



Data Validation (DV) Report
for TESS ID 299096355
Sectors 26 - 26

This Data Validation Report was produced in the
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at NASA Ames Research Center

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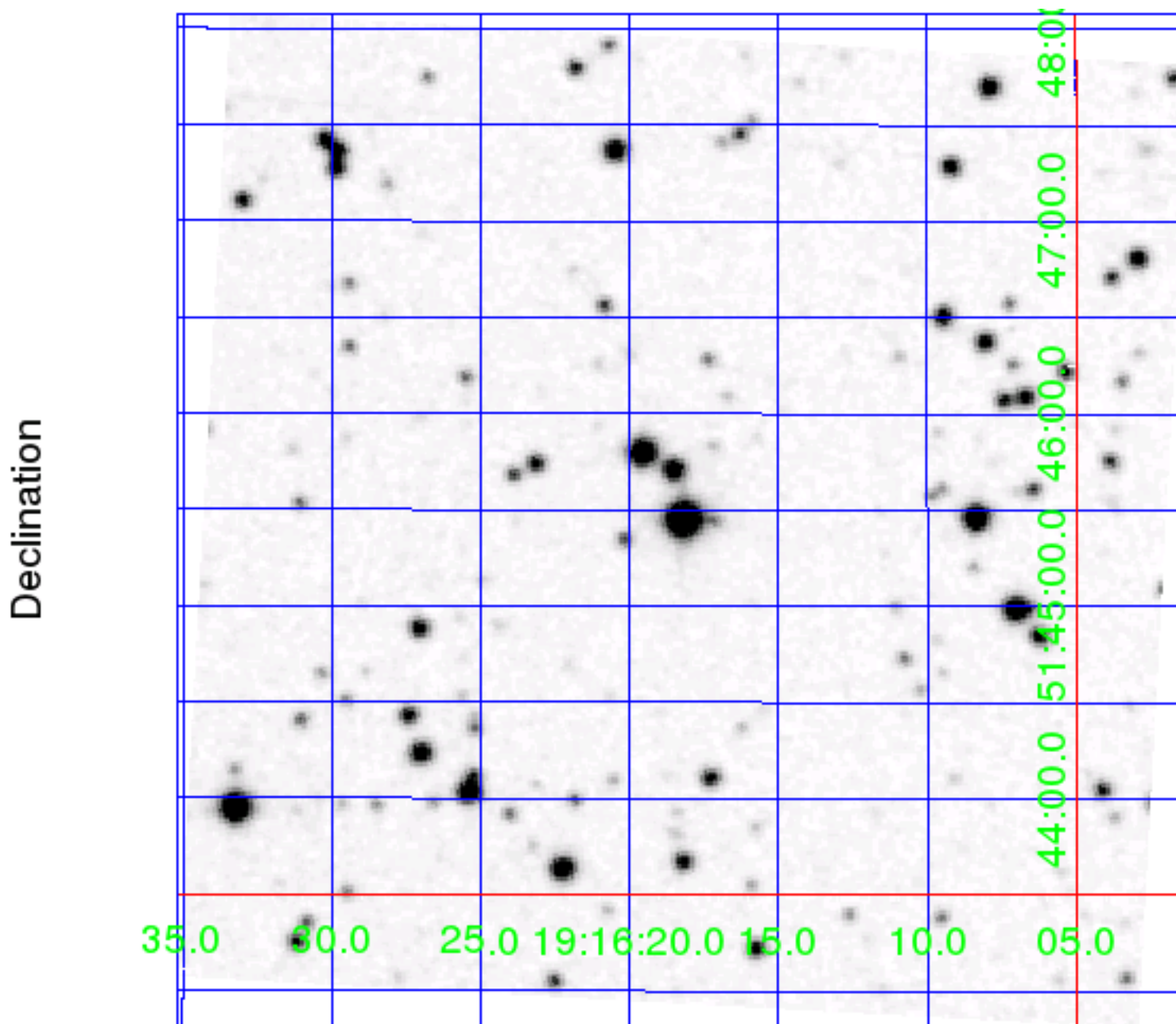
1 Summary

Target Properties	Value	Uncertainty	Units	Provenance
Catalog ID	299096355			
TOI ID	-			
TESS Name	-			
RA	289.07573299	0	degrees	TIC8
Dec	51.75743827	0	degrees	TIC8
Magnitude	10.9438	0.006		TIC8
Radius	0.769	0.071	Solar radii	TIC8
Effective Temperature	4018	111	Kelvin	TIC8
log(g)	4.466	0.10967	cm/sec ²	TIC8
[M/H]	-0.124	0.059	Solar metallicity	TIC8
Stellar Density	1.388	0.373	Solar density	TIC8-Derived
Limb Darkening Coefficient 1	0.66933			
Limb Darkening Coefficient 2	-0.0059595			
Limb Darkening Coefficient 3	0.14892			
Limb Darkening Coefficient 4	-0.047024			
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 23:56:27 Z			

Sector	Target Table	Camera/ CCD	Crowding Metric	Flux Fraction
26	254	2:1	0.8908	0.8213

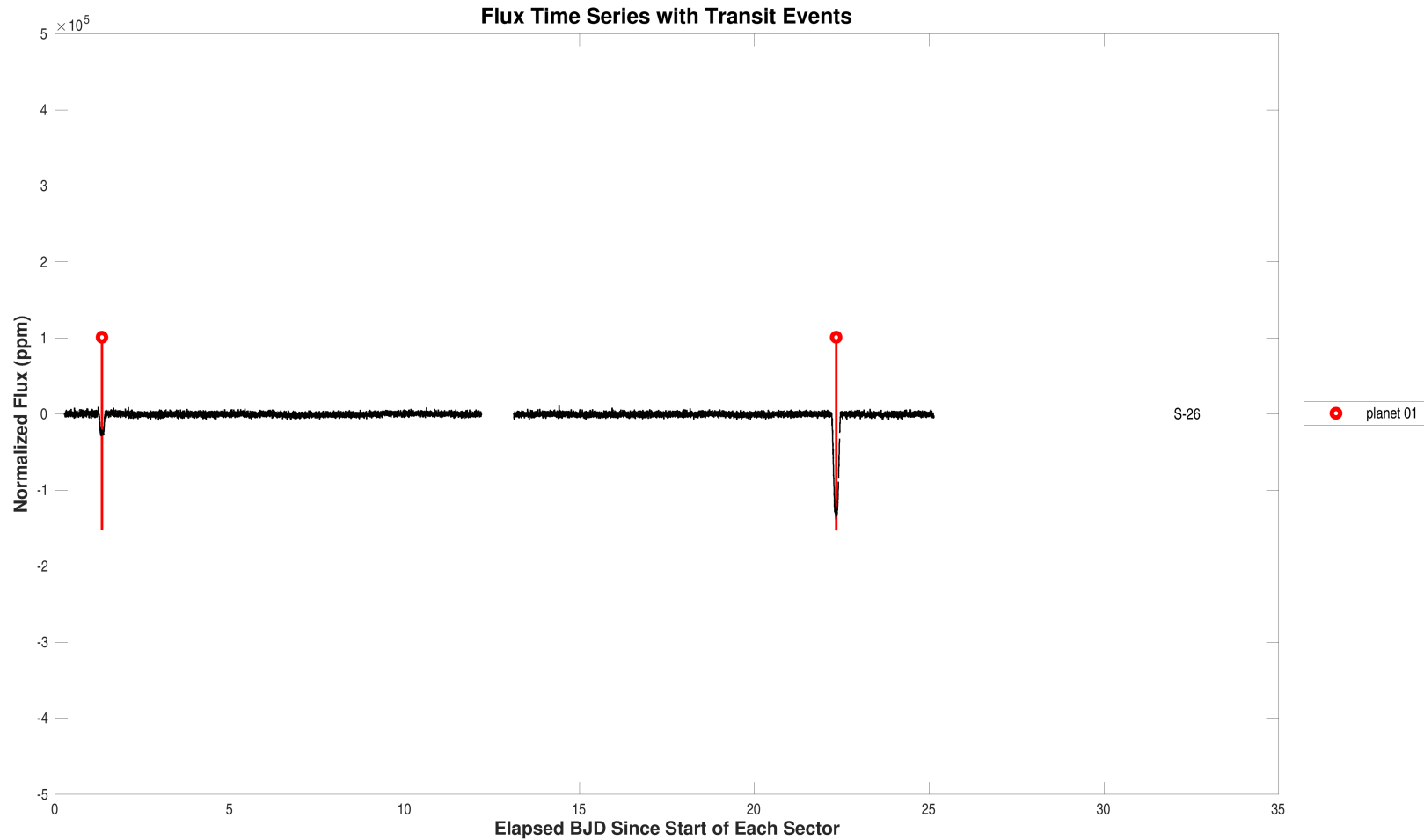
Planet Candidate	TOI ID	TESS Name	TOI Correlation	Period (days)	Period Ratio	Epoch (BTJD)	Semi-major Axis (AU)	Radius (Re)	Seff	Teq (K)	False Alarm	Suspected EB
1	-	-	-	21.001	1.00	2011.339	0.13	22.8	8.5	435	0.00e+00	false

2 Survey Image

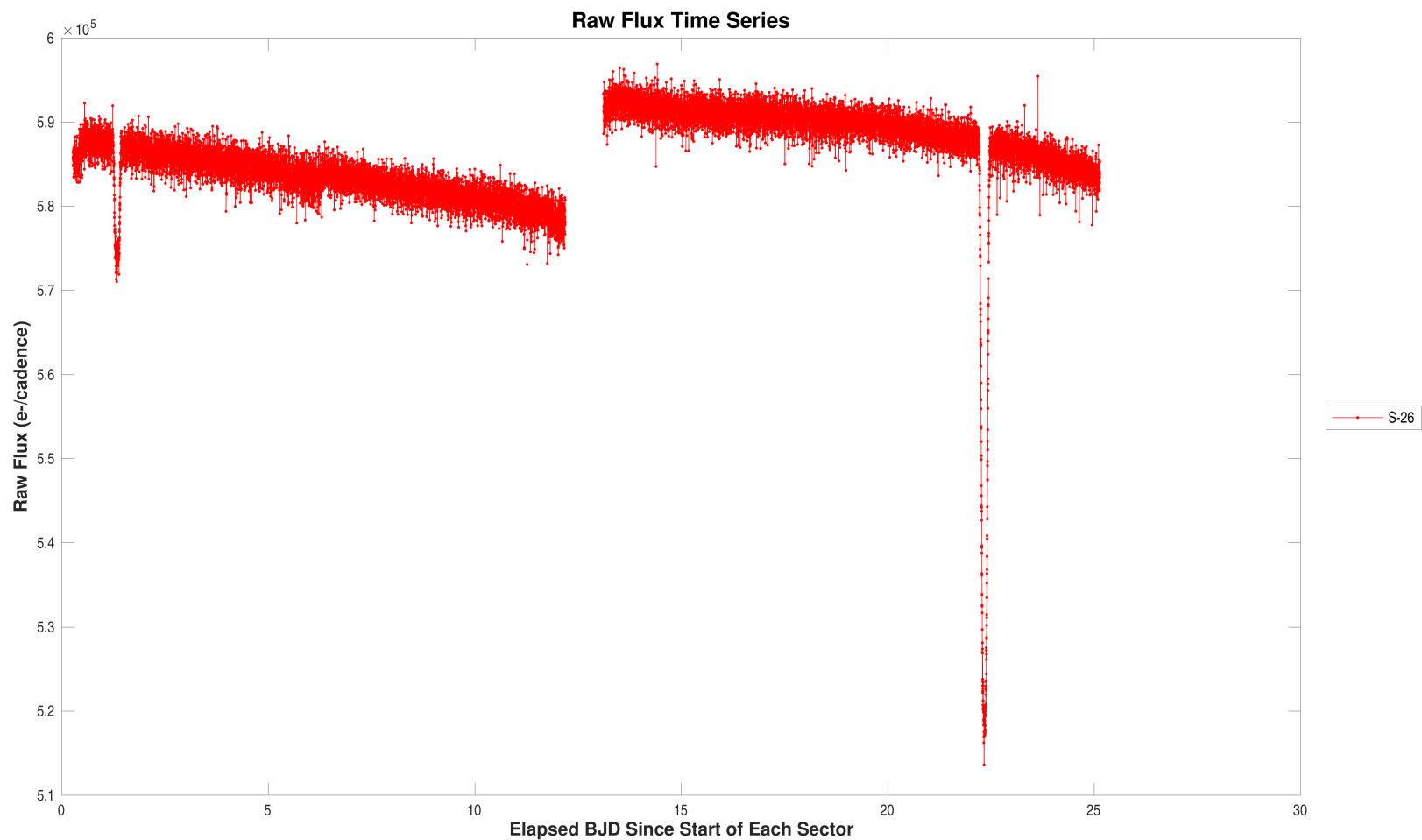


Digitized Sky Survey (DSS) red image. The 5' x 5' image is centered on the J2000 coordinates of target (299096355).

3 Flux Time Series



Summary plot of sector-stitched flux time series and transits for target 299096355, 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/0000000299096355-00-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/0000000299096355-00-raw-flux-26-254.fig`

4 Dashboards

Planet Candidate 1

Model Fitter	Stellar Radius 0.8 ± 0.1 Solar units		Core Aperture Correlation Statistic Value = 73.08 Significance = 100.00%		Ghost Diagnostic Test
	Period = 21.0 ± 0.0 days Depth = 87121 ± 602 ppm Planet Radius = 22.8 ± 2.1 Earth radii Semi-major Axis = 0.1 ± 0.0 AU Effective Stellar Flux = 8.5 ± 1.8 Equilibrium Temperature = 435 ± 23 Kelvin Chi-squared/DoF = 4.3 SNR = 154.9		Halo Aperture Correlation Statistic Value = 11.48 Significance = 100.00% Core/Halo Ratio Ratio = 6.37		
Eclipsing Binary Discrimination Test	Odd-Even Depth Comparison Statistic Value = 3.50e+04 Significance = 0.00%		Offsets Relative to Out of Transit Centroid Source RA Offset = -1.16e+00 ± 2.50e+00 arcsec (-0.47 σ) Source Dec Offset = -3.13e+00 ± 2.50e+00 arcsec (-1.25 σ) Source Offset Distance = 3.34e+00 ± 2.50e+00 arcsec (1.34 σ) Offsets Relative to TIC Position Source RA Offset = 1.56e+00 ± 2.50e+00 arcsec (0.62 σ) Source Dec Offset = -1.88e-01 ± 2.50e+00 arcsec (-0.08 σ) Source Offset Distance = 1.57e+00 ± 2.50e+00 arcsec (0.63 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 = 2 Max Multiple Event Statistic = 311.6		

Summary of model fitter results and validation test results for target 299096355, 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

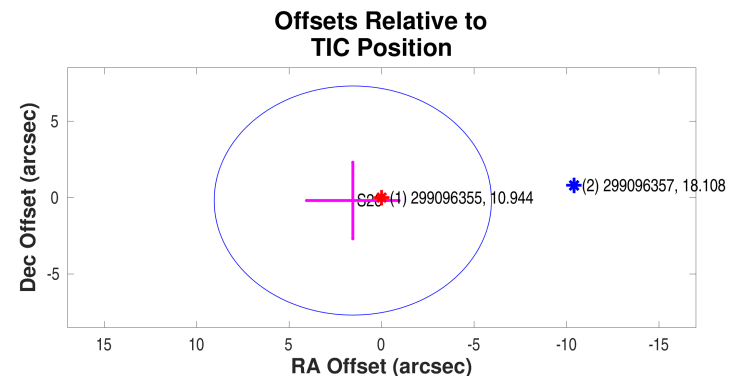
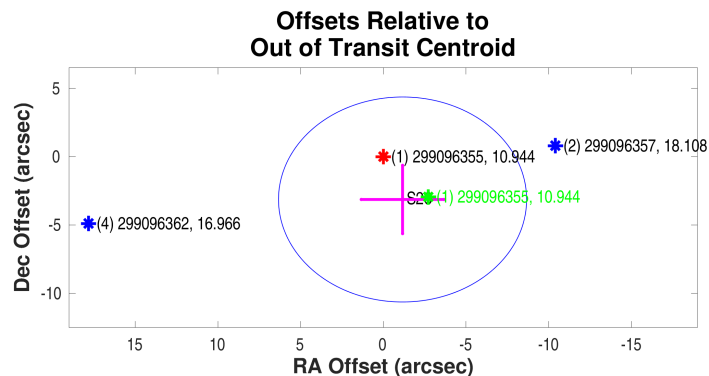
Mean offset from the PRF fit to the out of transit image

	RA	Dec	Units
Offset	$-1.1626 \pm 2.50e + 00$	$-3.1334 \pm 2.50e + 00$	arcseconds
Offset/ σ	-0.47	-1.25	
Offset Distance	$3.3422 \pm 2.50e + 00$		arcseconds
Offset Distance/ σ	1.34		
3σ Radius	7.5014		arcseconds

Mean offset from the TIC RA and Dec

	RA	Dec	Units
Offset	$1.5601 \pm 2.50e + 00$	$-0.1877 \pm 2.50e + 00$	arcseconds
Offset/ σ	0.62	-0.08	
Offset Distance	$1.5714 \pm 2.50e + 00$		arcseconds
Offset Distance/ σ	0.63		
3σ Radius	7.5003		arcseconds

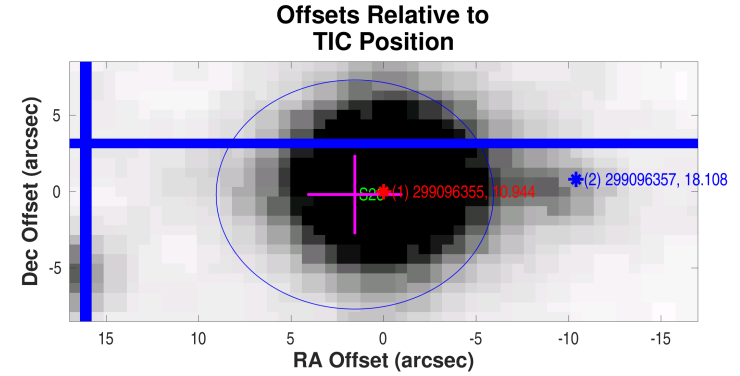
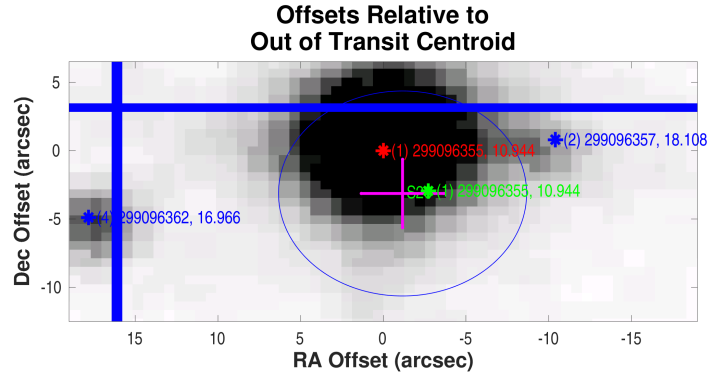
Planet Candidate 1



Difference image centroid offsets for target 299096355, 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/0000000299096355-01-difference-image-centroid-offsets.fig`

Planet Candidate 1



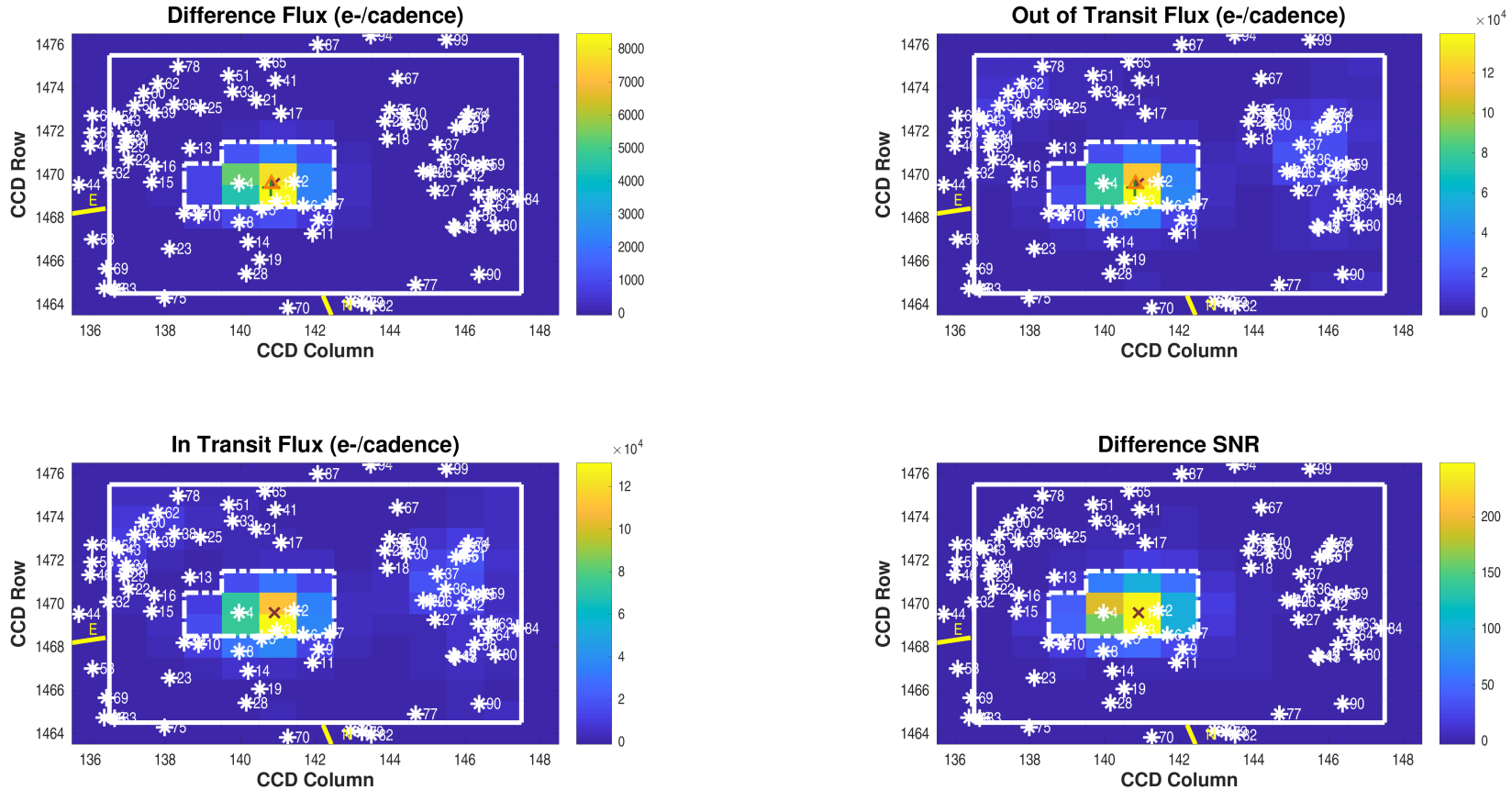
Difference image centroid offsets for target 299096355, planet candidate 1, displayed on survey image for given target. Left: difference image PRF centroid offsets in RA and Dec with respect to the per sector out-of-transit centroids for the given target. Right: difference image PRF centroid offsets 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/0000000299096355-01-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 299096355, 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 = 2; number of valid in-transit cadences = 200; number of in-transit cadence gaps = 5; number of valid out-of-transit cadences = 697; number of out-of-transit cadence gaps = 5. Difference image quality metric = 1.00 (good).

Open `./planet-01/difference-image/0000000299096355-01-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	$1469.40 \pm 6.58e - 05$	$140.81 \pm 5.70e - 05$	pixels	$289.07708385 \pm 1.04e - 06$	$51.75798015 \pm 1.04e - 06$	degrees
Difference Image Centroid	$1469.56 \pm 2.39e - 03$	$140.83 \pm 1.86e - 03$	pixels	$289.07656210 \pm 1.05e - 05$	$51.75710976 \pm 1.39e - 05$	degrees
Offset	$0.1632 \pm 2.39e - 03$	$0.0205 \pm 1.86e - 03$	pixels	$-1.1626 \pm 2.41e - 02$	$-3.1334 \pm 5.02e - 02$	arcseconds
Offset/ σ	68.25	10.98		-48.23	-62.43	
Offset Distance	$0.1645 \pm 2.35e - 03$		pixels	$3.3422 \pm 4.70e - 02$		arcseconds
Offset Distance/ σ	69.90			71.08		

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

	Row	Column	Units	RA	Dec	Units
TIC Reference Centroid	$1469.57 \pm 1.69e - 04$	$140.91 \pm 1.74e - 04$	pixels	$289.07586199 \pm 0.00e + 00$	$51.75716188 \pm 0.00e + 00$	degrees
Difference Image Centroid	$1469.56 \pm 2.39e - 03$	$140.83 \pm 1.86e - 03$	pixels	$289.07656210 \pm 1.05e - 05$	$51.75710976 \pm 1.39e - 05$	degrees
Offset	$-0.0109 \pm 2.40e - 03$	$-0.0796 \pm 1.87e - 03$	pixels	$1.5601 \pm 2.33e - 02$	$-0.1877 \pm 5.00e - 02$	arcseconds
Offset/ σ	-4.56	-42.57		66.87	-3.75	
Offset Distance	$0.0804 \pm 1.84e - 03$		pixels	$1.5714 \pm 2.44e - 02$		arcseconds
Offset Distance/ σ	43.71			64.47		

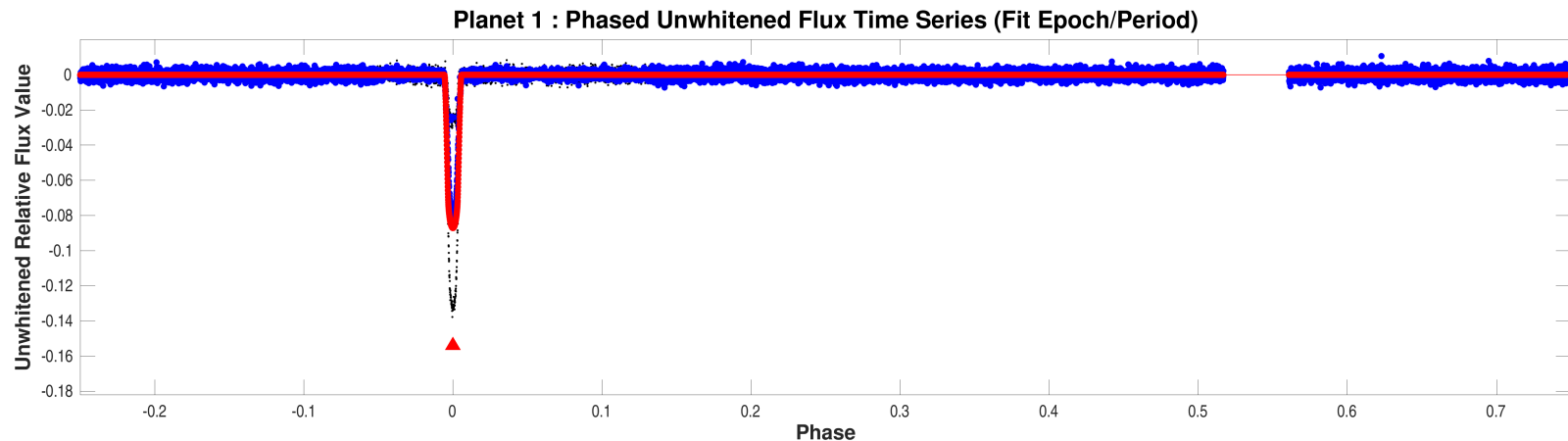
5.2 Difference Image TIC Key

Index	Catalog ID	Mag	RA (degrees)	Dec (degrees)	Distance (arcsec)
1	299096355	10.944	289.07586199	51.75716188	0.00
2	299096357	18.108	289.07119319	51.75738481	10.43
3	299096344	14.361	289.07711055	51.76176598	16.81
4	299096362	16.966	289.08386056	51.75580395	18.48
5	299096335	12.850	289.08131748	51.76329324	25.20
6	1717328416	18.784	289.07150250	51.76390499	26.15
7	1717328417	19.675	289.06531802	51.76446949	35.27
8	1717328418	19.589	289.08765192	51.76567266	40.36
9	1717328415	18.973	289.06941801	51.76811251	41.96
10	299096342	15.812	289.09619486	51.76235227	49.01
11	299096318	17.447	289.07212678	51.77133955	51.71
12	299096349	16.850	289.09927217	51.76136444	54.32
13	1717328406	19.722	289.09150856	51.74493458	56.15
14	1717328419	19.487	289.08760174	51.77102283	56.34
15	1717328411	18.851	289.10357662	51.75218470	64.31
16	1717328409	19.290	289.10144118	51.74823183	65.44
17	1717328407	18.667	289.06745469	51.73955562	66.09
18	1717328633	18.717	289.04583873	51.75005897	71.62
19	299096310	16.935	289.08666486	51.77597965	71.89
20	1717328638	18.128	289.04085521	51.75960932	78.50
21	299096417	15.920	289.07176374	51.73522604	79.50
22	1717328413	19.877	289.10666002	51.74563207	80.21
23	299161558	17.375	289.10606263	51.76980106	81.24
24	299096385	17.528	289.04465754	51.74546929	81.28
25	299096422	18.245	289.08517896	51.73511081	82.05
26	1717328636	18.392	289.03933306	51.76017016	82.12
27	1717328639	19.133	289.04008016	51.76501831	84.60
28	1717328451	19.147	289.09114243	51.77904367	85.82
29	299161532	18.277	289.10641286	51.74218899	86.83
30	1717328635	19.500	289.04009490	51.74707375	87.59
31	299096406	17.875	289.10473291	51.74053376	87.88
32	299161538	15.286	289.11252194	51.74813391	87.92
33	1717328401	19.351	289.07631919	51.73221970	89.80
34	299161527	17.667	289.10489429	51.73948171	90.76
35	1717326598	18.598	289.04243933	51.74272885	90.81
36	299096353	13.105	289.03463441	51.75755637	91.88
37	1717328634	18.725	289.03503485	51.75339943	91.98
38	299096431	16.646	289.09078891	51.73328132	92.18

Index	Catalog ID	Mag	RA (degrees)	Dec (degrees)	Distance (arcsec)
39	1717328404	19.603	289.09615391	51.73456732	93.06
40	1717326597	18.910	289.03935757	51.74418870	93.80
41	299096444	18.278	289.06547703	51.73100292	96.97
42	1717328644	19.911	289.03244122	51.76236178	98.55
43	299096415	16.763	289.10491961	51.73530867	101.89
44	1717328399	19.082	289.12033264	51.75010721	102.30
45	1717328648	15.868	289.03937969	51.77488786	103.35
46	299161530	15.784	289.11397335	51.74059225	103.78
47	299096312	15.412	289.03922600	51.77521500	104.35
48	1717328649	16.468	289.03917519	51.77527626	104.58
49	1717328643	18.959	289.02902434	51.75999609	104.87
50	1717328403	17.694	289.09981862	51.73201881	105.09
51	299096454	15.621	289.07562775	51.72796642	105.10
52	299096429	13.908	289.10558902	51.73399444	106.51
53	1717328432	19.383	289.12257308	51.76449856	107.39
54	299096329	16.148	289.03065309	51.76767466	107.62
55	299096370	13.561	289.02906919	51.74976445	107.62
56	299161524	14.605	289.11220969	51.73734762	107.93
57	1717328398	19.292	289.11982904	51.74434199	108.30
58	299096316	14.867	289.03353780	51.77286002	109.95
59	299096351	16.919	289.02661549	51.76016358	110.27
60	299096447	17.593	289.09661433	51.72920775	110.75
61	299096372	16.477	289.02709826	51.74974958	111.89
62	299096456	13.877	289.09250823	51.72731978	113.66
63	299096326	15.431	289.02772062	51.76816112	114.35
64	299096320	17.743	289.02951044	51.77091665	114.55
65	299096461	18.123	289.06611912	51.72587721	114.70
66	299161519	17.879	289.11046106	51.73302793	116.16
67	299096419	18.359	289.03763267	51.73503924	116.62
68	299096378	15.743	289.02579943	51.74745938	116.90
69	299161562	17.504	289.12237818	51.77249190	117.43
70	299096282	14.283	289.08509231	51.78935316	117.70
71	1717328396	18.008	289.12270838	51.74192587	117.92
72	299161550	17.460	289.12923234	51.75902358	119.12
73	1717328653	18.419	289.07017250	51.79008213	119.19
74	1717326606	19.338	289.02496047	51.74672512	119.49
75	1717328448	19.234	289.11205830	51.78217706	120.90
76	1717328400	18.345	289.12614004	51.74429434	121.24

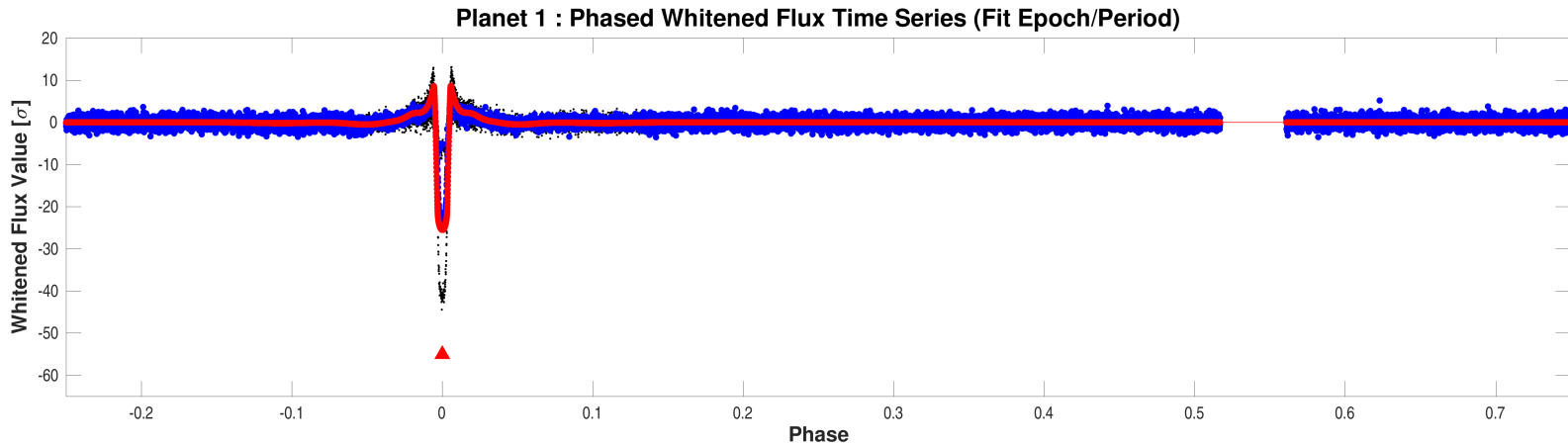
RA, Dec and Distances are corrected for proper motion. This table may not contain all of the objects shown.

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.

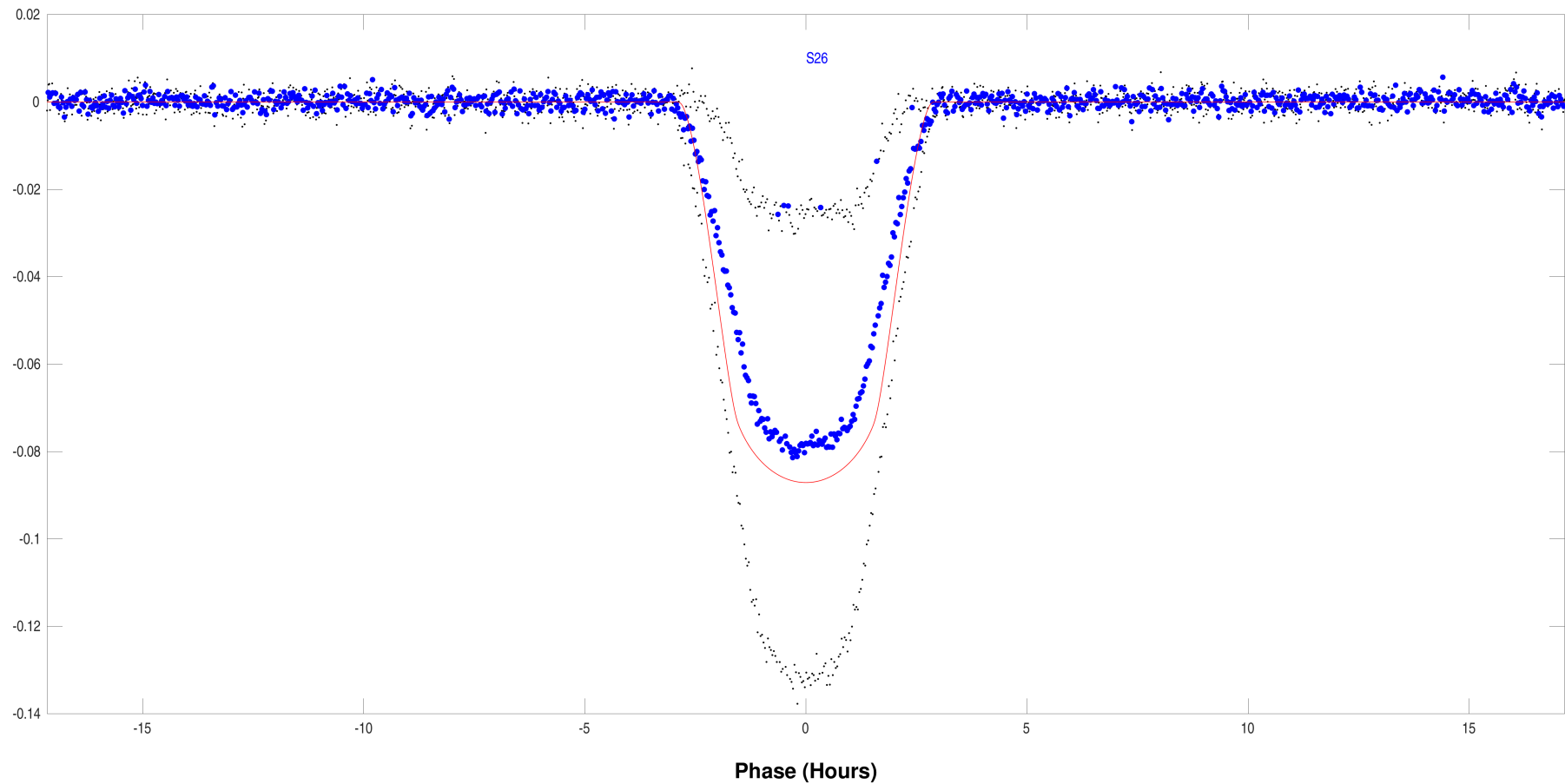
Open `./summary-plots/0000000299096355-01-phased-unwhitened-flux-time-series.fig`



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/0000000299096355-01-phased-whitened-flux-time-series.fig`

Planet: 1 Phased Unwhitened Flux Time Series by Sector



Phased unwhitened flux time series by sector for target 299096355, planet candidate 1. Period = 21.0011 days; transit epoch = 2011.3386 BTJD.
Open `./summary-plots/0000000299096355-01-phased-unwhitened-flux-time-series-by-sector.fig`

7 Planet Candidate 1

7.1 Model Fitter: All Transits

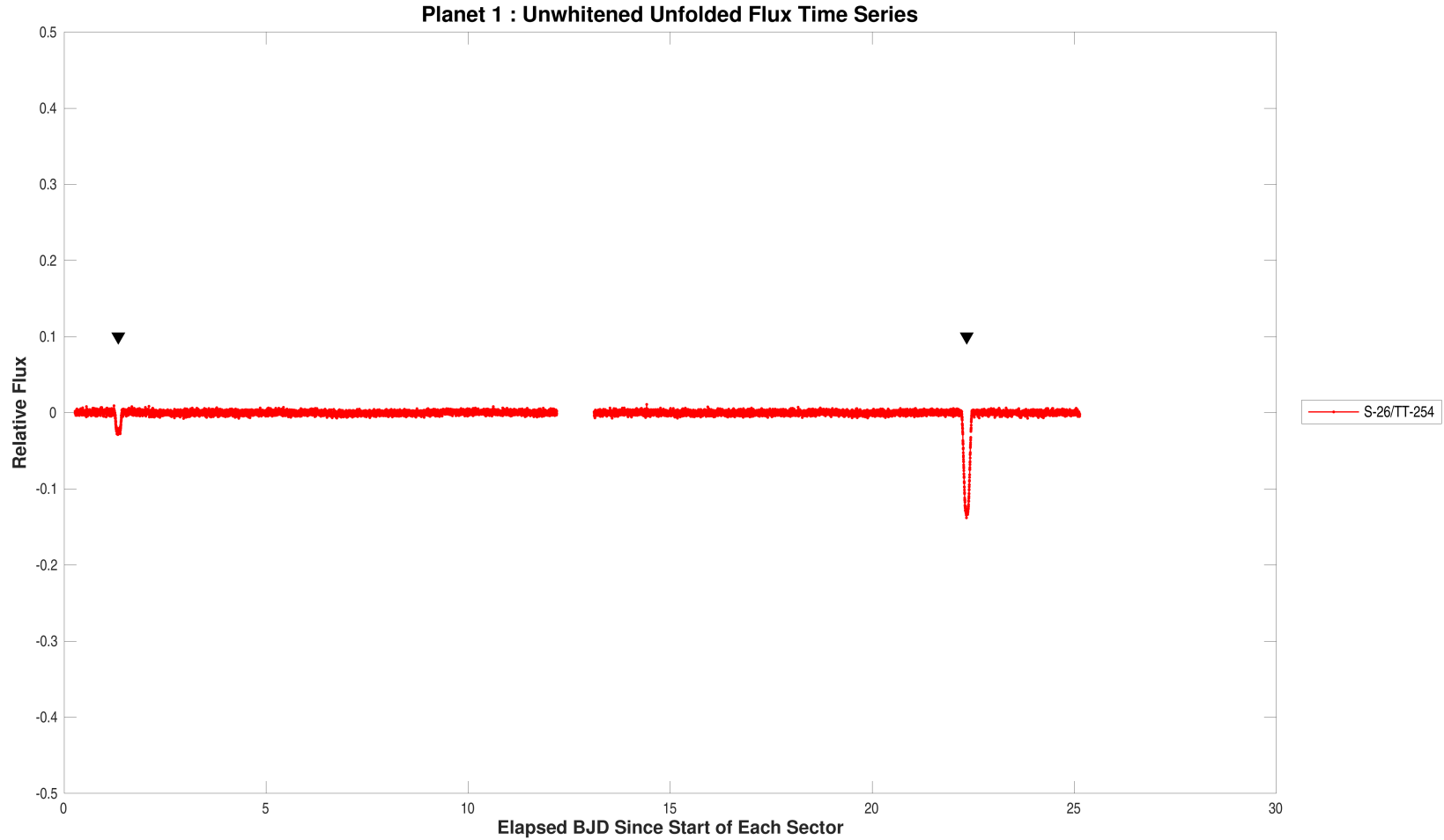
Model Characteristic	Name
Transit Model	mandel-agol_geometric_transit_model
Limb Darkening Model	claret_tess_nonlinear_limb_darkening_model

TCE Parameter	Value	Units
Trial Transit Pulse Duration	4.5	hours
Transit Epoch	2011.3398931	TJD
Orbital Period	21.0013790	days
Maximum SES	370.6	
Maximum MES	311.6	
Robust Statistic	272.6	
Chi Square Goodness of Fit Statistic (DoF)	47639.3 (264)	
Chi Square2 Statistic (DoF)	39586.6 (6963.9)	
Threshold for Desired PFA		

DoF: Degrees of Freedom

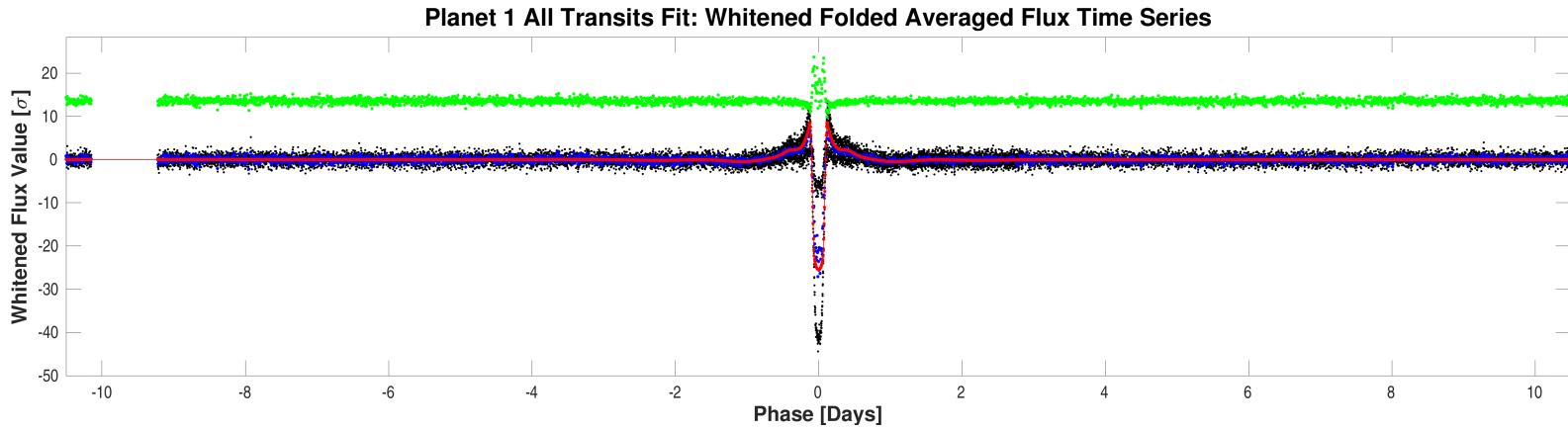
Parameter	Value	Uncertainty	Units
SNR	154.9		
Orbital Period	21.0010573	6.5159e-04	days
Transit Epoch	2011.3386250	4.6192e-04	BTJD
Impact Parameter	0.2572	4.9494e-02	
Planet Radius to Star Radius Ratio	0.2719784	1.4452e-03	
Semi-major Axis to Star Radius Ratio	34.9534	4.7917e-01	
Planet Radius	22.8213	2.1022e+00	Earth radii
Semi-major Axis	0.1278	1.3306e-02	AU
Effective Stellar Flux	8.4512	1.7811e+00	Goldilocks
Equilibrium Temperature	435	2.2911e+01	Kelvin
Stellar Density	1.3008	5.3500e-02	Solar density
Transit Depth	87121	6.0161e+02	ppm
Transit Duration	5.7191	4.0321e-02	hours
Transit Ingress Duration	1.2964	4.2305e-02	hours
Eccentricity	0.0000	0.0000e+00	
Peri Longitude	0.0000	0.0000e+00	degrees
Model Chi Square Statistic (DoF)	6696.4 (1564.2)		
Model Chi Square Goodness of Fit Statistic (DoF)	518.1 (349)		
Model Chi Square2 Statistic (DoF)	513.2 (1)		

DoF: Degrees of Freedom



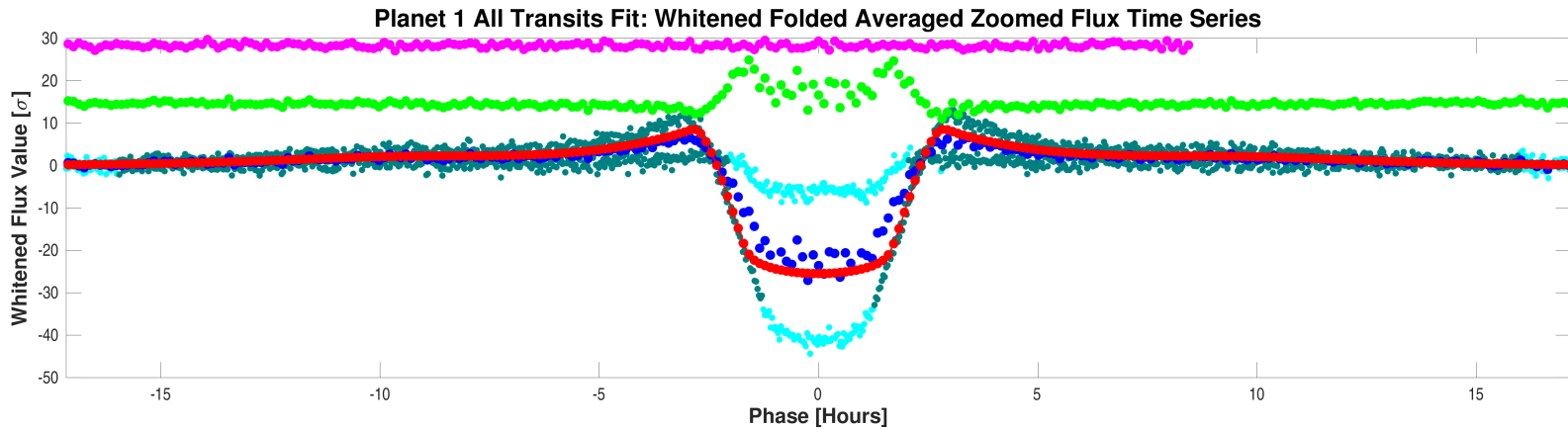
Flux time series for CatId 299096355, Planet candidate 1 in the unwhitened domain. For the data of Sector-26/TargetTableId-254, start BJD is 2459010. Transit event markers indicate the location of transits of the given planet candidate. All transits fit completed with full convergence.

Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000299096355-01-all-unwhitened-26-254.fig`



Folded flux time series for CatId 299096355, Planet candidate 1 in the whitenened 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/0000000299096355-01-all-whitenened.fig`



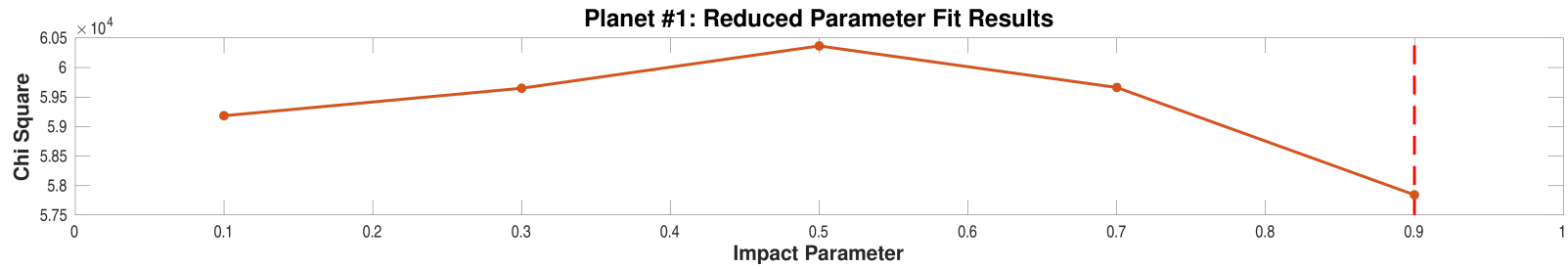
Folded flux time series for CatId 299096355, Planet candidate 1 in the whitenened domain, zoomed on the transit. The flux data whose robust weights are larger/smaller than 0.1 are plotted in dark green/cyan dots, respectively. Values are averaged into 1 cadence wide bins. The blue dots represent the 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/0000000299096355-01-all-whitenened-zoomed.fig`

7.2 Model Fitter: Reduced Parameter Fit Results

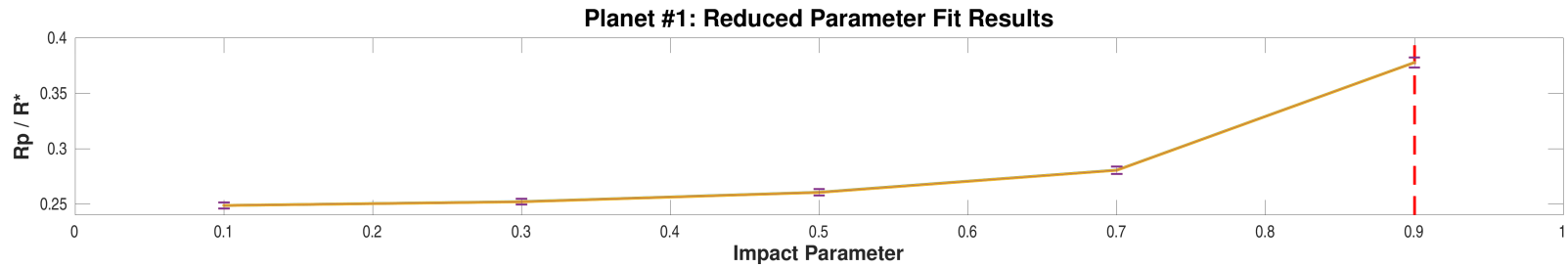
Impact Parameter	SNR	Model Chi Square	Planet Radius to Star Radius	Uncert	Semi-major Axis to Star Radius	Uncert	Transit Depth (ppm)	Uncert	Transit Duration (hours)	Uncert
0.10	317.8	59181.6	0.2486664	2.6408e-03	38.6383	4.5543e-01	73976	1.5520e+03	5.1689	6.0942e-02
0.30	320.6	59646.9	0.2520884	2.6842e-03	37.0680	4.5533e-01	74483	1.5647e+03	5.2623	6.4499e-02
0.50	326.0	60363.1	0.2605741	2.7947e-03	33.7223	4.6136e-01	75883	1.5989e+03	5.5068	7.5026e-02
0.70	319.6	59659.5	0.2805685	3.3526e-03	28.5778	4.8116e-01	79303	1.8112e+03	6.0228	9.9449e-02
0.90	312.9	57842.7	0.3777544	4.4556e-03	26.8536	5.0398e-01	82868	1.8424e+03	6.2371	1.0961e-01

Highlighted row is the best reduced-parameter model fit.



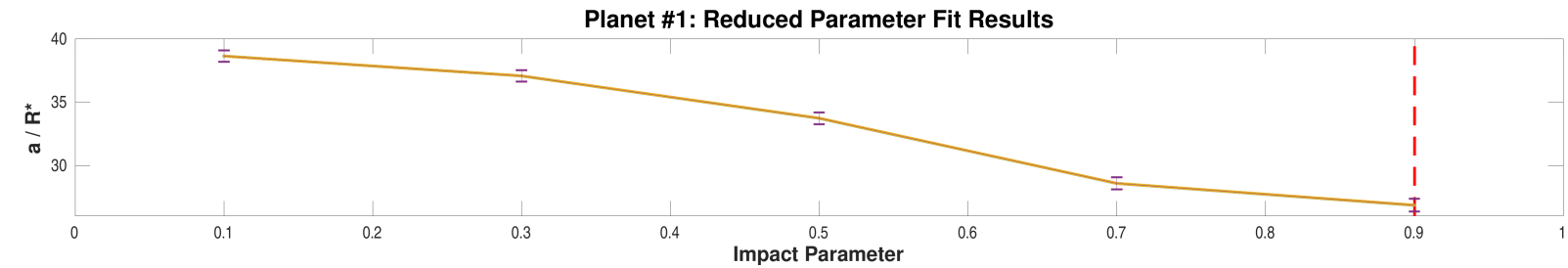
Model chi squares of reduced parameter fits vs. impact parameter for CatId 299096355, Planet candidate 1. The fit result with the minimum chi square is marked with a dashed line in the plot.

Open `./planet-01/planet-search-and-model-fitting-results/reduced-parameter-fits/0000000299096355-01-reduced-fits-chi-square.fig`



Ratios of planet radius to star radius of reduced parameter fits vs. impact parameter for CatId 299096355, 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/0000000299096355-01-reduced-fits-rp-over-rstar.fig`



Ratios of semimajor axis to star radius of reduced parameter fits vs. impact parameter for CatId 299096355, 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/0000000299096355-01-reduced-fits-a-over-rstar.fig`

7.3 Model Fitter: Trapezoidal Fit Results

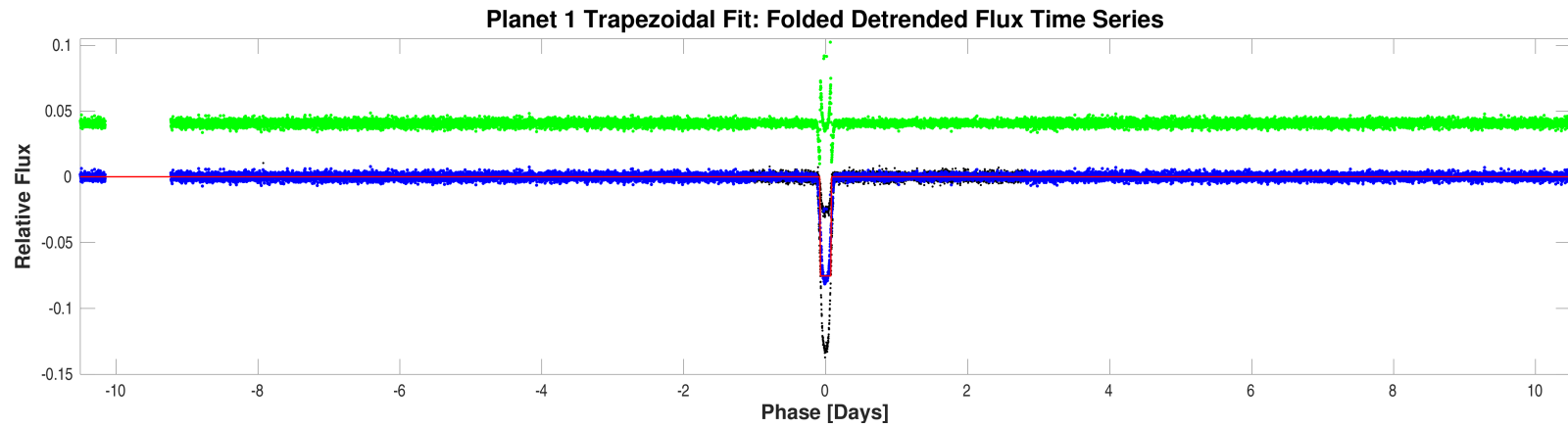
Model Characteristic	Name
Transit Model	trapezoidal_model
Limb Darkening Model	

TCE Parameter	Value	Units
Trial Transit Pulse Duration	4.5	hours
Transit Epoch	2011.3398931	TJD
Orbital Period	21.0013790	days
Maximum SES	370.6	
Maximum MES	311.6	
Robust Statistic	272.6	
Chi Square Goodness of Fit Statistic (DoF)	47639.3 (264)	
Chi Square2 Statistic (DoF)	39586.6 (6963.9)	
Threshold for Desired PFA		

DoF: Degrees of Freedom

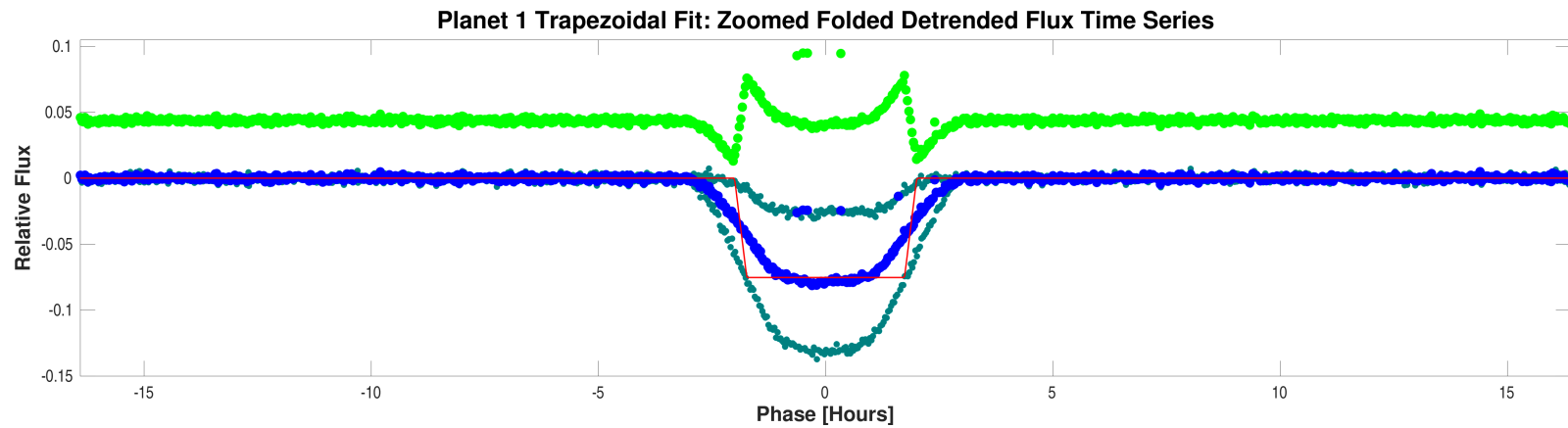
Parameter	Value	Uncertainty	Units
SNR	472.1		
Orbital Period	21.0013790		days
Transit Epoch	2011.3382574		BTJD
Transit Depth	75344		ppm
Transit Duration	5.4682		hours
Transit Ingress Duration	1.7277		hours
Model Chi Square Statistic (DoF)	150969.2 (2132)		

DoF: Degrees of Freedom



Folded detrended flux time series for CatId 299096355, Planet candidate 1 and folded trapezoidal model light curve.

Open `./planet-01/planet-search-and-model-fitting-results/trapezoidal-model-fit/0000000299096355-01-all-trapezoidal.fig`



Zoomed folded detrended flux time series for CatId 299096355, Planet candidate 1 and folded trapezoidal model light curve.

Open `./planet-01/planet-search-and-model-fitting-results/trapezoidal-model-fit/0000000299096355-01-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	21.0014		days		
Transit Duration	4.5		hours		
Maximum MES	311.6				
Secondary Phase	-0.60278		days		
Secondary MES	6.2				
Minimum Phase	-0.85694		days		
Minimum MES	-4.6				
Median MES	0.1				
MAD MES	0.89232				
Robust Statistic	-1.9				
Secondary Depth	-718.4	3.2720e+02	ppm		
Geometric Albedo	N/A	N/A		N/A	N/A
Planet Effective Temperature	N/A	N/A	Kelvin	N/A	N/A

7.4.2 Eclipsing Binary Discrimination Test

Result	Value	Value in Sigmas	Significance (%)
Odd Even Transit Depth Comparison Statistic	3.4995e+04	187.0692	0.00

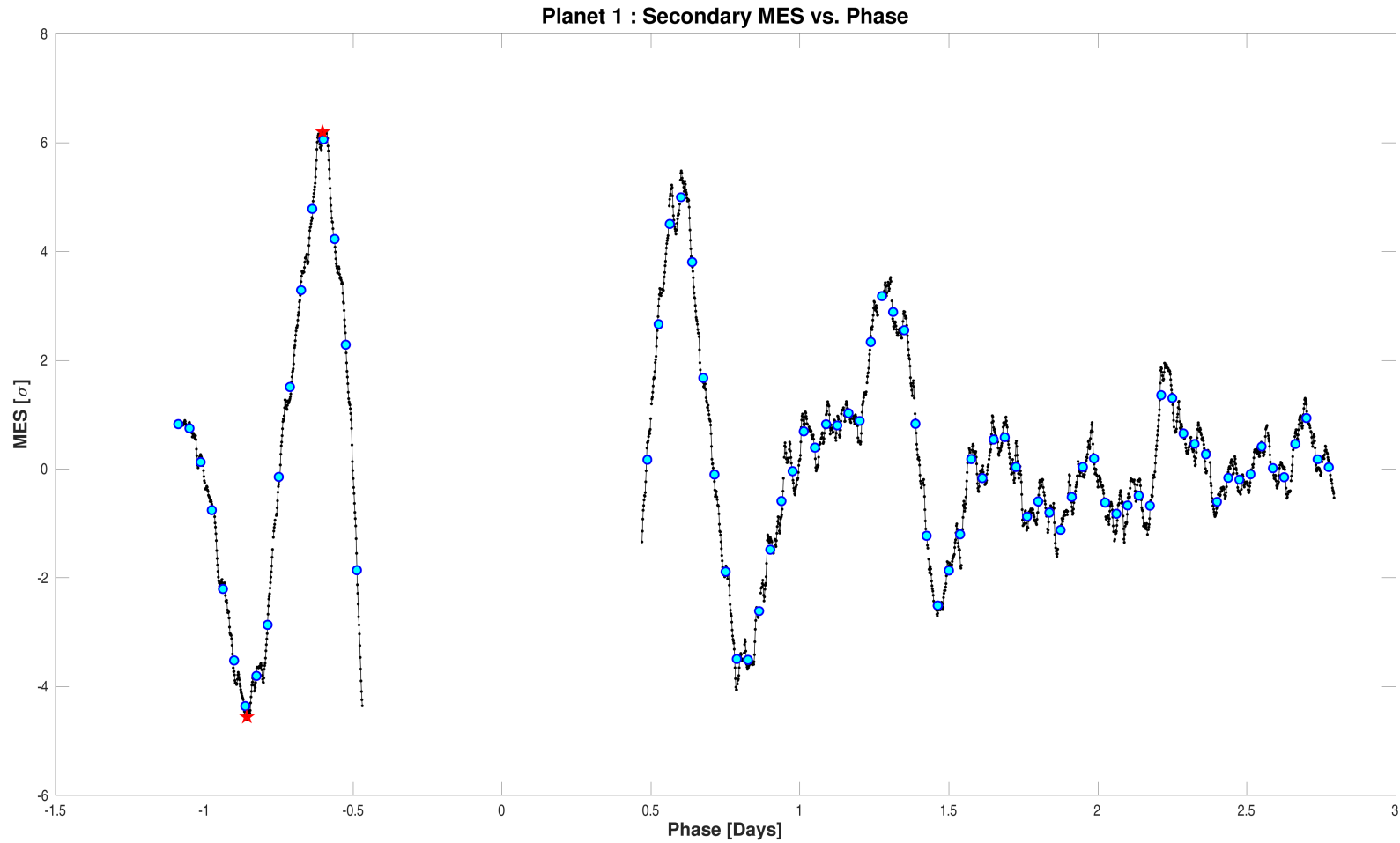
7.4.3 Bootstrap Test

Result	Value
False Alarm Probability	0.0000e+00
Bootstrap Threshold for Desired PFA	6.1
MES Mean	-0.94
MES Standard Deviation	1.40
Transit Count	2

7.4.4 Ghost Diagnostic Test

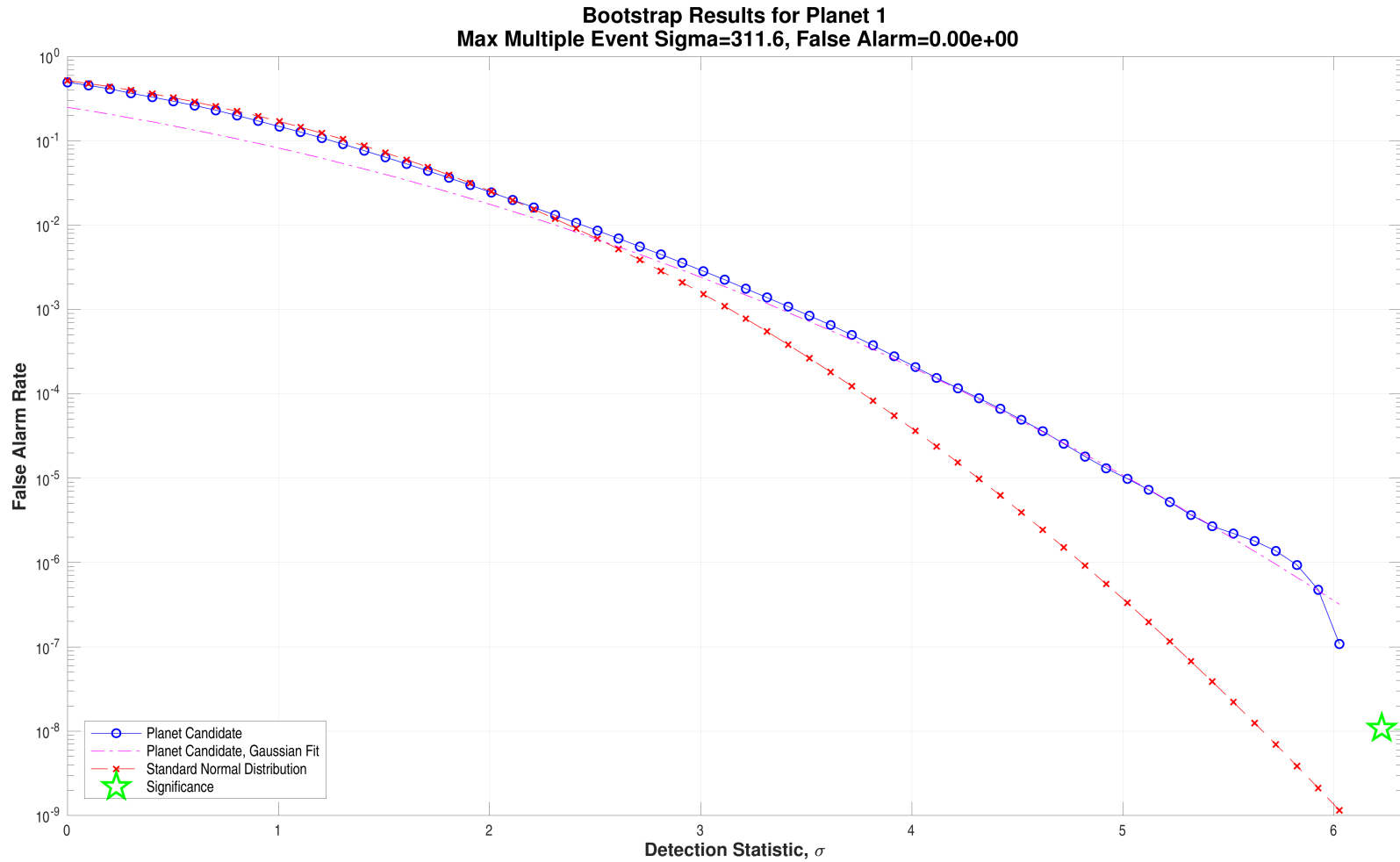
Result	Value	Significance (%)
Maximum MES	311.6	
SNR	154.9	
Core Aperture Statistic	7.3082e+01	100.00
Halo Aperture Statistic	1.1479e+01	100.00
Ratio of Core/Halo Aperture Statistics	6.3664e+00	

7.4.5 Validation Test Figures



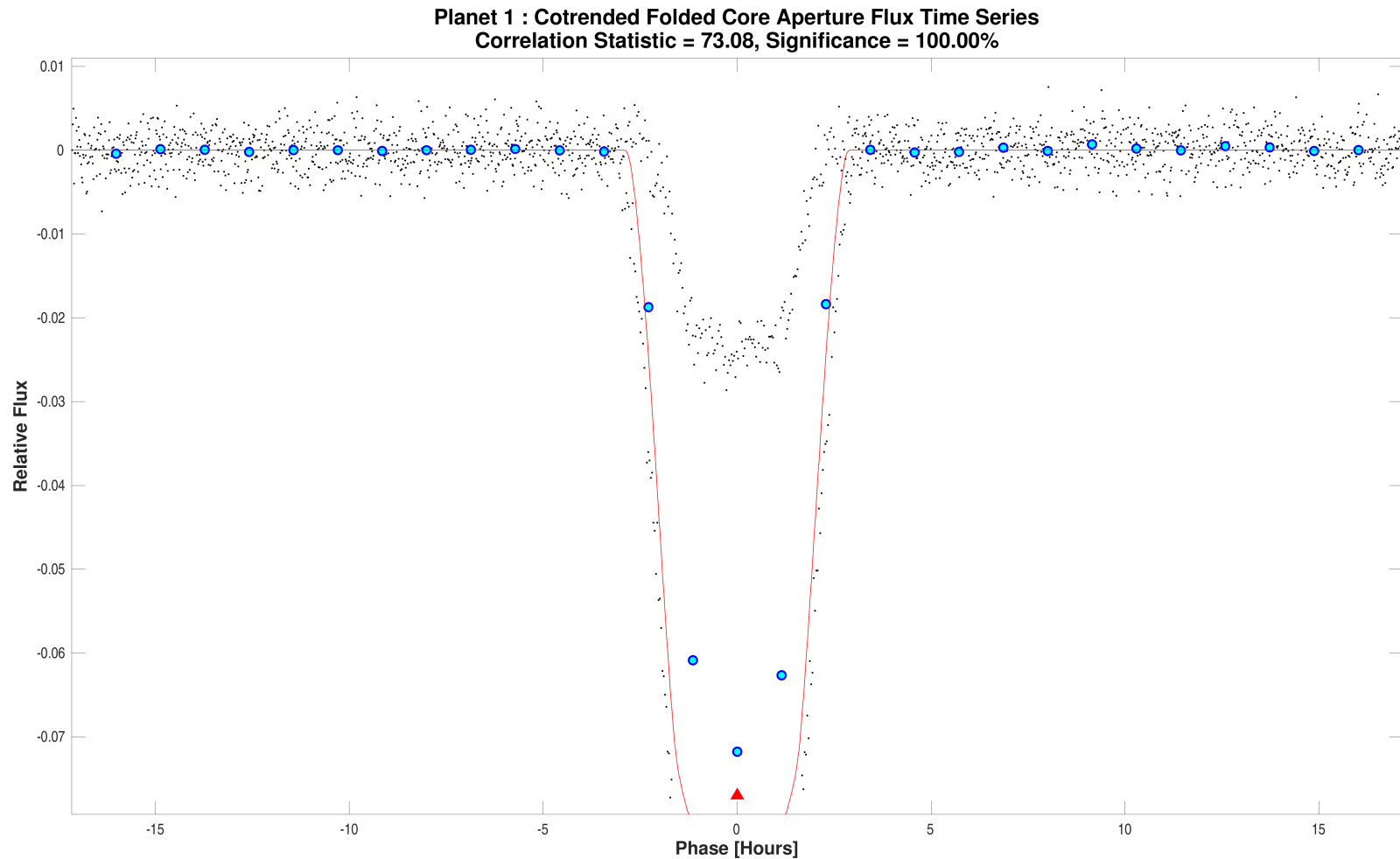
The primary event has been set to zero and both the max and min of the resulting MES vs. Phase are marked with a red star. The best matched pulse duration in hours is 4.5. The maximum secondary MES and corresponding phase are 6.1986 and -0.60278 days respectively. The minimum secondary MES and corresponding phase are -4.5552 and -0.85694 days respectively.

Open `./planet-01/report-summary/0000000299096355-01-weak-secondary-diagnostic.fig`



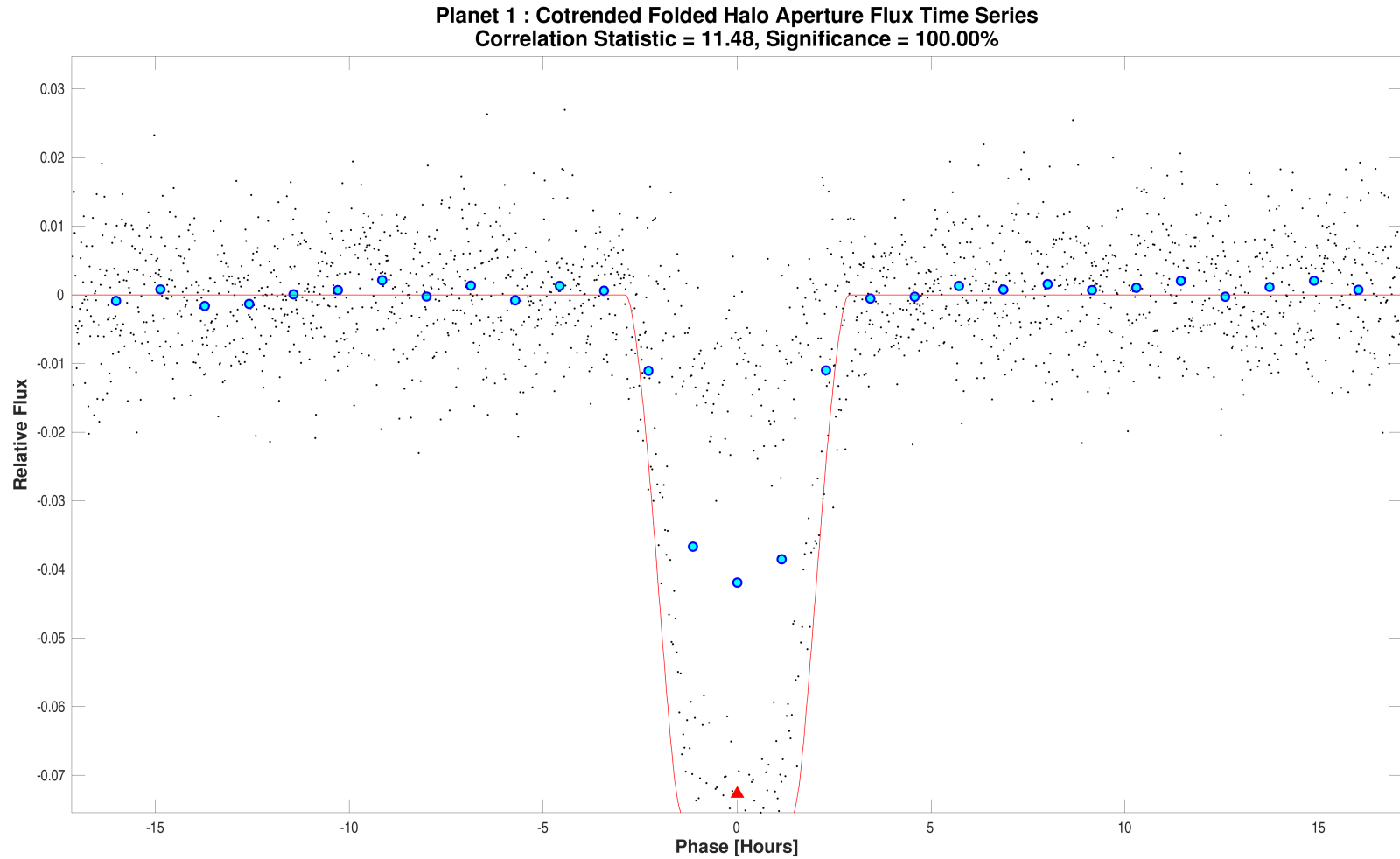
Bootstrap results for target 299096355, planet 1. Cumulative sum of the probabilities (derived from the histogram of counts) from upper tail to the search transit threshold; false alarm probability is indicated by the star. The Gaussian equivalent threshold for this false alarm probability is Inf. The threshold on this distribution that achieves the same false alarm rate as a 7.1 sigma threshold on a Gaussian distribution is 6.1255.

Open `./planet-01/bootstrap-results/0000000299096355-01-bootstrap-false-alarm.fig`



Optical ghost diagnostic core aperture flux time series for target 299096355, 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/0000000299096355-01-core-unwhitened-cotrended-zoomed-model.fig`

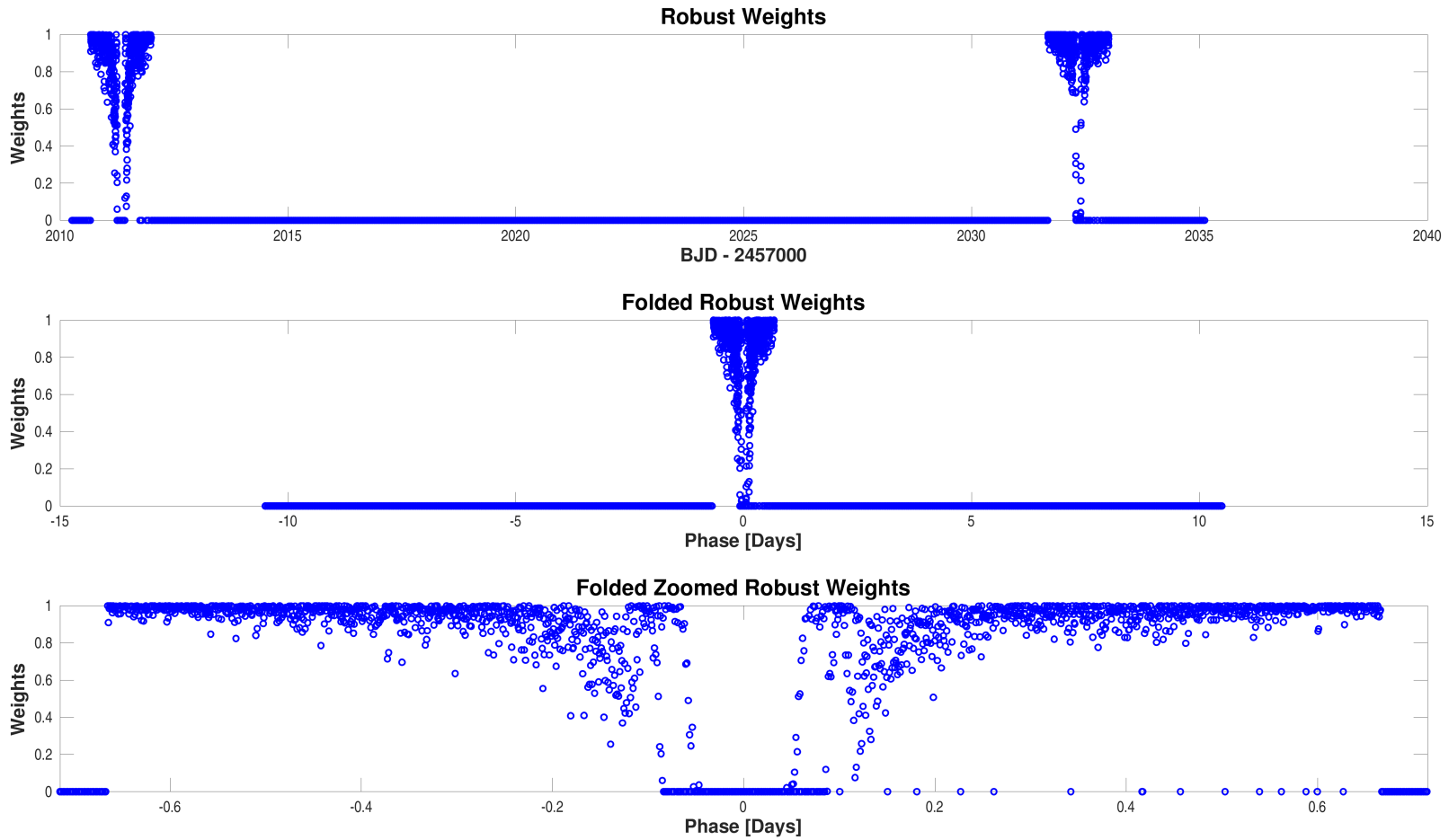


Optical ghost diagnostic halo aperture flux time series for target 299096355, planet candidate 1. The unwhitened time series is phase folded at the orbital period associated with the planet candidate and centered on the epoch of the first transit. The time series was first cotrended against spacecraft 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 halo aperture; 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/000000299096355-01-halo-unwhitened-cotrended-zoomed-model.fig`

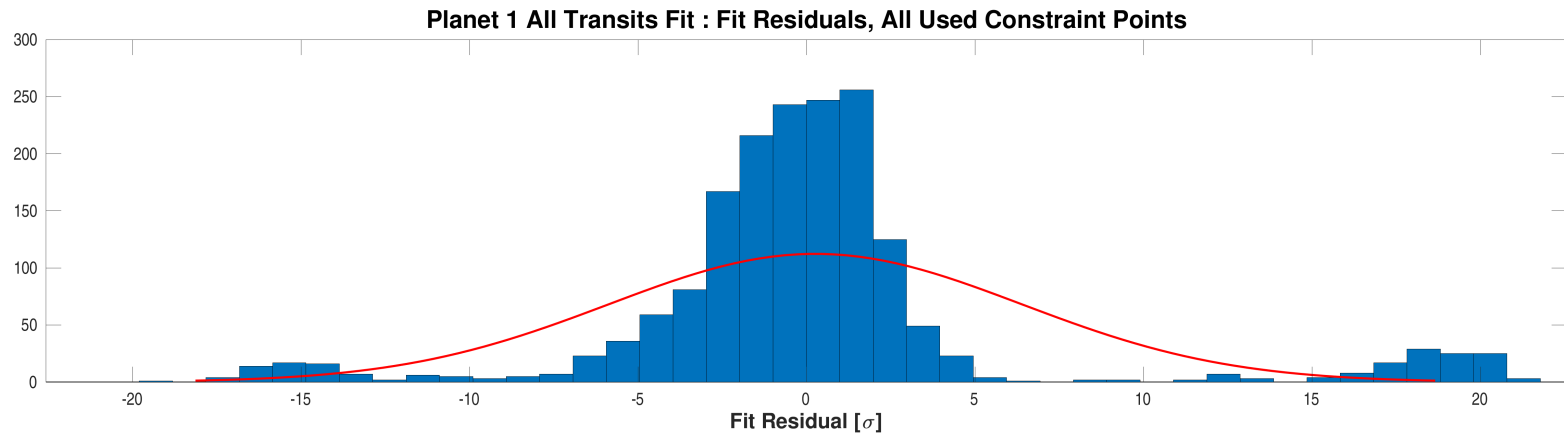
Appendix A Planet Candidate 1

A.1 Model Fitter: All Transits



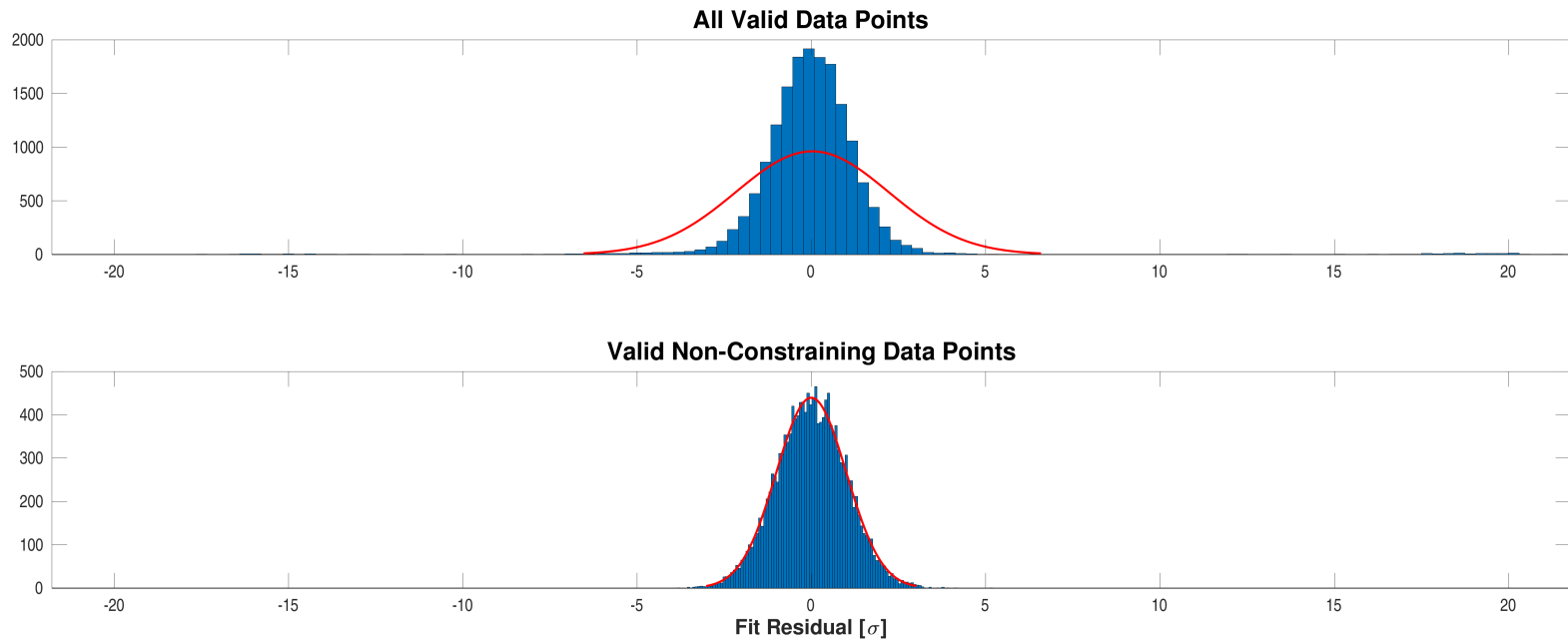
Robust weights distribution for CatId 299096355, Planet candidate 1. Top plot: all data points. Middle plot: all data points, folded per the fitted period and epoch. Bottom plot: all data points, folded and zoomed.

Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000299096355-01-all-robust-weights.fig`



Fit residuals distribution for CatId 299096355, 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/0000000299096355-01-all-histo-used.fig`



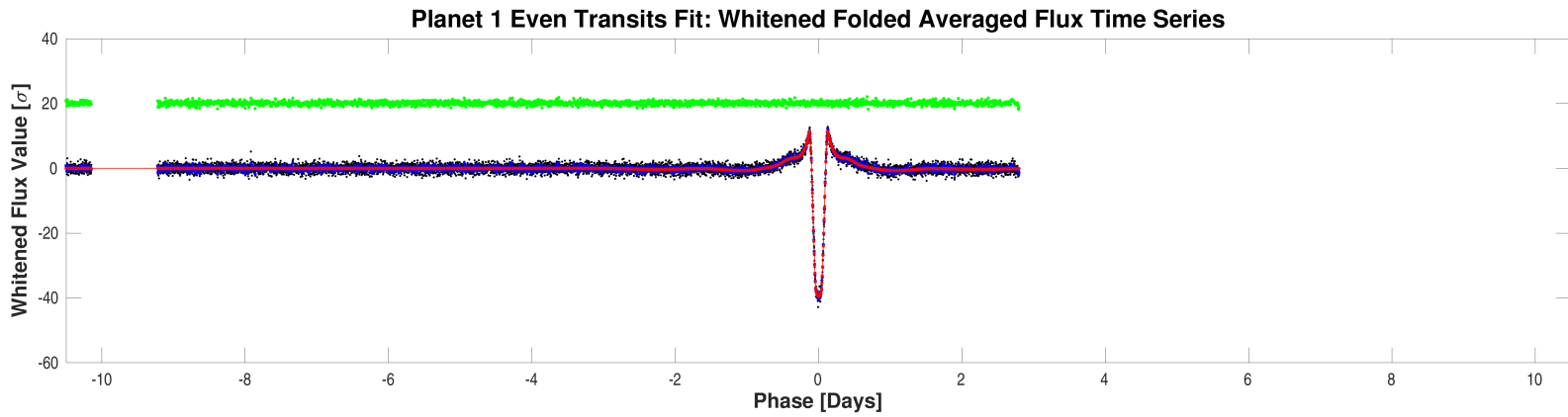
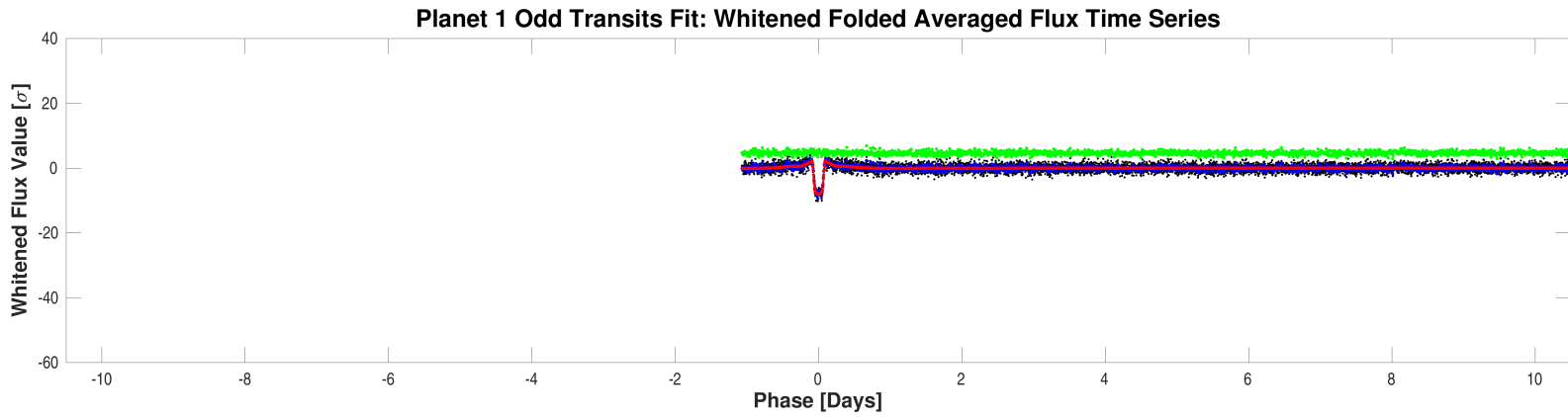
Fit residuals distribution for CatId 299096355, Planet candidate 1. Top plot: all valid data. Bottom plot: valid data not used to constrain fit (due to distance from a transit). Gaussian fits to the histograms are shown in red.

Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000299096355-01-all-histo-all-and-unused.fig`

A.2 Model Fitter: Odd & Even Transits

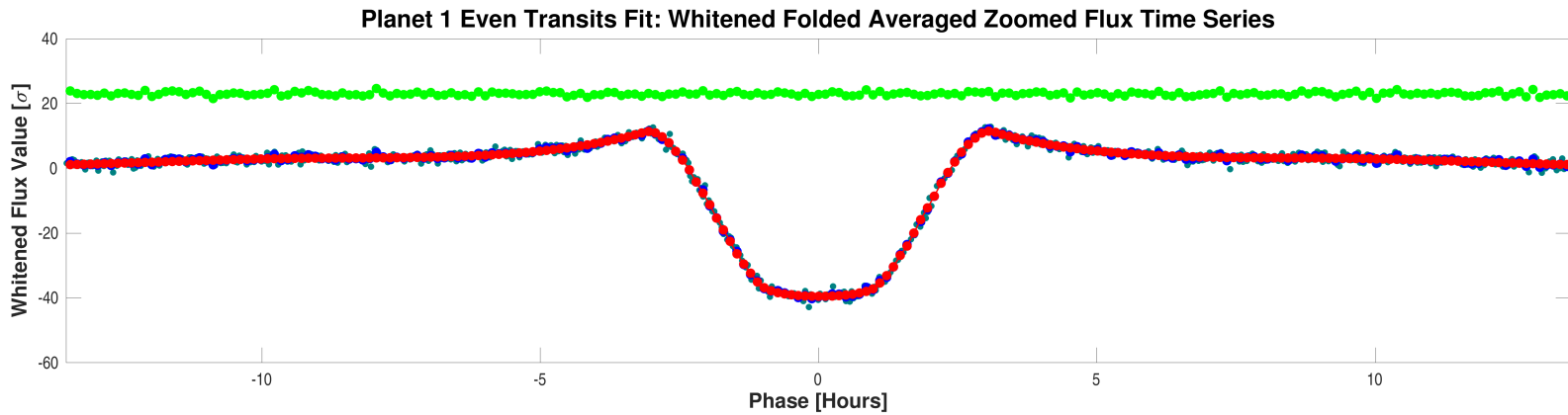
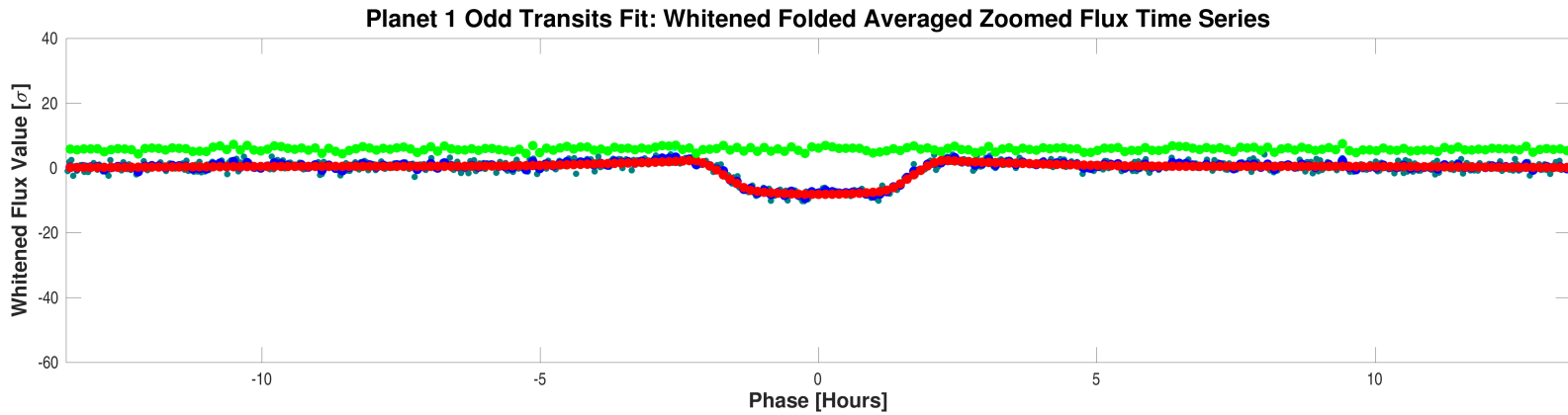
Parameter	Odd Transits Value	Odd Transits Uncertainty	Even Transits Value	Even Transits Uncertainty	Units	$\frac{\text{Difference}}{\ \text{Uncertainty}\ }$
SNR	71.8		357.6			
Orbital Period	20.9997254	0.0000e+00	20.9997254	0.0000e+00	days	
Transit Epoch	2011.3391885	5.7877e-04	2032.3396115	1.5824e-04	BTJD	1.0572e+00
Impact Parameter	0.6765	2.5927e-02	0.5274	5.5606e-03		5.6248e+00
Planet Radius to Star Radius Ratio	0.1564212	1.8270e-03	0.3480902	8.0575e-04		9.5987e+01
Semi-major Axis to Star Radius Ratio	33.4009	1.0516e+00	32.2691	1.2514e-01		1.0688e+00
Planet Radius	13.1251	1.2167e+00	29.2077	2.6869e+00	Earth radii	5.4526e+00
Semi-major Axis	0.1278	1.3306e-02	0.1278	1.3306e-02	AU	0.0000e+00
Effective Stellar Flux	8.4519	1.7812e+00	8.4519	1.7812e+00	Goldilocks	0.0000e+00
Equilibrium Temperature	435	2.2912e+01	435	2.2912e+01	Kelvin	0.0000e+00
Stellar Density	1.1352	1.0723e-01	1.0237	1.1910e-02	Solar density	1.0339e+00
Transit Depth	25609	3.7922e+02	132541	4.2771e+02	ppm	1.8707e+02
Transit Duration	4.5062	6.7667e-02	6.1703	1.7326e-02	hours	2.3823e+01
Transit Ingress Duration	1.0426	8.1029e-02	2.1324	2.4834e-02	hours	1.2858e+01
Eccentricity	0.0000	0.0000e+00	0.0000	0.0000e+00		
Peri Longitude	0.0000	0.0000e+00	0.0000	0.0000e+00	degrees	
Model Chi Square Statistic (DoF)	1494.0 (1728.0)		1494.0 (1728.0)			

DoF: Degrees of Freedom



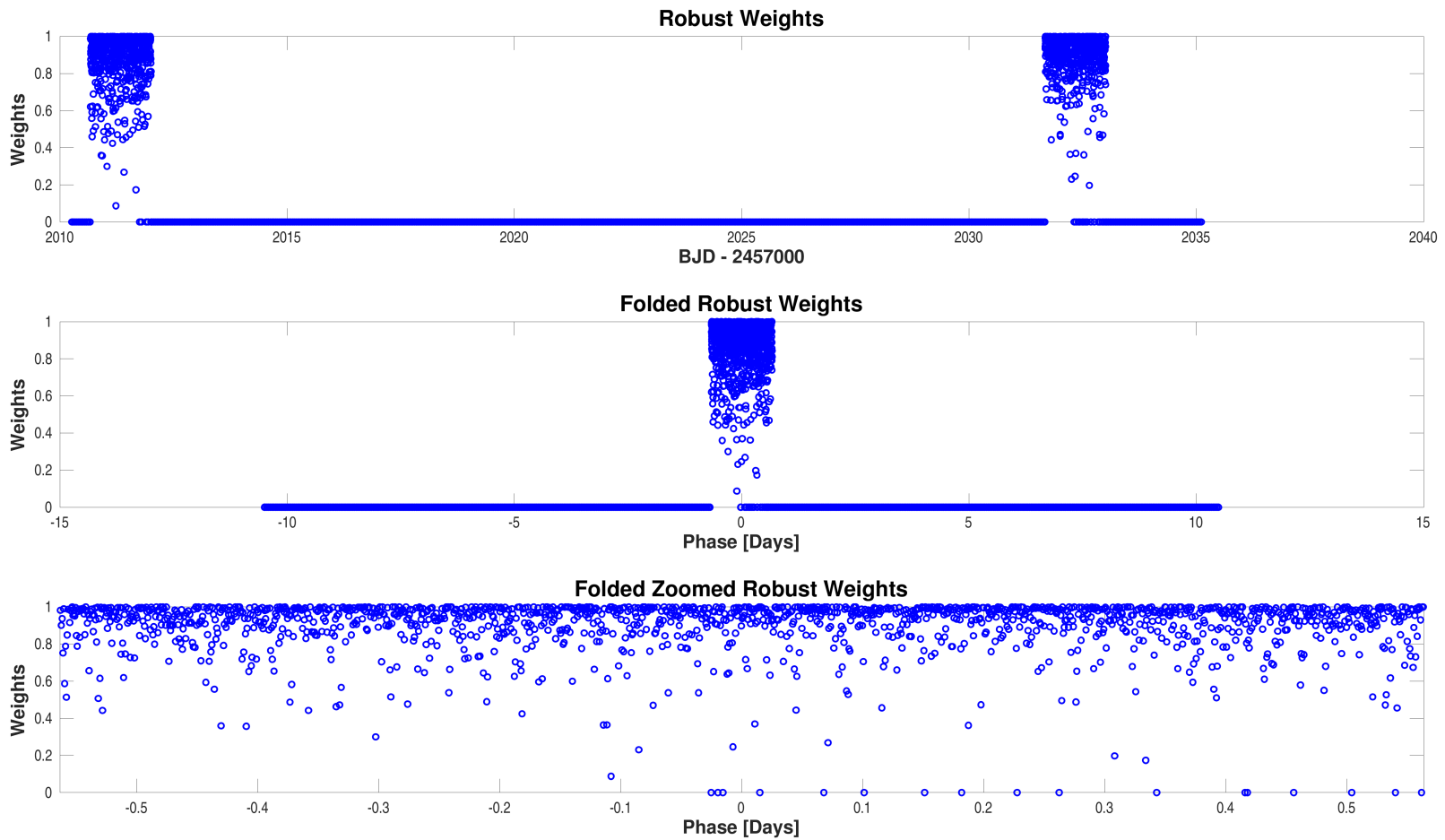
Folded flux time series for CatId 299096355, Planet candidate 1 in the whitened domain is plotted in black dots. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged values of the folded flux time series; the red dots represent the averaged values of the folded model light 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/0000000299096355-01-odd-even-whitened.fig`



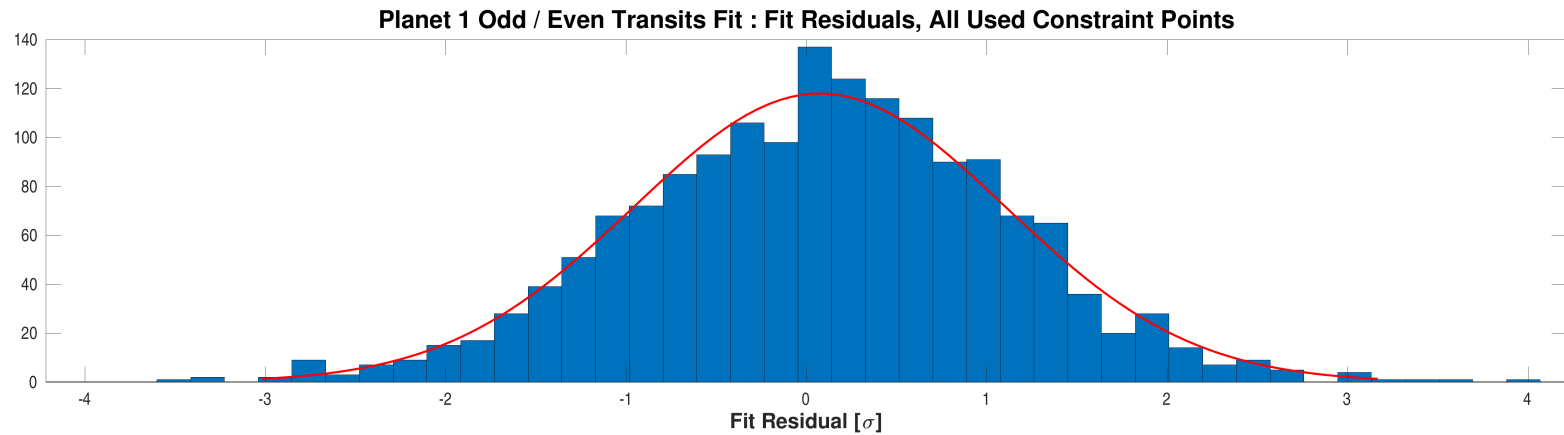
Folded flux time series for CatId 299096355, Planet candidate 1 in the whitened domain, zoomed on the transit. The flux data whose robust weights are larger/smaller than 0.1 are plotted in dark green/cyan dots, respectively. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged 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/0000000299096355-01-odd-even-whitened-zoomed.fig`



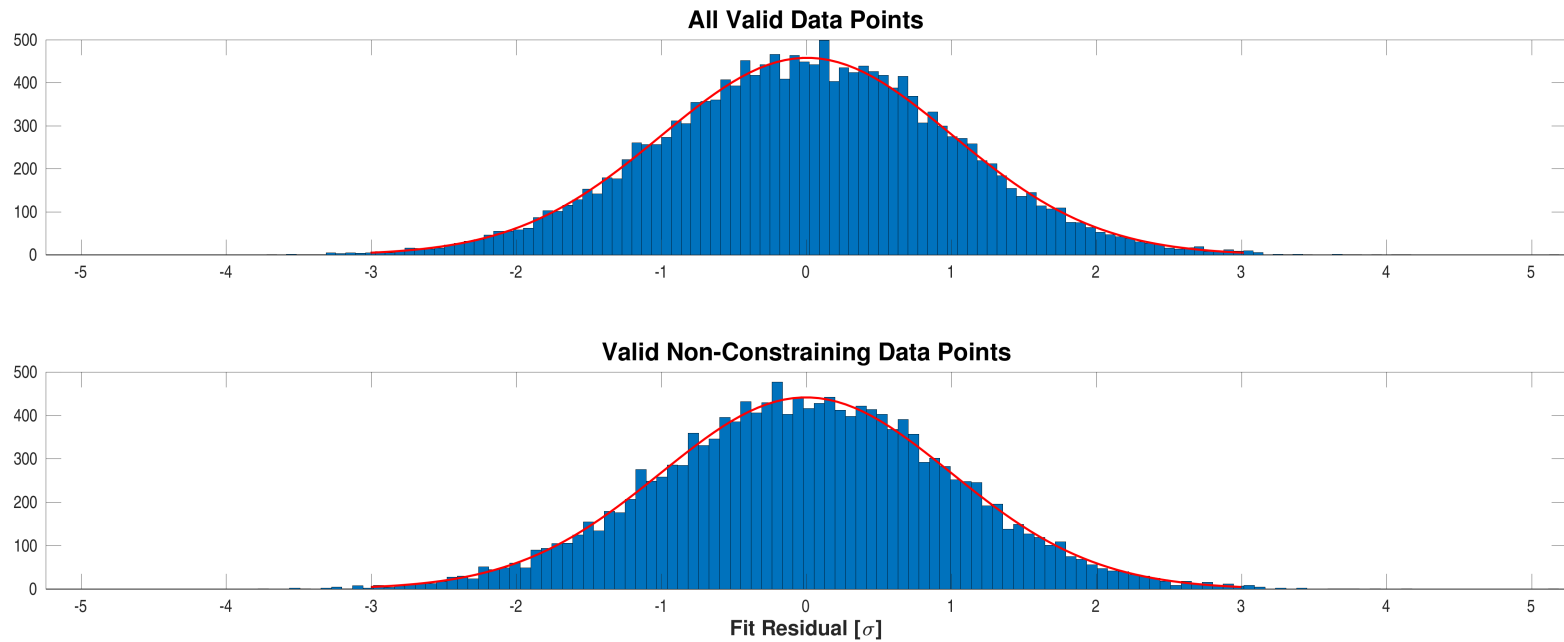
Robust weights distribution for CatId 299096355, Planet candidate 1. Top plot: all data points. Middle plot: all data points, folded per the fitted period and epoch. Bottom plot: all data points, folded and zoomed.

Open `./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000299096355-01-odd-even-robust-weights.fig`



Fit residuals distribution for CatId 299096355, 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.

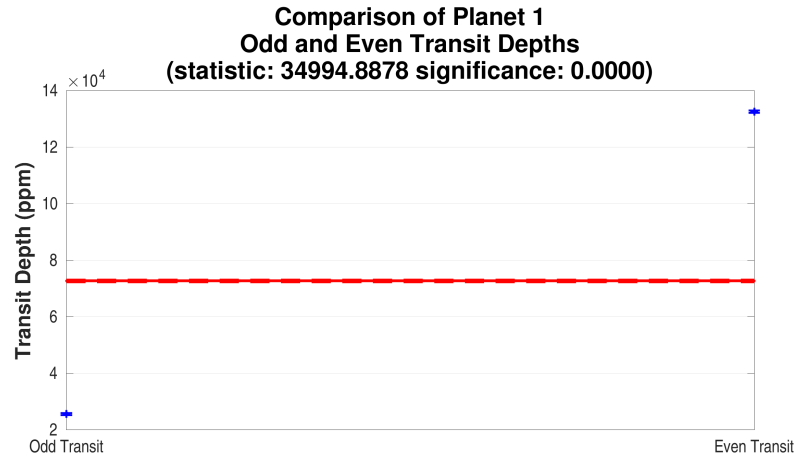
Open `./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000299096355-01-odd-even-histo-used.fig`



Fit residuals distribution for CatId 299096355, 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/0000000299096355-01-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 299096355, planet 1. A significance level close to 1/0 favors a transiting planet/an eclipsing binary. Open `./planet-01/binary-discrimination-test-results/0000000299096355-01-eclipsing-binary-discrimination-tests.fig`

Appendix B Alerts

Time	Severity	Message
2055.4983	warning	All fit coefficients fractional change not < 0.01 in 15 iterations for ts2 data. (target=1, catId=299096355, component=ghostDiagnosticTests)