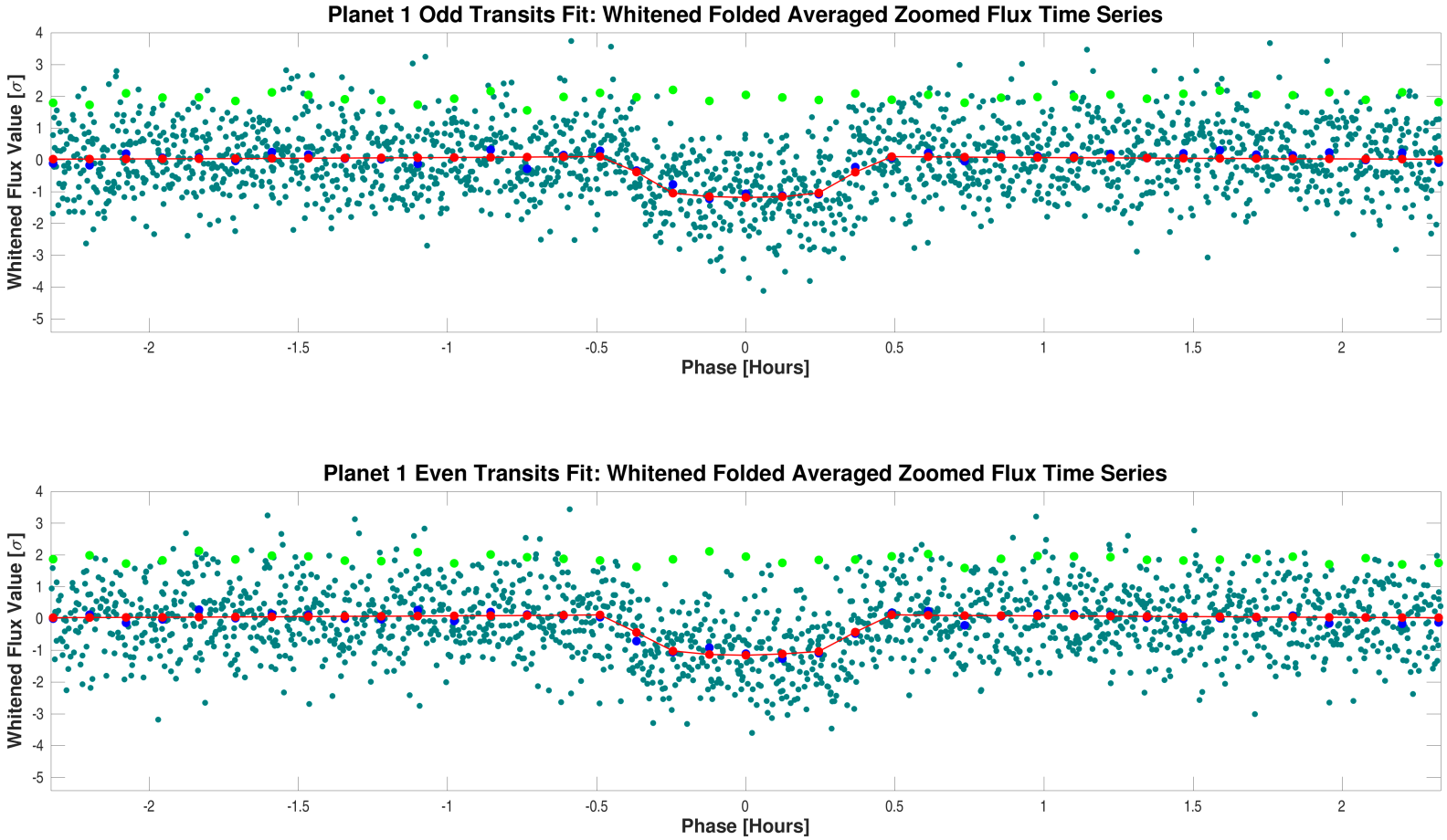
Parameter	Odd Transits Value	Odd Transits Uncertainty	Even Transits Value	Even Transits Uncertainty	Units	Difference / Uncertainty
SNR	18.0		17.3			
Orbital Period	1.6288534	5.2722e-05	1.6288509	5.1519e-05	days	3.4506e-02
Transit Epoch	1544.7149976	8.1068e-04	1546.3438325	8.3135e-04	BTJD	3.1323e-02
Impact Parameter	0.1355	2.5837e+01	0.0168	2.2008e+02		5.3549e-04
Planet Radius to Star Radius Ratio	0.0478962	3.1700e-02	0.0480772	3.3014e-02		3.9554e-03
Semi-major Axis to Star Radius Ratio	16.6643	5.9066e+01	16.4730	6.0511e+01		2.2621e-03
Planet Radius	1.3595	8.9978e-01	1.3646	9.3708e-01	Earth radii	3.9554e-03
Semi-major Axis	0.0153	3.3037e-07	0.0153	3.2283e-07	AU	3.4506e-02
Effective Stellar Flux	27.1625	1.1722e-03	27.1626	1.1455e-03	Goldilocks	3.4506e-02
Equilibrium Temperature	582	6.2820e-03	582	6.1387e-03	Kelvin	3.4506e-02
Stellar Density	23.4332	2.4917e+02	22.6356	2.4945e+02	Solar density	2.2623e-03
Transit Depth	2693	1.8561e+02	2723	1.9757e+02	ppm	1.0951e-01
Transit Duration	0.7764	2.7094e-01	0.7921	2.8180e-01	hours	4.0136e-02
Transit Ingress Duration	0.0362	2.8179e-01	0.0364	2.9395e-01	hours	5.5401e-04
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)	2917.0 (3445.6)		2917.0 (3445.6)			

DoF: Degrees of Freedom

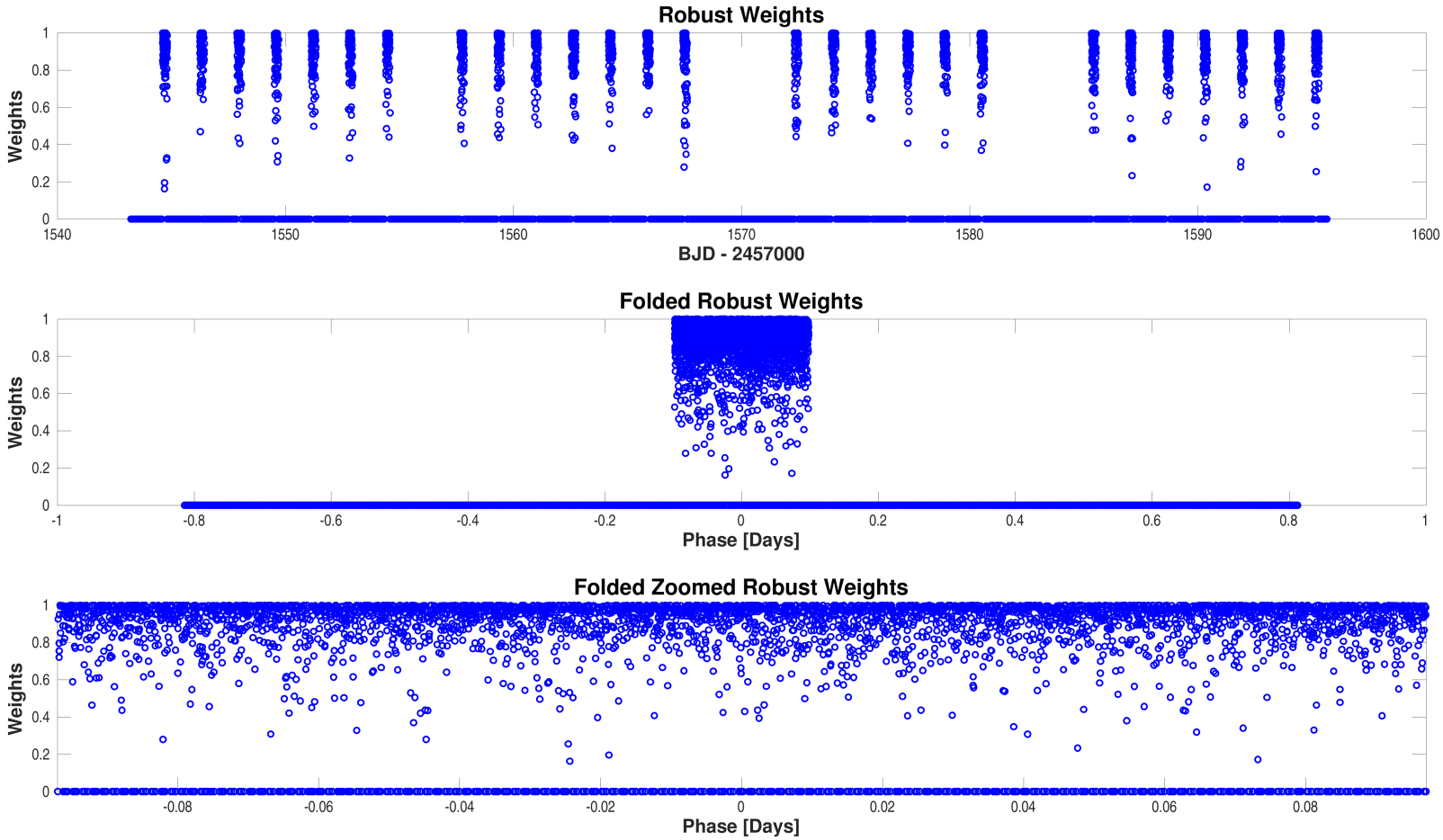




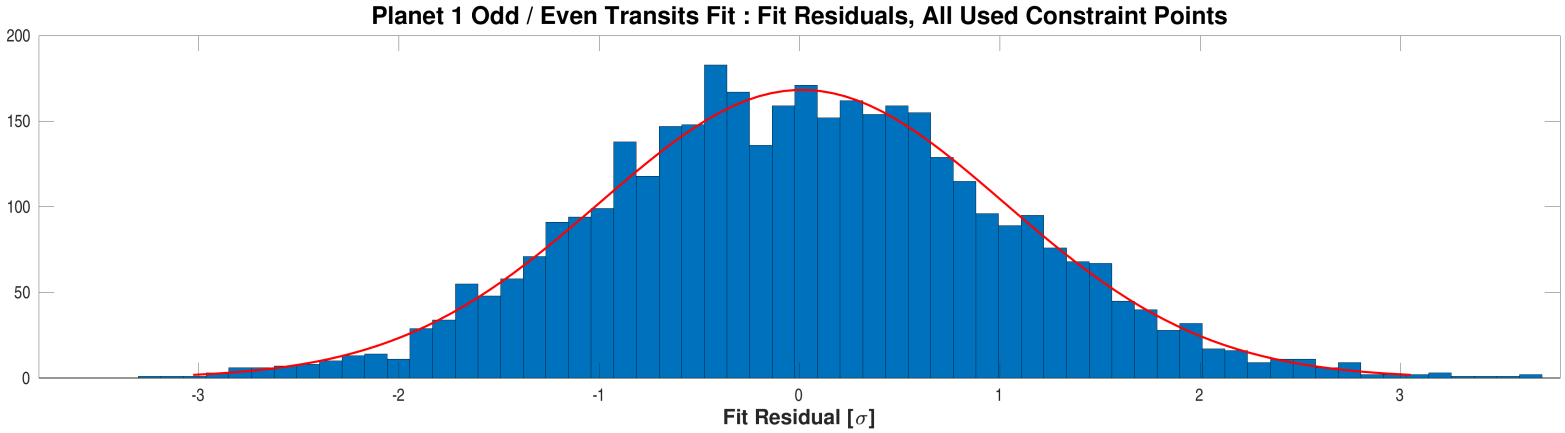
Folded flux time series for CatId 101955023, Planet candidate 1 in the whitened domain is plotted in black dots. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged values of the folded flux time series; the red dots represent the averaged values of the folded model light 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/0000000101955023-01-odd-even-whitened.fig`



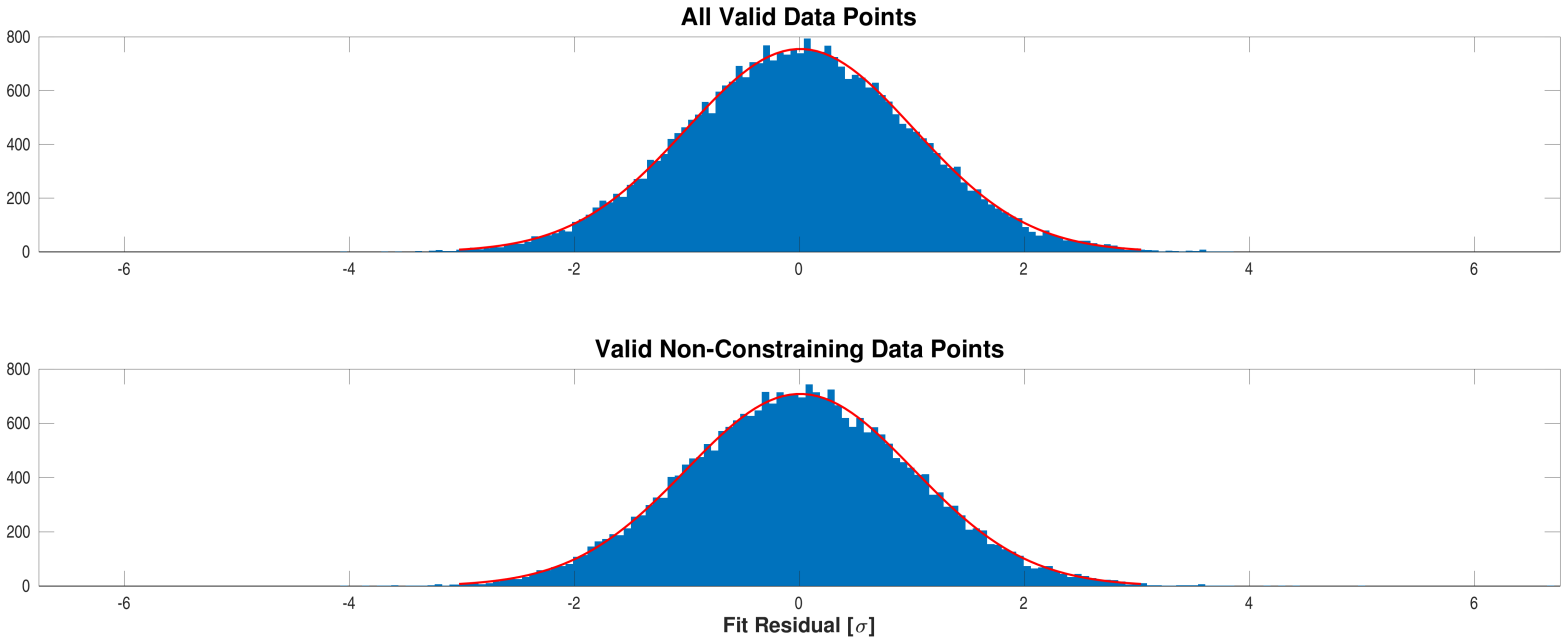
Folded flux time series for CatId 101955023, Planet candidate 1 in the whitened domain, zoomed on the transit. The flux data whose robust weights are larger/smaller than 0.1 are plotted in dark green/cyan dots, respectively. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged 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/0000000101955023-01-odd-even-whitened-zoomed.fig`



Robust weights distribution for CatId 101955023, 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/0000000101955023-01-odd-even-robust-weights.fig`

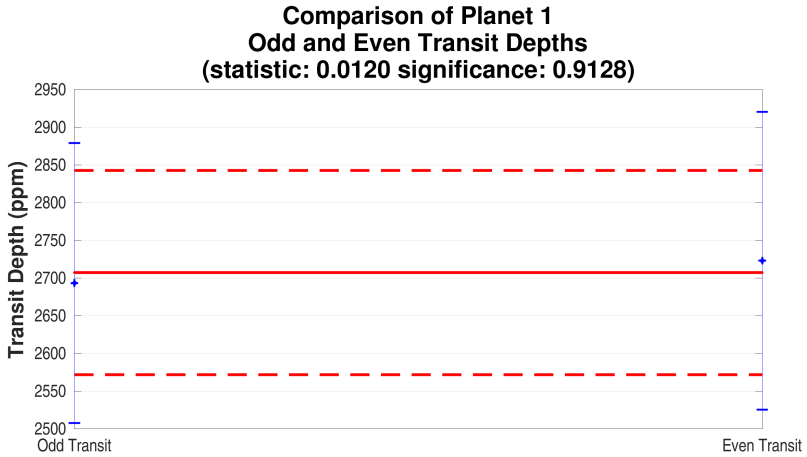


Fit residuals distribution for CatId 101955023, Planet candidate 1. Only the valid data points used to constrain the fit are shown here. A Gaussian fit to the histogram is shown in red.
Open `./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000101955023-01-odd-even-histo-used.fig`



Fit residuals distribution for CatId 101955023, 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/0000000101955023-01-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 101955023, planet 1. A significance level close to 1/0 favors a transiting planet/an eclipsing binary. Open `./planet-01/binary-discrimination-test-results/0000000101955023-01-eclipsing-binary-discrimination-tests.fig`

Appendix B Alerts

This target did not trigger any alerts.