



Data Validation (DV) Report
for TESS ID 28230919
Sectors 14 - 15

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

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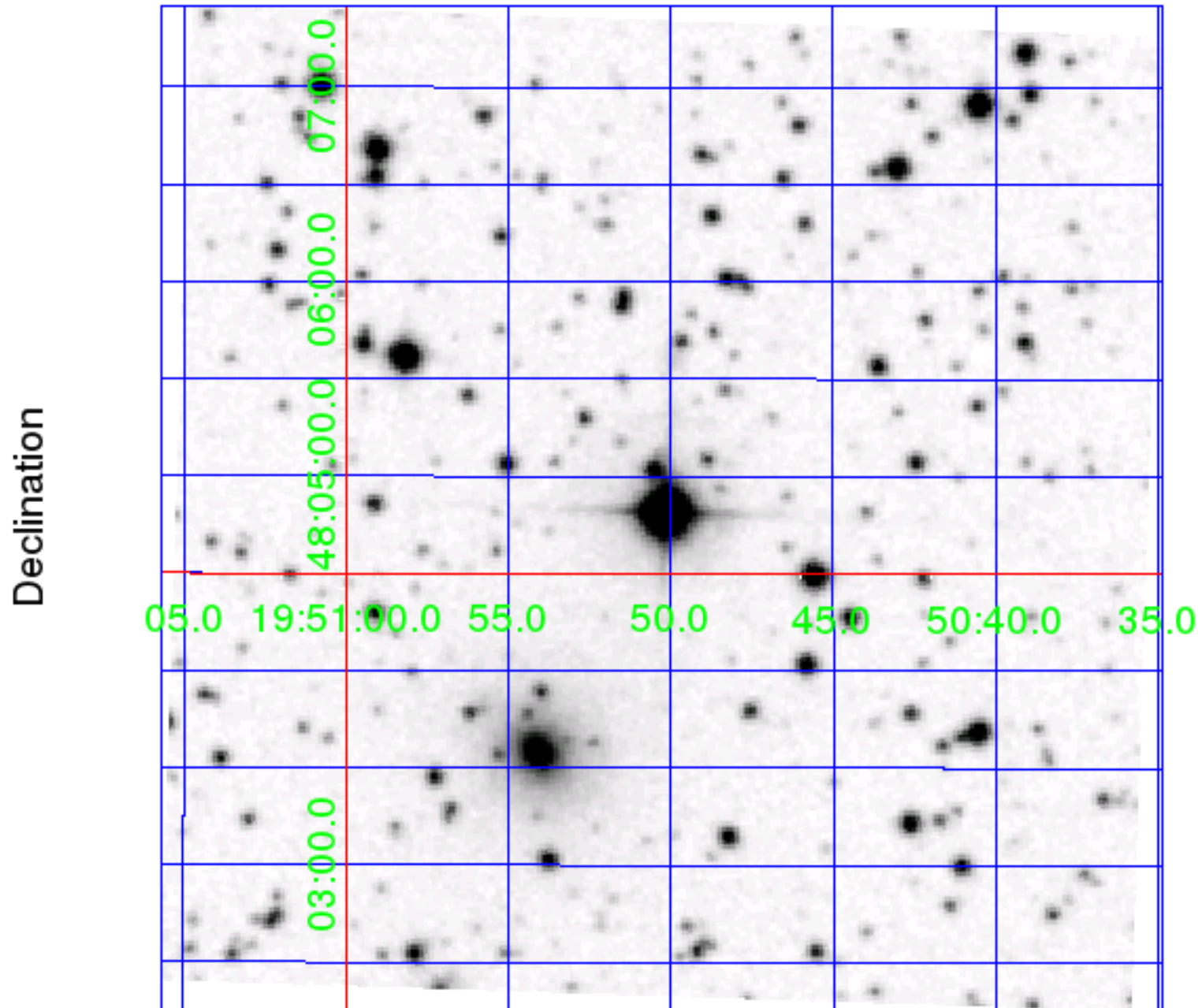
1 Summary

Target Properties	Value	Uncertainty	Units	Provenance
Catalog ID	28230919			
TOI ID	1144			
TESS Name	-			
RA	297.70936440	0	degrees	TIC8
Dec	48.08086038	0	degrees	TIC8
Magnitude	8.5077	0.006		TIC8
Radius	0.760	0.048	Solar radii	TIC8
Effective Temperature	4778	113	Kelvin	TIC8
log(g)	4.563	0.086511	cm/sec ²	TIC8
[M/H]	0.300	0.05268	Solar metallicity	TIC8
Stellar Density	1.755	0.367	Solar density	TIC8-Derived
Limb Darkening Coefficient 1	0.74654			
Limb Darkening Coefficient 2	-0.70802			
Limb Darkening Coefficient 3	1.2035			
Limb Darkening Coefficient 4	-0.48308			
Number of Planet Candidates	1			
TOI Model	toi-plus-2019-10-18_edited-2.csv			
TESS Names Model	-			
External TCE Model	-			
Software Revision	spoc-4.0.11-20191024			
Date Report Generated	25-Oct-2019 21:55:25 Z			

Sector	Target Table	Camera/ CCD	Crowding Metric	Flux Fraction
14	167	2:4	0.9844	0.8848
15	169	2:3	0.9823	0.8793

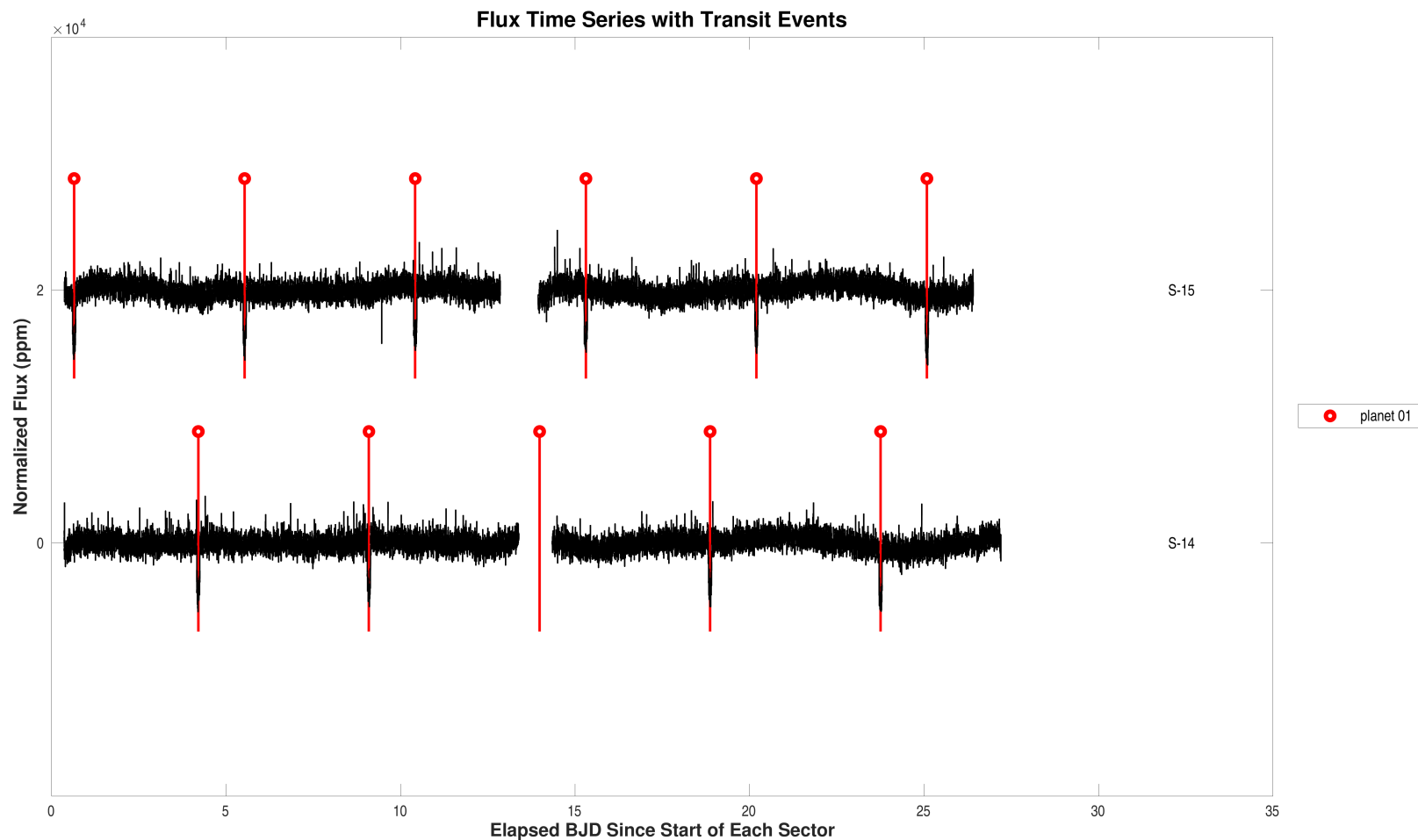
Planet Candidate	TOI ID	TESS Name	TOI Correlation	Period (days)	Period Ratio	Epoch (BTJD)	Semi-major Axis (AU)	Radius (Re)	Seff	Teq (K)	False Alarm	Suspected EB
1	1144.01	-	0.95	4.888	1.00	1687.206	0.05	4.9	100.9	808	0.00e+00	false

2 Survey Image

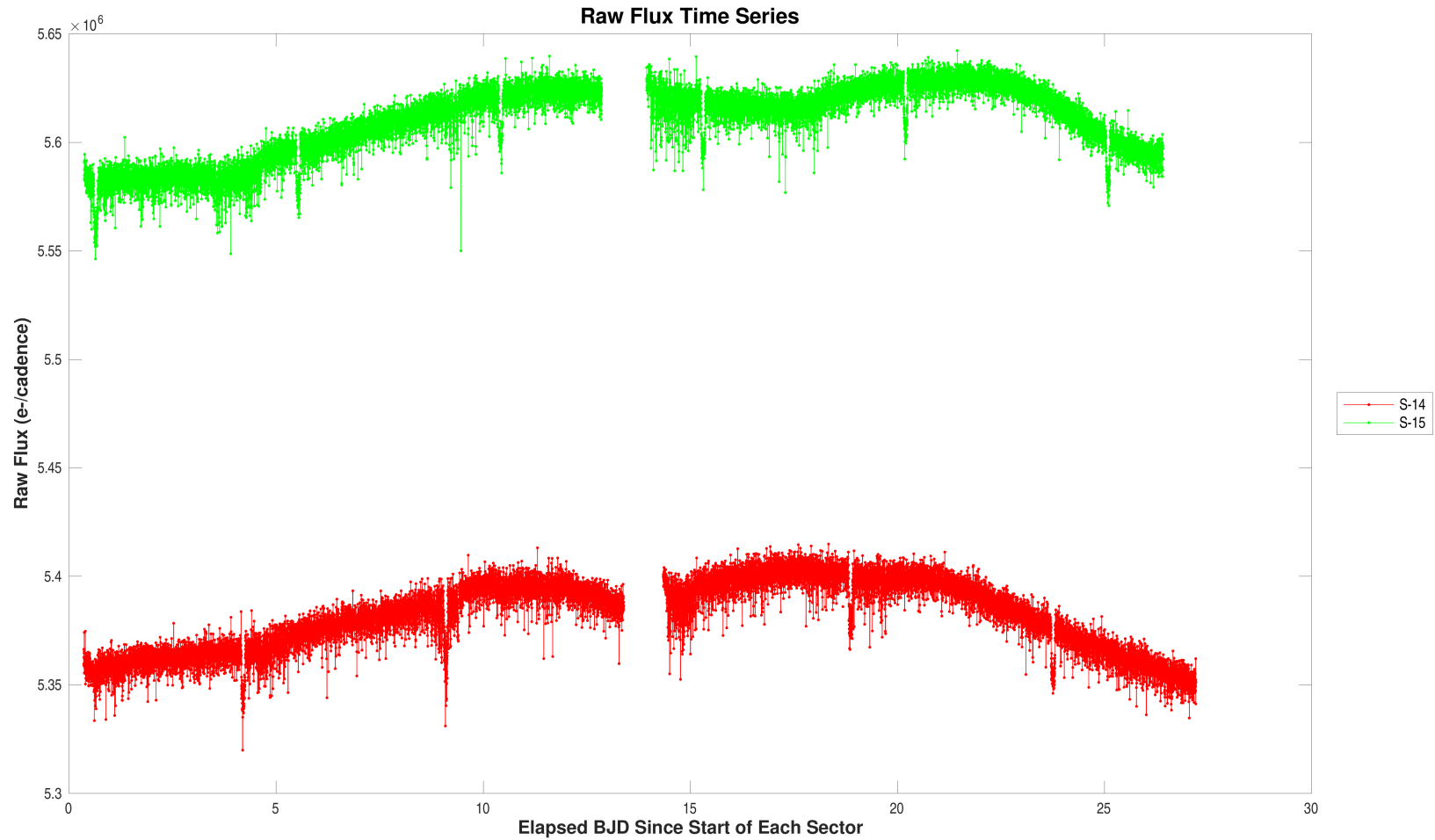


Digitized Sky Survey (DSS) red image. The 5' x 5' image is centered on the J2000 coordinates of target (28230919).

3 Flux Time Series



Summary plot of sector-stitched flux time series and transits for target 28230919, marked with DV fitted epoch/period (or TPS epoch/period if fit was not successful). Transits of identified planets are labeled with epoch BTJD and orbital period. For the data of sector 14, target table 167, start BJD is 2458683 and the vertical offset is 0 ppm. For the data of sector 15, target table 169, start BJD is 2458711 and the vertical offset is 20000 ppm. Open `./summary-plots/0000000028230919-00-flux-dv-fit-14-167.fig`



Summary plot of raw flux time series. For the data of sector 14, target table 167, start BJD is 2458683 and the vertical offset is 0 electrons/cadence. For the data of sector 15, target table 169, start BJD is 2458711 and the vertical offset is 230000 electrons/cadence.

Open `./summary-plots/000000028230919-00-raw-flux-14-167.fig`

4 Dashboards

Planet Candidate 1

Model Fitter	Stellar Radius 0.8 ± 0.0 Solar units		Core Aperture Correlation Statistic Value = 48.72 Significance = 100.00%		Ghost Diagnostic Test	
	Period = 4.9 ± 0.0 days Depth = 4239 ± 34 ppm Planet Radius = 4.9 ± 0.4 Earth radii Semi-major Axis = 0.1 ± 0.0 AU Effective Stellar Flux = 100.9 ± 17.0 Equilibrium Temperature = 808 ± 34 Kelvin Chi-squared/DoF = 0.8 SNR = 122.8		Halo Aperture Correlation Statistic Value = 20.13 Significance = 100.00% Core/Halo Ratio Ratio = 2.42			
Eclipsing Binary Discrimination Test	Odd-Even Depth Comparison Statistic Value = 1.61e-01 Significance = 68.86%		Offsets Relative to Out of Transit Centroid Source RA Offset = -5.23e-01 ± 2.50e+00 arcsec (-0.21 σ) Source Dec Offset = 1.32e+00 ± 2.74e+00 arcsec (0.48 σ) Source Offset Distance = 1.42e+00 ± 2.71e+00 arcsec (0.52 σ) Offsets Relative to TIC Position Source RA Offset = -9.08e-01 ± 2.53e+00 arcsec (-0.36 σ) Source Dec Offset = 1.93e+00 ± 2.89e+00 arcsec (0.67 σ) Source Offset Distance = 2.13e+00 ± 2.83e+00 arcsec (0.75 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 = 11 Max Multiple Event Statistic = 114.4		Bootstrap Test	

Summary of model fitter results and validation test results for target 28230919, 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

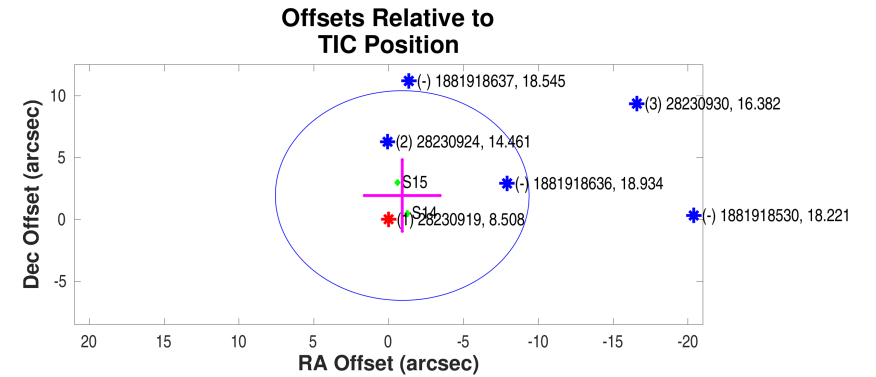
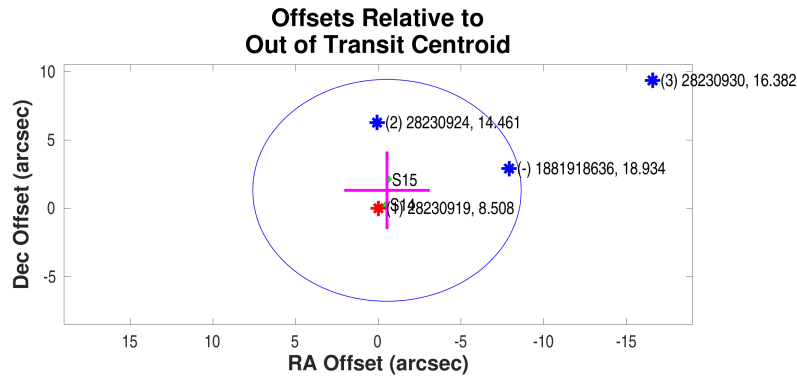
Mean offset from the PRF fit to the out of transit image

	RA	Dec	Units
Offset	$-0.5231 \pm 2.50e + 00$	$1.3153 \pm 2.74e + 00$	arcseconds
Offset/ σ	-0.21	0.48	
Offset Distance	$1.4155 \pm 2.71e + 00$		arcseconds
Offset Distance/ σ	0.52		
3σ Radius	8.1157		arcseconds

Mean offset from the TIC RA and Dec

	RA	Dec	Units
Offset	$-0.9084 \pm 2.53e + 00$	$1.9292 \pm 2.89e + 00$	arcseconds
Offset/ σ	-0.36	0.67	
Offset Distance	$2.1323 \pm 2.83e + 00$		arcseconds
Offset Distance/ σ	0.75		
3σ Radius	8.4793		arcseconds

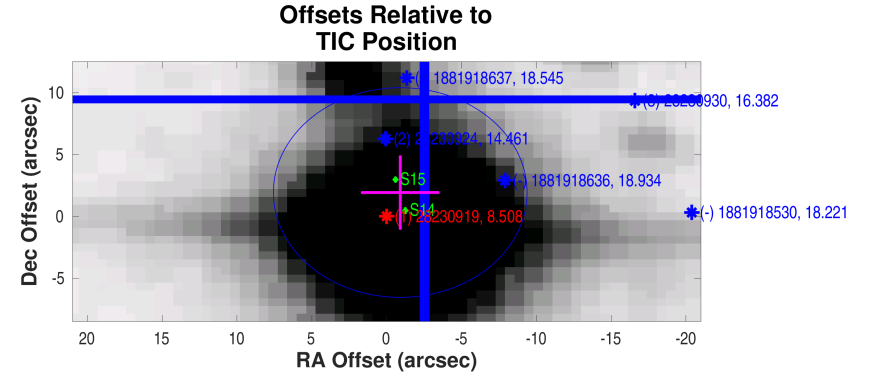
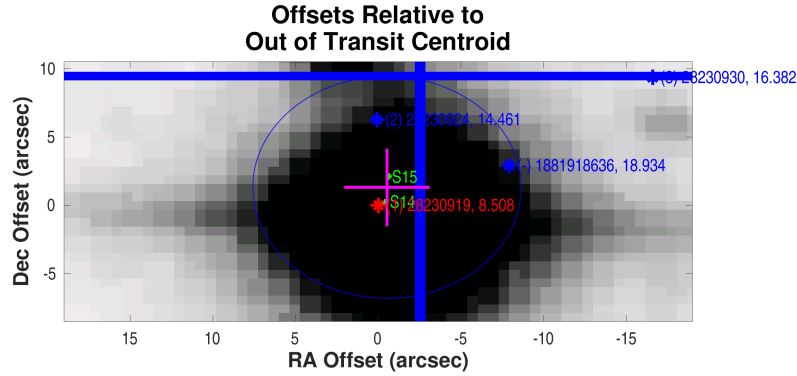
Planet Candidate 1



Difference image centroid offsets for target 28230919, 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/0000000028230919-01-difference-image-centroid-offsets.fig`

Planet Candidate 1



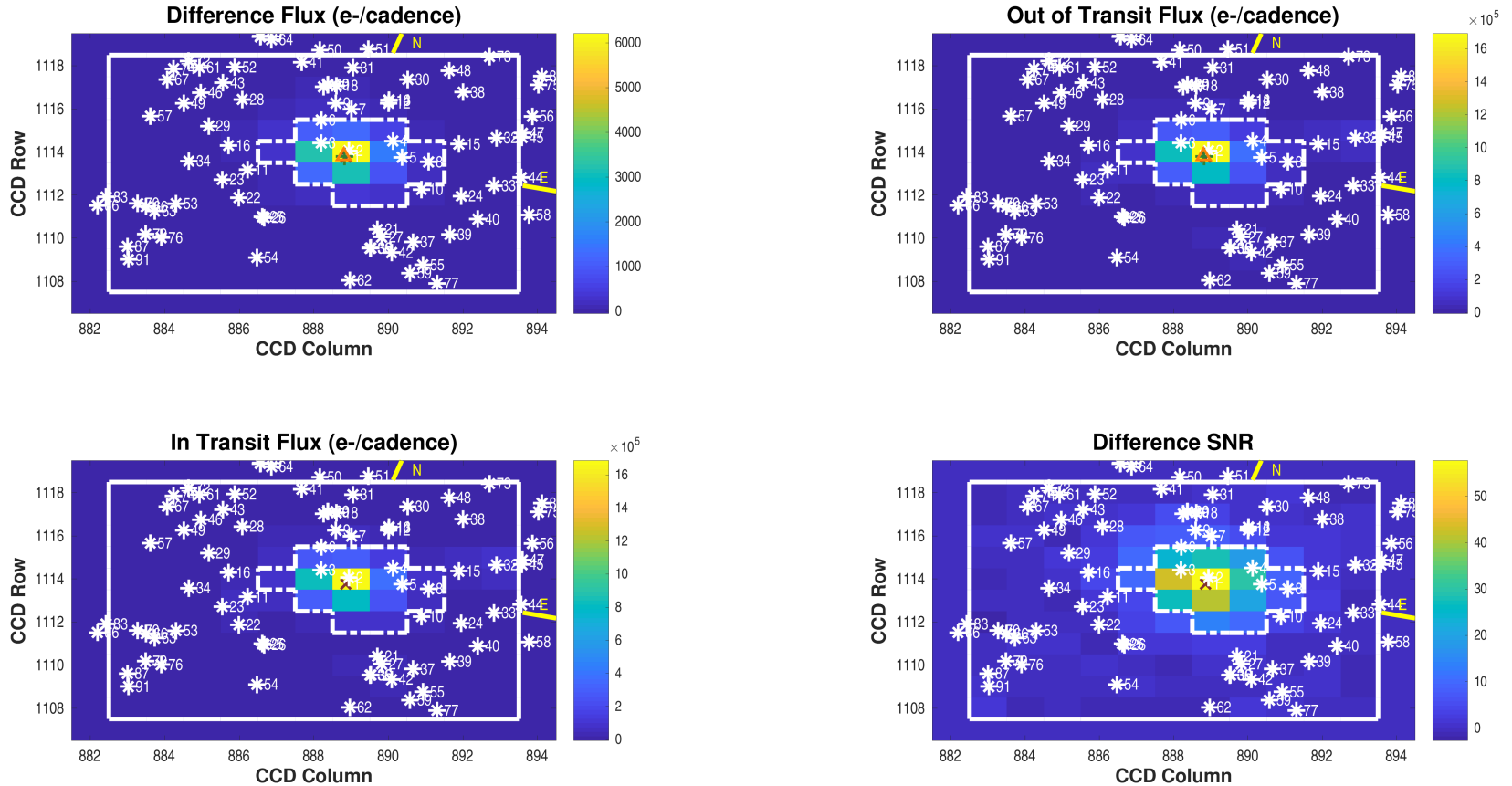
Difference image centroid offsets for target 28230919, planet candidate 1, displayed on survey image for given target. Left: difference image PRF centroid offsets in RA and Dec with respect to the per sector out-of-transit centroids for the given target. Right: difference image PRF centroid offsets in RA and Dec with respect to the TIC coordinates of the given target. Symbol key: green cross: per sector centroid offsets with 1-sigma error bars in RA and Dec; magenta cross: robust weighted mean offset over all sectors with 1-sigma error bars in RA and Dec; blue circle: 3-sigma radius of confusion for weighted mean offset; red asterisk: location of target star; blue asterisk: location of other TIC objects in the neighborhood. TIC ID and magnitude are noted in the text associated with each marked offset. 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/0000000028230919-01-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
Planet Candidate 1 / Sector 14 / Target Pixel Table 167



Difference image for target 28230919, planet candidate 1, sector 14, target pixel table 167. Upper left: difference between mean flux out-of-transit and in-transit; upper right: mean out-of-transit flux; lower left: mean in-transit flux; lower right: difference between mean flux out-of-transit and in-transit after normalizing by the uncertainty in the difference for each pixel. The optimal aperture is outlined with a white dash-dotted line in each panel and the target mask is outlined with a solid white line. Symbol key: x: target position from TIC RA and Dec converted to CCD coordinates via motion polynomials; *: position of nearby TIC objects converted to CCD coordinates via motion polynomials; +: PRF-fit location of target from out-of-transit image; triangle: PRF-fit location of transit source from the difference image. Number of transits = 4; number of valid in-transit cadences = 219; number of in-transit cadence gaps = 2; number of valid out-of-transit cadences = 595; number of out-of-transit cadence gaps = 2. Difference image quality metric = 1.00 (good).

Open `./planet-01/difference-image/0000000028230919-01-difference-image-14-167.fig`

PRF Fit of the Difference Image

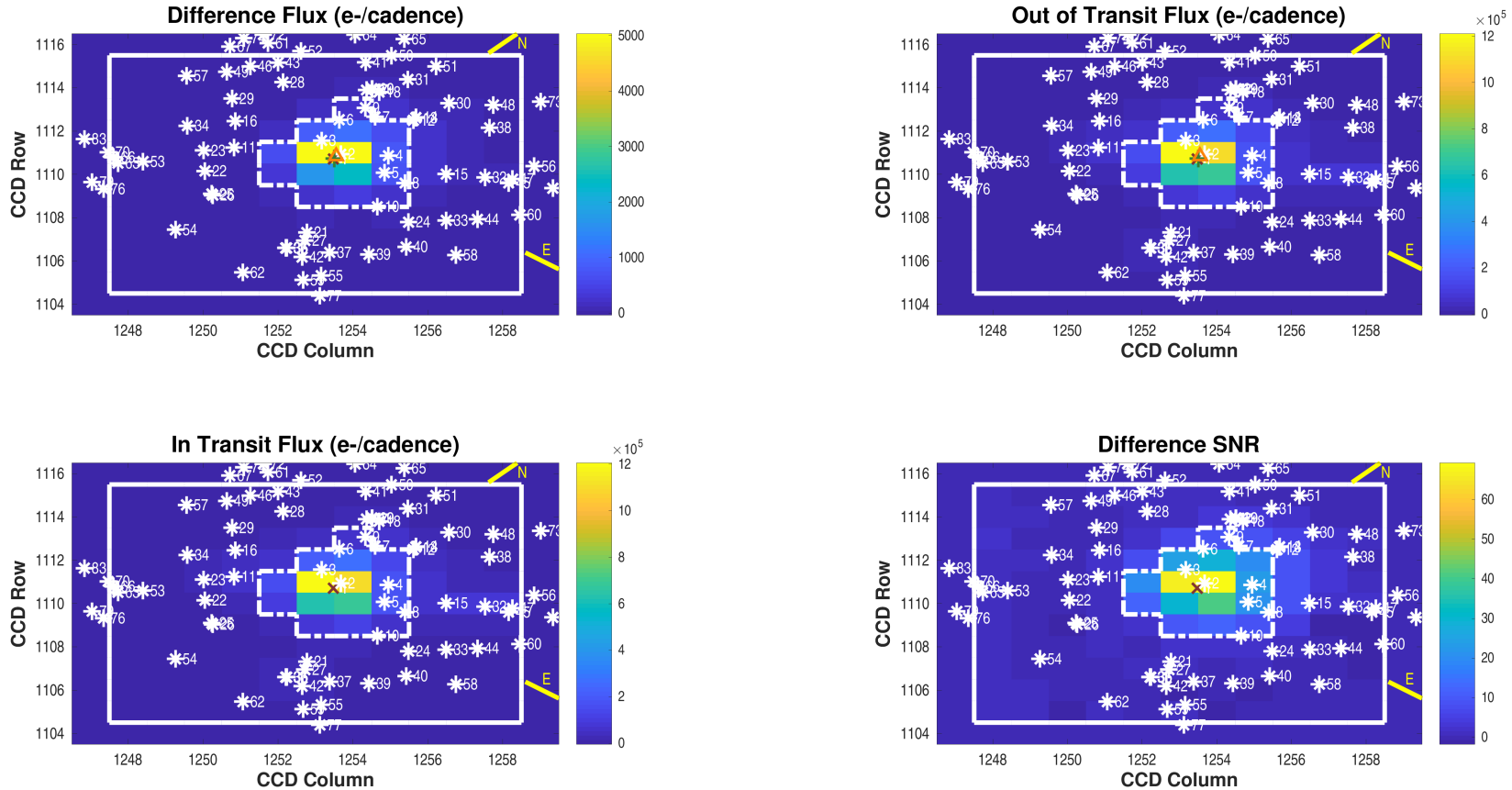
Offset from the PRF fit to the out of transit image

	Row	Column	Units	RA	Dec	Units
Out of Transit Image Centroid	$1113.79 \pm 1.50e - 05$	$888.82 \pm 1.48e - 05$	pixels	$297.71004383 \pm 5.34e - 07$	$48.08220398 \pm 5.35e - 07$	degrees
Difference Image Centroid	$1113.80 \pm 7.74e - 03$	$888.80 \pm 7.44e - 03$	pixels	$297.70987329 \pm 4.12e - 05$	$48.08225732 \pm 4.56e - 05$	degrees
Offset	$0.0143 \pm 7.74e - 03$	$-0.0168 \pm 7.44e - 03$	pixels	$-0.4102 \pm 9.91e - 02$	$0.1920 \pm 1.64e - 01$	arcseconds
Offset/ σ	1.85	-2.26		-4.14	1.17	
Offset Distance	$0.0221 \pm 7.10e - 03$		pixels	$0.4529 \pm 1.07e - 01$		arcseconds
Offset Distance/ σ	3.11			4.22		

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

	Row	Column	Units	RA	Dec	Units
TIC Reference Centroid	$1113.77 \pm 9.17e - 05$	$888.86 \pm 9.30e - 05$	pixels	$297.71039007 \pm 0.00e + 00$	$48.08212761 \pm 0.00e + 00$	degrees
Difference Image Centroid	$1113.80 \pm 7.74e - 03$	$888.80 \pm 7.44e - 03$	pixels	$297.70987329 \pm 4.12e - 05$	$48.08225732 \pm 4.56e - 05$	degrees
Offset	$0.0380 \pm 7.74e - 03$	$-0.0523 \pm 7.44e - 03$	pixels	$-1.2429 \pm 9.90e - 02$	$0.4670 \pm 1.64e - 01$	arcseconds
Offset/ σ	4.91	-7.03		-12.55	2.84	
Offset Distance	$0.0647 \pm 7.09e - 03$		pixels	$1.3277 \pm 1.04e - 01$		arcseconds
Offset Distance/ σ	9.12			12.80		

Difference Image
Planet Candidate 1 / Sector 15 / Target Pixel Table 169



Difference image for target 28230919, planet candidate 1, sector 15, target pixel table 169. 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 = 6; number of valid in-transit cadences = 330; number of in-transit cadence gaps = 3; number of valid out-of-transit cadences = 894; number of out-of-transit cadence gaps = 3. Difference image quality metric = 1.00 (good).

Open `./planet-01/difference-image/0000000028230919-01-difference-image-15-169.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	$1110.74 \pm 1.43e - 05$	$1253.51 \pm 1.37e - 05$	pixels	$297.71040987 \pm 6.09e - 07$	$48.08237047 \pm 5.96e - 07$	degrees
Difference Image Centroid	$1110.83 \pm 7.09e - 03$	$1253.55 \pm 6.67e - 03$	pixels	$297.71014793 \pm 4.01e - 05$	$48.08295944 \pm 3.86e - 05$	degrees
Offset	$0.0983 \pm 7.09e - 03$	$0.0437 \pm 6.67e - 03$	pixels	$-0.6300 \pm 9.64e - 02$	$2.1203 \pm 1.39e - 01$	arcseconds
Offset/ σ	13.87	6.56		-6.54	15.25	
Offset Distance	$0.1076 \pm 6.97e - 03$		pixels	$2.2119 \pm 1.38e - 01$		arcseconds
Offset Distance/ σ	15.45			16.04		

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

	Row	Column	Units	RA	Dec	Units
TIC Reference Centroid	$1110.71 \pm 1.05e - 04$	$1253.48 \pm 1.04e - 04$	pixels	$297.71039403 \pm 0.00e + 00$	$48.08213250 \pm 0.00e + 00$	degrees
Difference Image Centroid	$1110.83 \pm 7.09e - 03$	$1253.55 \pm 6.67e - 03$	pixels	$297.71014793 \pm 4.01e - 05$	$48.08295944 \pm 3.86e - 05$	degrees
Offset	$0.1291 \pm 7.09e - 03$	$0.0721 \pm 6.67e - 03$	pixels	$-0.5919 \pm 9.64e - 02$	$2.9770 \pm 1.39e - 01$	arcseconds
Offset/ σ	18.20	10.81		-6.14	21.41	
Offset Distance	$0.1478 \pm 6.93e - 03$		pixels	$3.0352 \pm 1.39e - 01$		arcseconds
Offset Distance/ σ	21.34			21.85		

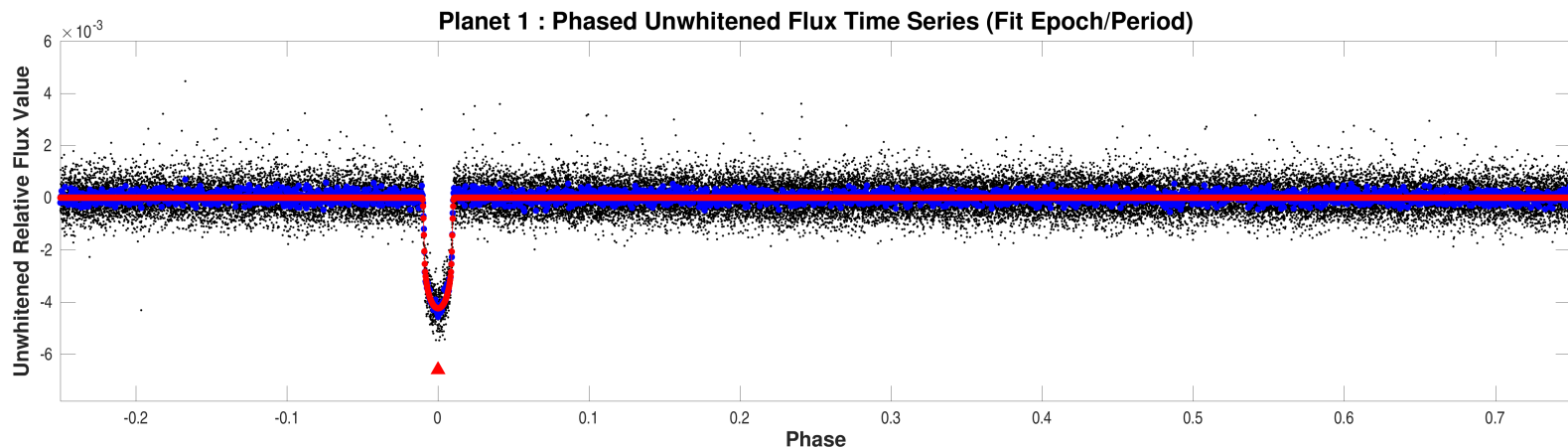
5.2 Difference Image TIC Key

Index	Catalog ID	Mag	RA (degrees)	Dec (degrees)	Distance (arcsec)
1	28230919	8.508	297.71039202	48.08213002	0.00
2	28230924	14.461	297.71042281	48.08387399	6.28
3	28230930	16.382	297.70349711	48.08473116	19.04
4	28230935	16.028	297.71927056	48.08821987	30.60
5	28230929	17.322	297.72297206	48.08441544	31.35
6	28230942	16.953	297.70121866	48.09063140	37.73
7	28230950	15.888	297.70683673	48.09472419	46.14
8	28230926	14.519	297.72929431	48.08432619	46.14
9	28230951	16.911	297.70276078	48.09558693	51.80
10	1881918608	17.387	297.73051699	48.07688123	51.96
11	28230906	12.164	297.68980330	48.07472080	56.24
12	1881918644	15.465	297.71450206	48.09778997	57.24
13	28230962	14.250	297.71430000	48.09853700	59.81
14	1881918645	15.282	297.71420745	48.09863440	60.12
15	28230941	16.147	297.73424514	48.09019134	64.29
16	28230917	17.251	297.68313812	48.08017024	65.93
17	1881918638	16.888	297.69833552	48.09929206	68.25
18	28230969	14.972	297.70111413	48.10010341	68.44
19	28230968	16.550	297.69903300	48.10002500	69.98
20	1881918623	16.782	297.69909158	48.10006860	70.06
21	28230891	16.289	297.72471433	48.06477363	71.35
22	28230896	14.128	297.69074475	48.06714545	71.71
23	28230901	14.623	297.68519076	48.07113502	72.39
24	28230912	17.009	297.74005227	48.07683597	73.84
25	28230889	15.959	297.69786776	48.06321759	74.45
26	1881918528	17.315	297.69840037	48.06304026	74.53
27	28230885	17.313	297.72643899	48.06296892	79.04
28	28230946	14.739	297.68153623	48.09264184	79.05
29	28230927	15.030	297.67677051	48.08436612	81.26
30	1881918639	17.471	297.71636636	48.10475028	82.69
31	28230982	15.197	297.70293835	48.10546965	85.91
32	28230947	11.649	297.74198594	48.09334301	86.04
33	28230920	15.120	297.74627597	48.08088160	86.42
34	28230905	15.784	297.67589247	48.07448003	87.42
35	28230875	13.373	297.72515400	48.05969200	88.23
36	10000766665	12.607	297.72500600	48.05959700	88.41
37	28230887	16.251	297.73394007	48.06298795	89.20
38	28230977	15.758	297.72993903	48.10376738	90.98

Index	Catalog ID	Mag	RA (degrees)	Dec (degrees)	Distance (arcsec)
39	28230893	17.506	297.74137848	48.06647410	93.44
40	28230903	14.850	297.74603316	48.07160359	93.72
41	28230980	16.130	297.69102574	48.10475691	93.83
42	28230873	17.140	297.73024699	48.05936649	94.85
43	28230954	15.588	297.67555031	48.09614502	97.81
44	28230925	17.247	297.75151853	48.08415141	99.18
45	28230948	14.762	297.74762999	48.09452748	100.06
46	28230944	17.247	297.67162660	48.09265187	100.63
47	28230952	17.323	297.74729811	48.09569403	101.31
48	28230986	17.174	297.72471776	48.10871332	101.71
49	28230939	16.121	297.66887896	48.08922201	103.05
50	28230988	15.823	297.69383185	48.10866336	103.49
51	28230992	15.676	297.70450657	48.11087675	104.45
52	28230972	17.098	297.67661849	48.10066778	105.13
53	28230886	15.836	297.67733093	48.06296910	105.26
54	28230861	14.596	297.70076154	48.05244311	109.35
55	28230870	15.283	297.73843557	48.05750823	111.38
56	28230971	16.537	297.74780401	48.10040630	111.47
57	28230928	17.420	297.66276351	48.08447769	114.86
58	28230907	16.406	297.75698716	48.07484343	115.09
59	28230867	16.427	297.73636339	48.05484755	116.40
60	28230938	17.348	297.75790285	48.08920801	117.07
61	28230963	17.056	297.66875430	48.09905156	117.21
62	28230858	14.557	297.72376720	48.05046215	118.46
63	28230876	16.545	297.67333148	48.06017741	119.12
64	28230990	16.585	297.68199574	48.10926923	119.20
65	28230998	15.532	297.69180061	48.11325403	120.64
66	28230879	16.235	297.67099374	48.06093115	121.67
67	28230949	15.180	297.66284622	48.09463440	122.89
68	28230991	13.333	297.67919856	48.10958730	124.09
69	1881921589	15.524	297.67919956	48.10980748	124.72
70	28230880	13.453	297.66878320	48.06141526	124.80
71	28230959	17.184	297.75683535	48.09780566	125.14
72	28230970	16.732	297.66570976	48.10029328	125.79
73	28231001	15.580	297.73225643	48.11402822	126.30
74	28230958	17.302	297.66314991	48.09766618	126.64
75	28230989	14.289	297.74600869	48.10879014	128.64
76	28230863	14.122	297.67747166	48.05357531	129.75

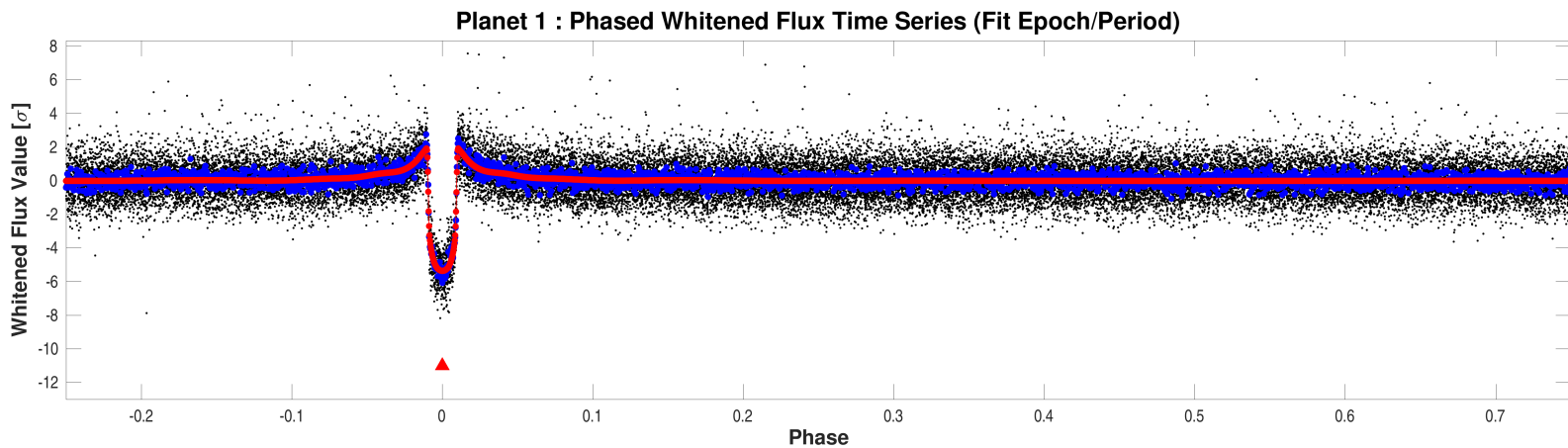
RA, Dec and Distances are corrected for proper motion. This table may not contain all of the objects shown.

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.

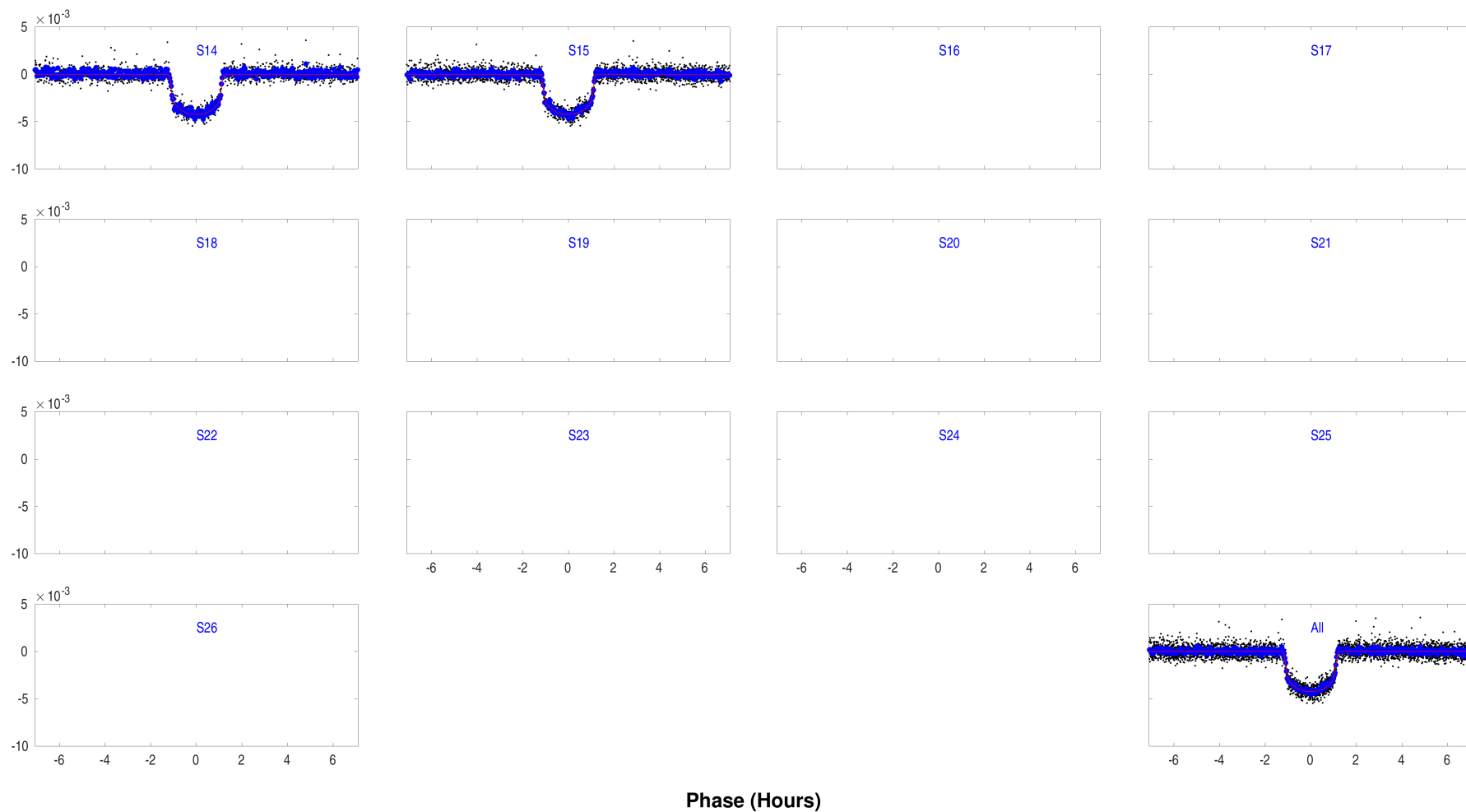
Open `./summary-plots/0000000028230919-01-phased-unwhitened-flux-time-series.fig`



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/0000000028230919-01-phased-whitened-flux-time-series.fig`

Planet: 1 Phased Unwhitened Flux Time Series by Sector



Phased unwhitened flux time series by sector for target 28230919, planet candidate 1. Period = 4.8878 days; transit epoch = 1687.2061 BTJD.
 Open `./summary-plots/000000028230919-01-phased-unwhitened-flux-time-series-by-sector.fig`

7 Planet Candidate 1

7.1 Model Fitter: All Transits

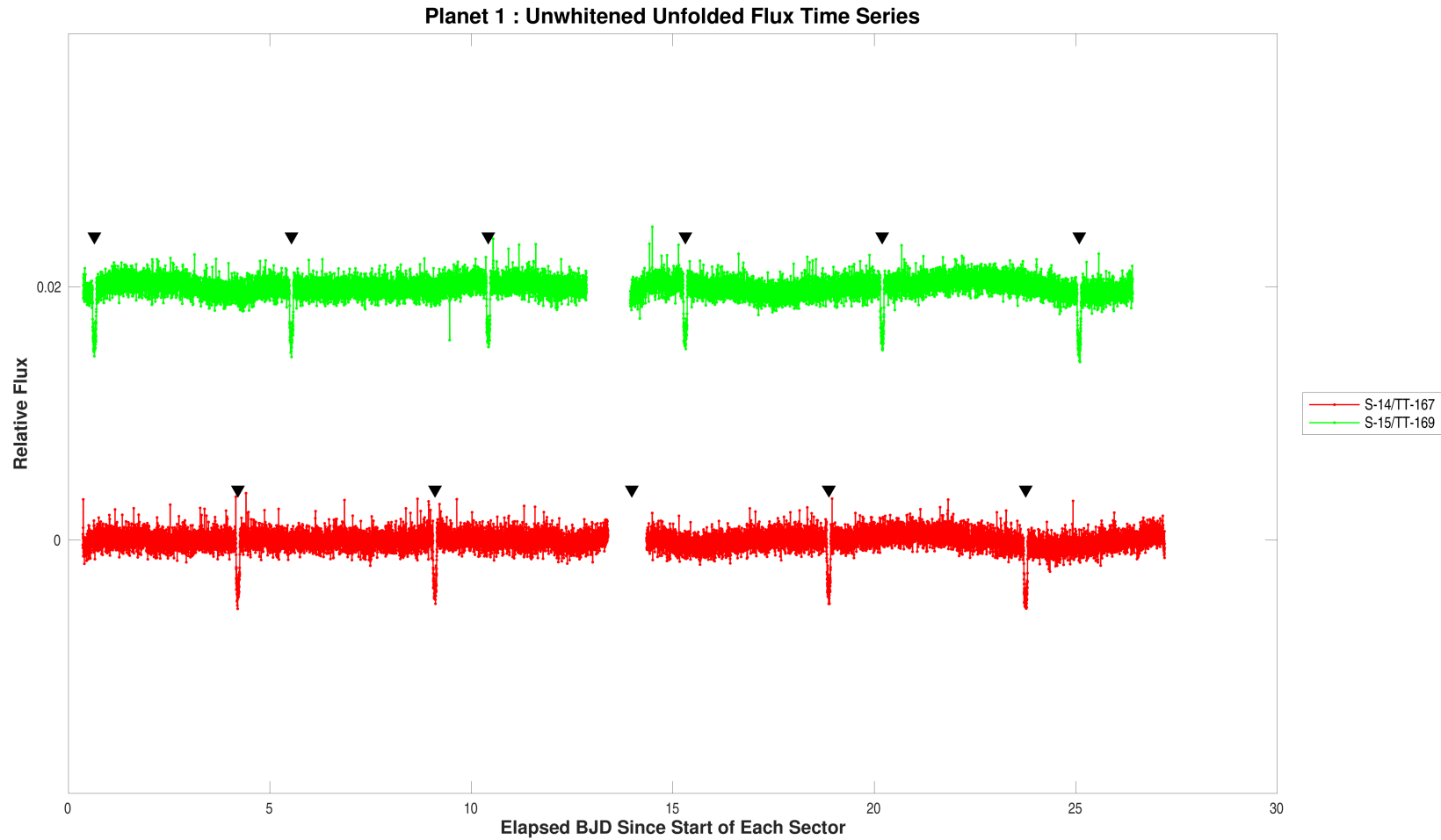
Model Characteristic	Name
Transit Model	mandel-agol_geometric_transit_model
Limb Darkening Model	claret_tess_nonlinear_limb_darkening_model

TCE Parameter	Value	Units
Trial Transit Pulse Duration	2.5	hours
Transit Epoch	1687.2053123	TJD
Orbital Period	4.8874979	days
Maximum SES	43.9	
Maximum MES	114.4	
Robust Statistic	105.5	
Chi Square Goodness of Fit Statistic (DoF)	1976.5 (669)	
Chi Square2 Statistic (DoF)	209.5 (942.7)	
Threshold for Desired PFA		

DoF: Degrees of Freedom

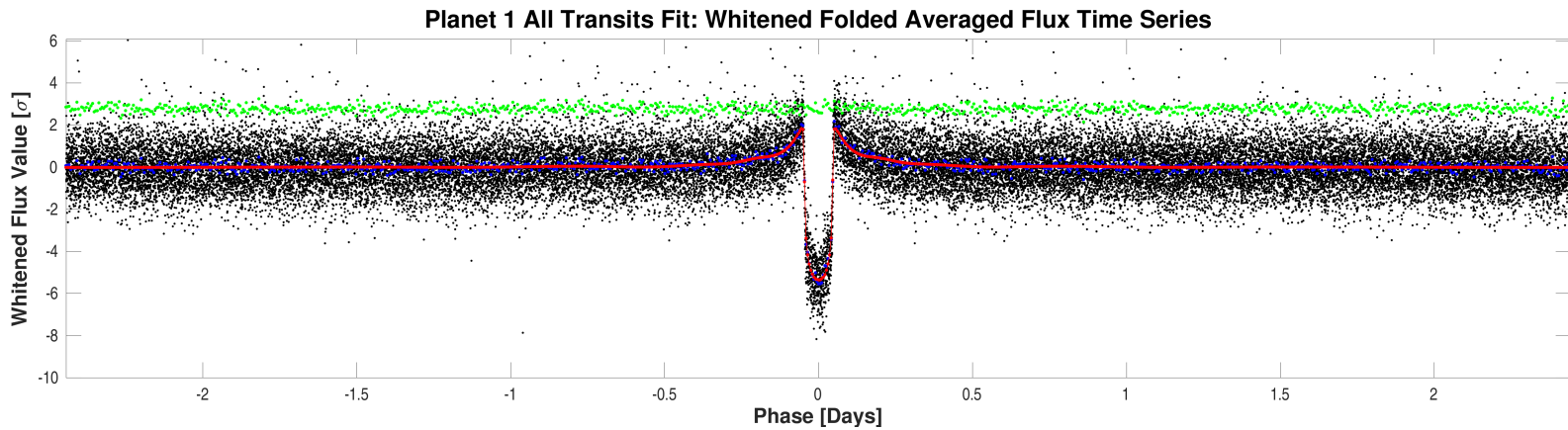
Parameter	Value	Uncertainty	Units
SNR	122.8		
Orbital Period	4.8878230	4.4165e-05	days
Transit Epoch	1687.2061169	2.7172e-04	BTJD
Impact Parameter	0.0894	1.4752e+00	
Planet Radius to Star Radius Ratio	0.0587627	1.9978e-03	
Semi-major Axis to Star Radius Ratio	16.7047	2.1830e+00	
Planet Radius	4.8745	3.5134e-01	Earth radii
Semi-major Axis	0.0517	4.0715e-03	AU
Effective Stellar Flux	100.8639	1.6986e+01	Goldilocks
Equilibrium Temperature	808	3.4029e+01	Kelvin
Stellar Density	2.6213	1.0277e+00	Solar density
Transit Depth	4239	3.4445e+01	ppm
Transit Duration	2.3598	3.5195e-02	hours
Transit Ingress Duration	0.1321	3.9409e-02	hours
Eccentricity	0.0000	0.0000e+00	
Peri Longitude	0.0000	0.0000e+00	degrees
Model Chi Square Statistic (DoF)	2867.9 (3466.5)		
Model Chi Square Goodness of Fit Statistic (DoF)	434.1 (740)		
Model Chi Square2 Statistic (DoF)	11.3 (9)		

DoF: Degrees of Freedom



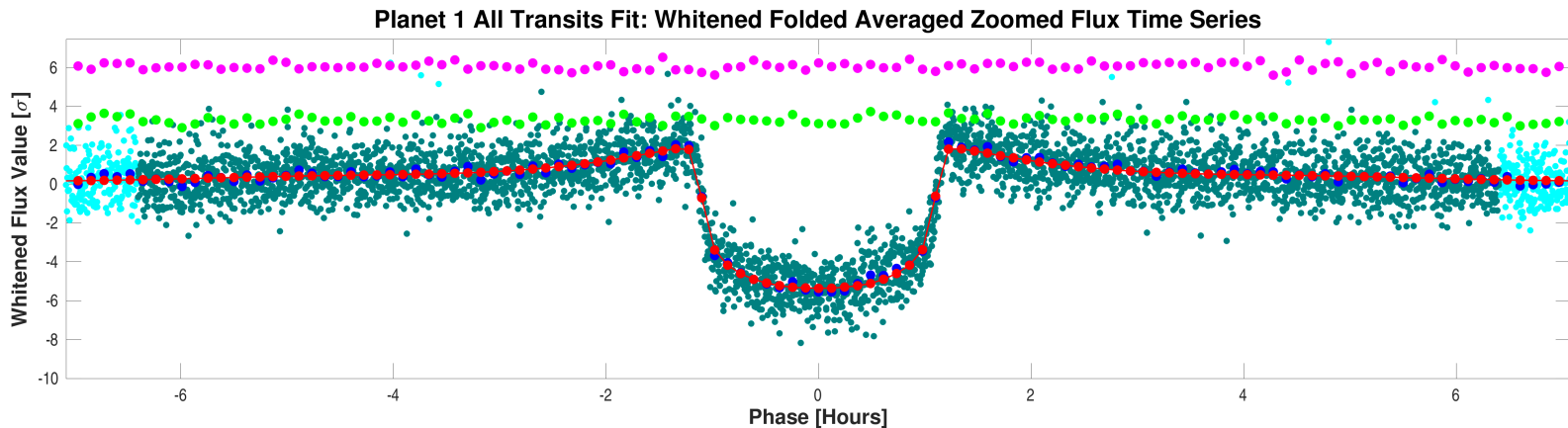
Flux time series for CatId 28230919, Planet candidate 1 in the unwhitened domain. For the data of Sector-14/TargetTableId-167, start BJD is 2458683 and the vertical offset is 0. For the data of Sector-15/TargetTableId-169, start BJD is 2458711 and the vertical offset is 0.02. Transit event markers indicate 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/000000028230919-01-all-unwhitened-14-167.fig`



Folded flux time series for CatId 28230919, 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/000000028230919-01-all-whitened.fig`



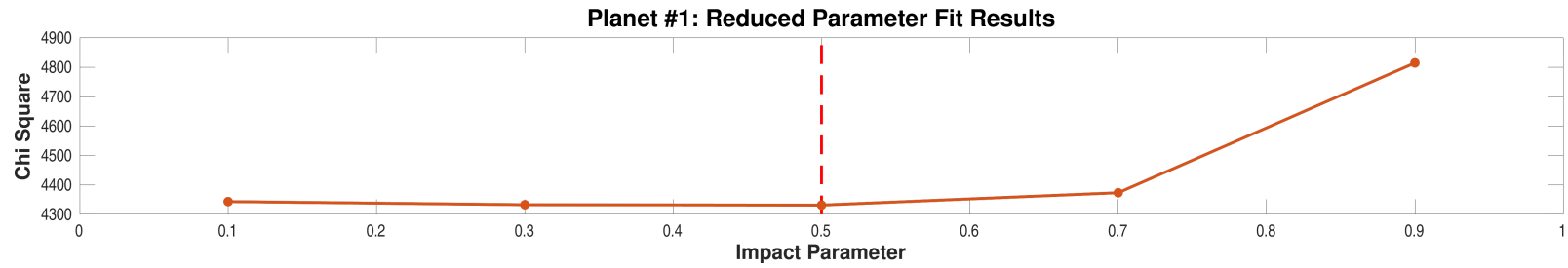
Folded flux time series for CatId 28230919, Planet candidate 1 in the whitened domain, zoomed on the transit. The flux data whose robust weights are larger/smaller than 0.1 are plotted in dark green/cyan dots, respectively. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged 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/000000028230919-01-all-whitened-zoomed.fig`

7.2 Model Fitter: Reduced Parameter Fit Results

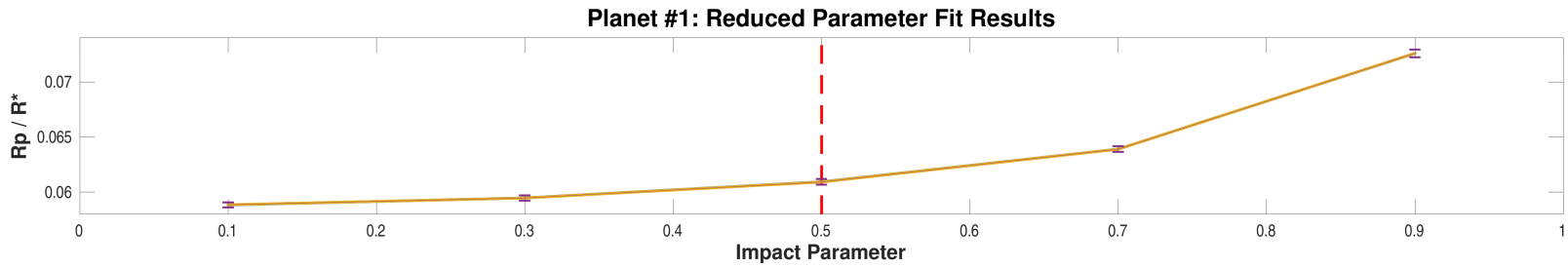
Impact Parameter	SNR	Model Chi Square	Planet Radius to Star Radius	Uncert	Semi-major Axis to Star Radius	Uncert	Transit Depth (ppm)	Uncert	Transit Duration (hours)	Uncert
0.10	128.7	4343.2	0.0588483	2.3949e-04	16.6801	5.3731e-02	4249	3.4393e+01	2.3614	7.5976e-03
0.30	128.8	4332.6	0.0594784	2.4175e-04	16.0047	5.2186e-02	4249	3.4347e+01	2.3727	7.7294e-03
0.50	128.8	4331.3	0.0609395	2.4825e-04	14.5564	4.9350e-02	4248	3.4408e+01	2.4034	8.1471e-03
0.70	128.6	4373.2	0.0639044	2.6362e-04	12.0672	4.5934e-02	4246	3.4801e+01	2.4852	9.4762e-03
0.90	125.5	4814.3	0.0725792	3.4063e-04	7.7306	4.6950e-02	4360	4.0224e+01	2.8403	1.7329e-02

Highlighted row is the best reduced-parameter model fit.



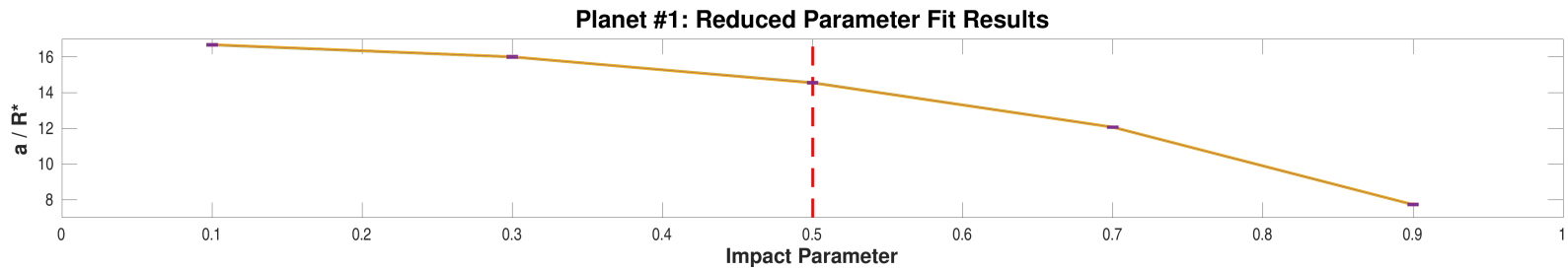
Model chi squares of reduced parameter fits vs. impact parameter for CatId 28230919, Planet candidate 1. The fit result with the minimum chi square is marked with a dashed line in the plot.

Open `./planet-01/planet-search-and-model-fitting-results/reduced-parameter-fits/0000000028230919-01-reduced-fits-chi-square.fig`



Ratios of planet radius to star radius of reduced parameter fits vs. impact parameter for CatId 28230919, 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/0000000028230919-01-reduced-fits-rp-over-rstar.fig`



Ratios of semimajor axis to star radius of reduced parameter fits vs. impact parameter for CatId 28230919, 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/0000000028230919-01-reduced-fits-a-over-rstar.fig`

7.3 Model Fitter: Trapezoidal Fit Results

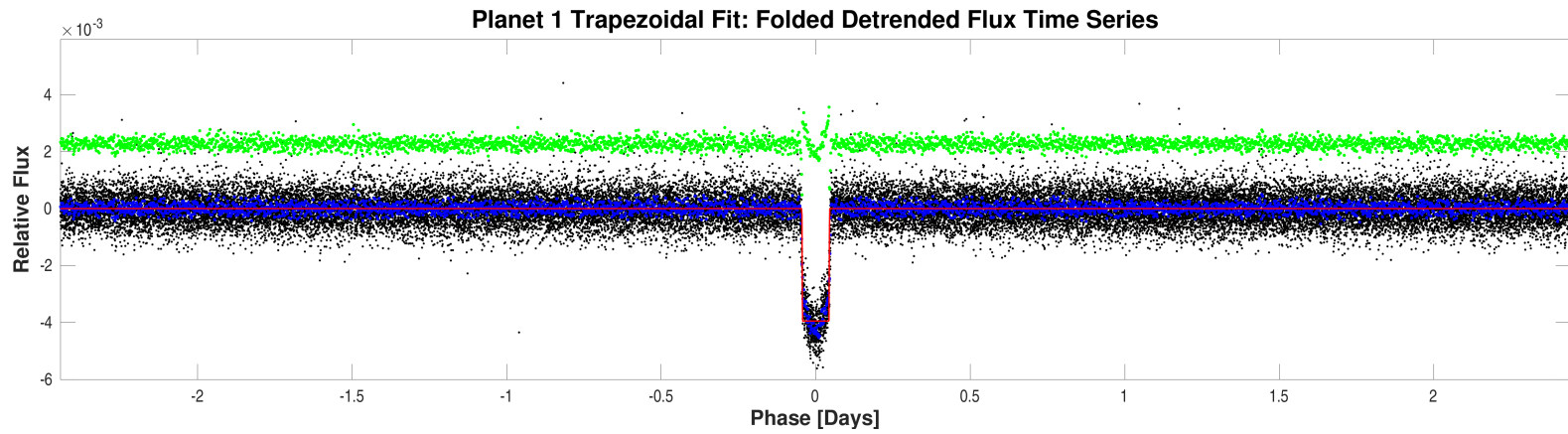
Model Characteristic	Name
Transit Model	trapezoidal_model
Limb Darkening Model	

TCE Parameter	Value	Units
Trial Transit Pulse Duration	2.5	hours
Transit Epoch	1687.2053123	TJD
Orbital Period	4.8874979	days
Maximum SES	43.9	
Maximum MES	114.4	
Robust Statistic	105.5	
Chi Square Goodness of Fit Statistic (DoF)	1976.5 (669)	
Chi Square2 Statistic (DoF)	209.5 (942.7)	
Threshold for Desired PFA		

DoF: Degrees of Freedom

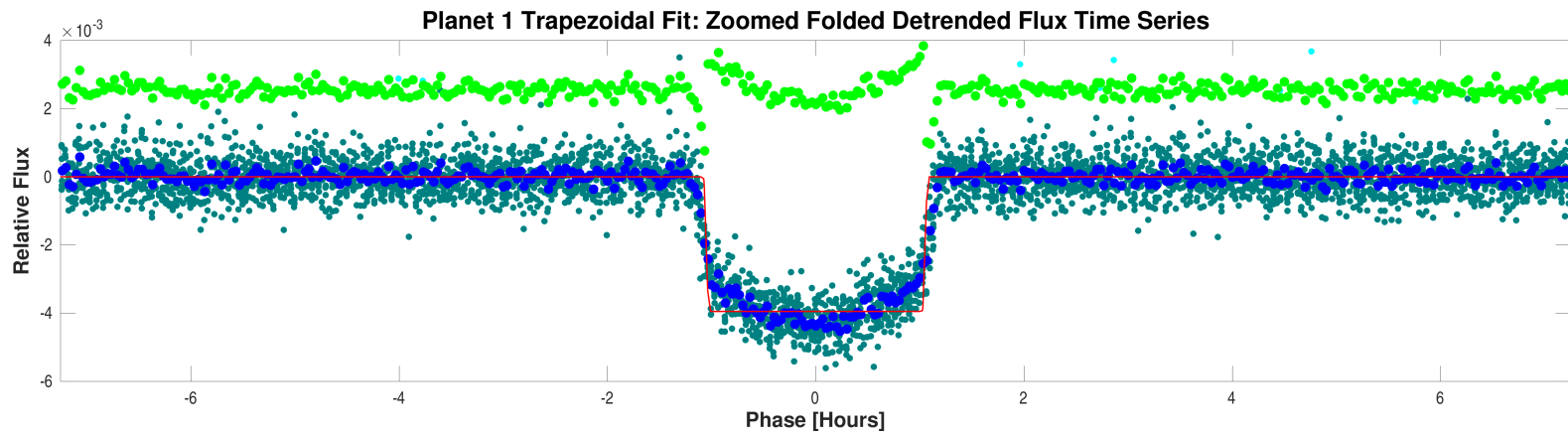
Parameter	Value	Uncertainty	Units
SNR	179.1		
Orbital Period	4.8874979		days
Transit Epoch	1687.2077978		BTJD
Transit Depth	3951		ppm
Transit Duration	2.4175		hours
Transit Ingress Duration	0.3157		hours
Model Chi Square Statistic (DoF)	38698.5 (5873)		

DoF: Degrees of Freedom



Folded detrended flux time series for CatId 28230919, Planet candidate 1 and folded trapezoidal model light curve.

Open `./planet-01/planet-search-and-model-fitting-results/trapezoidal-model-fit/0000000028230919-01-all-trapezoidal.fig`



Zoomed folded detrended flux time series for CatId 28230919, Planet candidate 1 and folded trapezoidal model light curve.

Open `./planet-01/planet-search-and-model-fitting-results/trapezoidal-model-fit/0000000028230919-01-all-trapezoidal-zoomed.fig`

7.4 Validation Tests

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

7.4.1 Weak Secondary Test

Result	Value	Uncertainty	Units	Statistic in Sigmas	Significance (%)
Orbital Period	4.8875		days		
Transit Duration	2.5		hours		
Maximum MES	114.4				
Secondary Phase	2.3639		days		
Secondary MES	3.0				
Minimum Phase	2.925		days		
Minimum MES	-2.3				
Median MES	-0.0				
MAD MES	0.65282				
Robust Statistic	3.0				
Secondary Depth	113.7	3.2402e+01	ppm		
Geometric Albedo	7.0	2.2820e+00		2.6430	0.41
Planet Effective Temperature	2035	1.5666e+02	Kelvin	7.6515	0.00

7.4.2 Eclipsing Binary Discrimination Test

Result	Value	Value in Sigmas	Significance (%)
Odd Even Transit Depth Comparison Statistic	1.6062e-01	0.4008	68.86

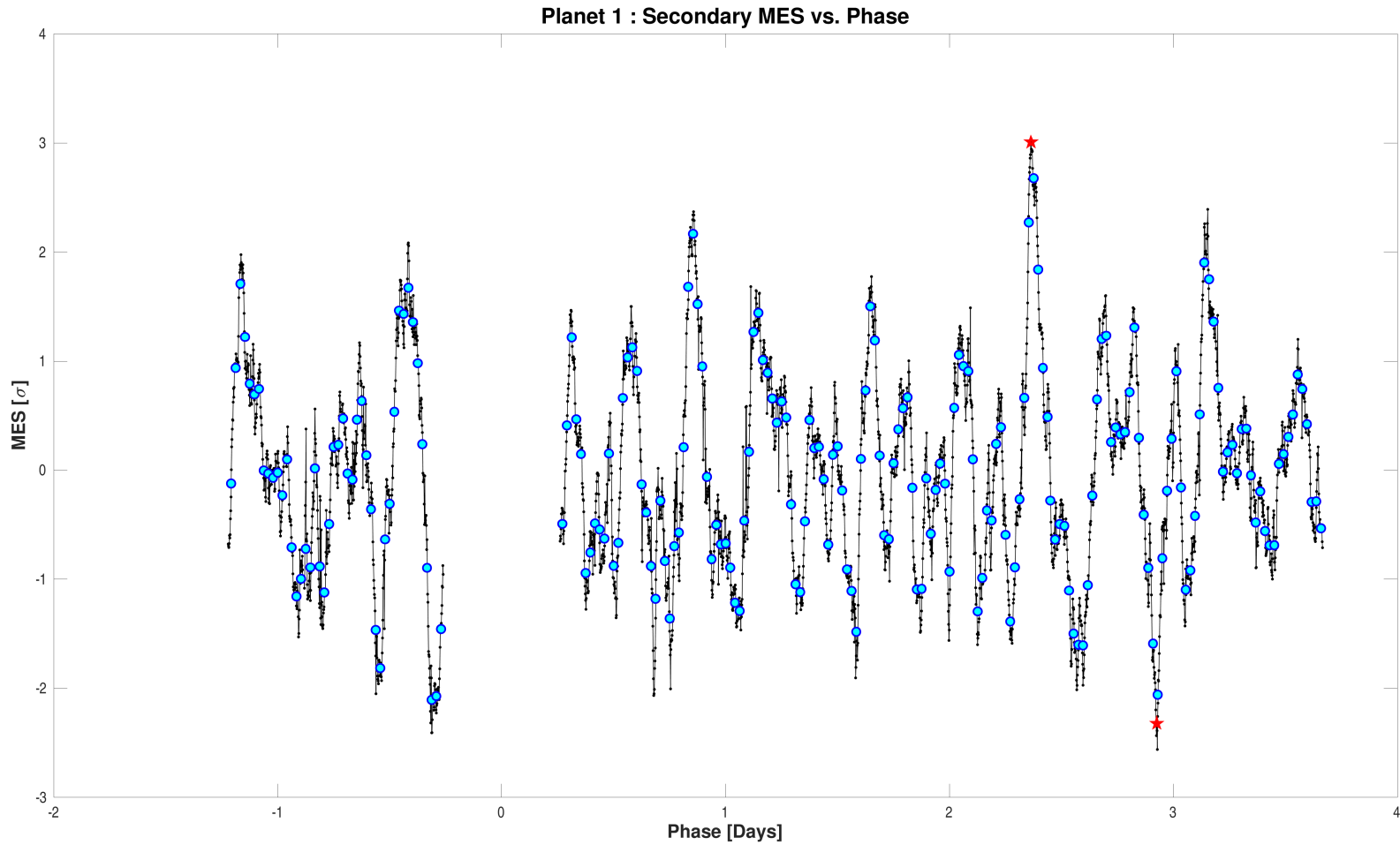
7.4.3 Bootstrap Test

Result	Value
False Alarm Probability	0.0000e+00
Bootstrap Threshold for Desired PFA	8.1
MES Mean	-0.62
MES Standard Deviation	1.22
Transit Count	11

7.4.4 Ghost Diagnostic Test

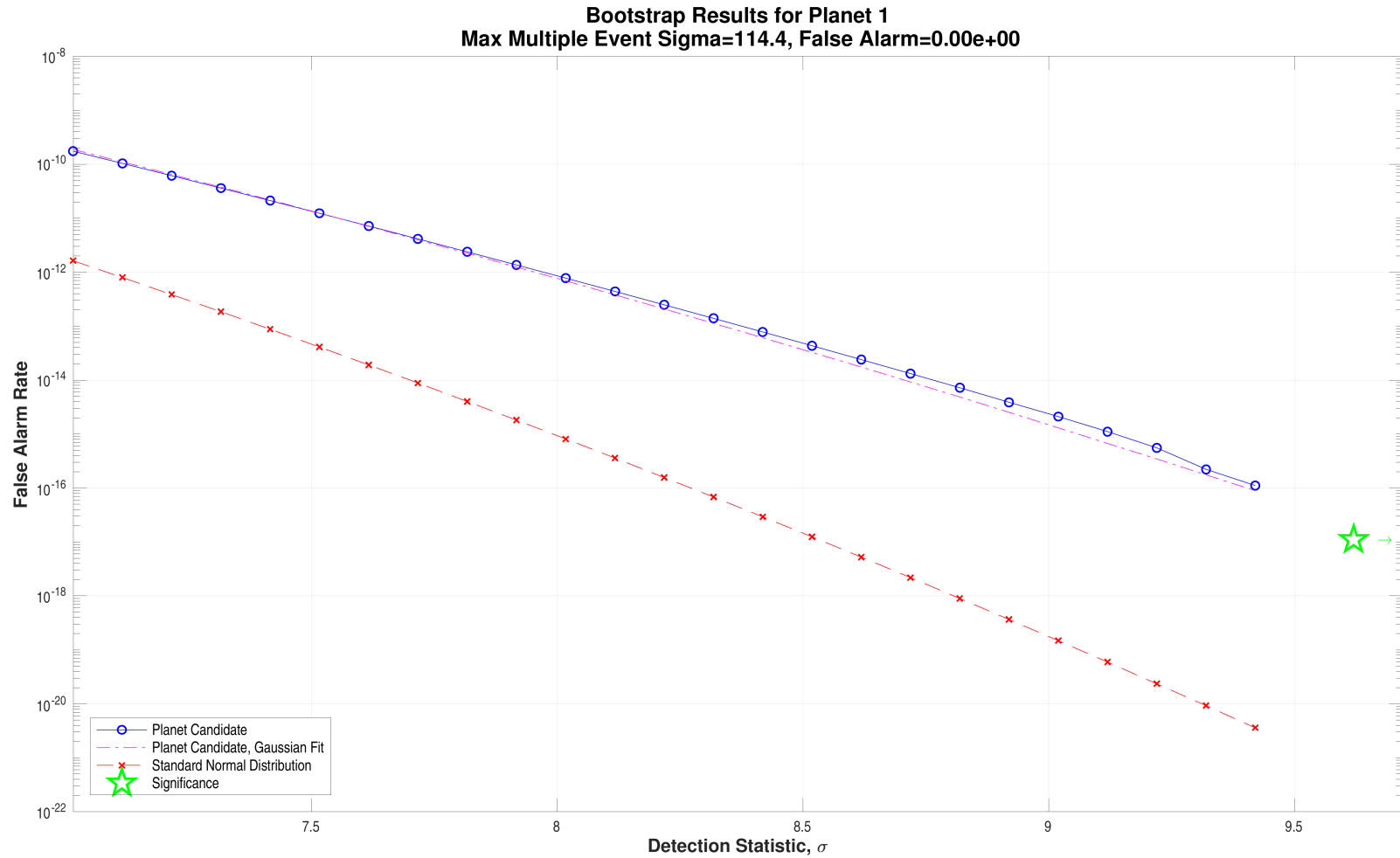
Result	Value	Significance (%)
Maximum MES	114.4	
SNR	122.8	
Core Aperture Statistic	4.8723e+01	100.00
Halo Aperture Statistic	2.0133e+01	100.00
Ratio of Core/Halo Aperture Statistics	2.4201e+00	

7.4.5 Validation Test Figures



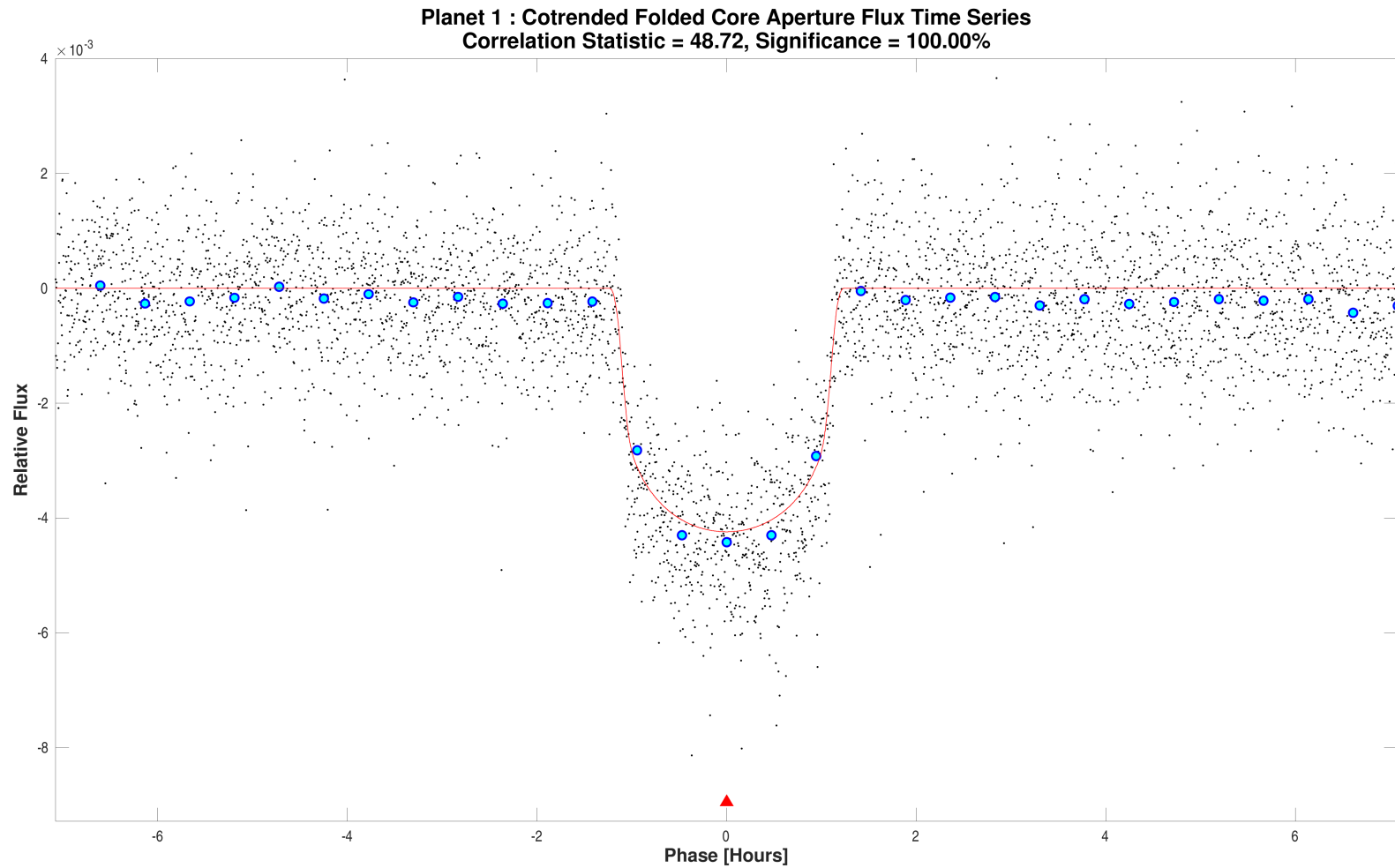
The primary event has been set to zero and both the max and min of the resulting MES vs. Phase are marked with a red star. The best matched pulse duration in hours is 2.5. The maximum secondary MES and corresponding phase are 3.0089 and 2.3639 days respectively. The minimum secondary MES and corresponding phase are -2.3223 and 2.925 days respectively.

Open `./planet-01/report-summary/000000028230919-01-weak-secondary-diagnostic.fig`



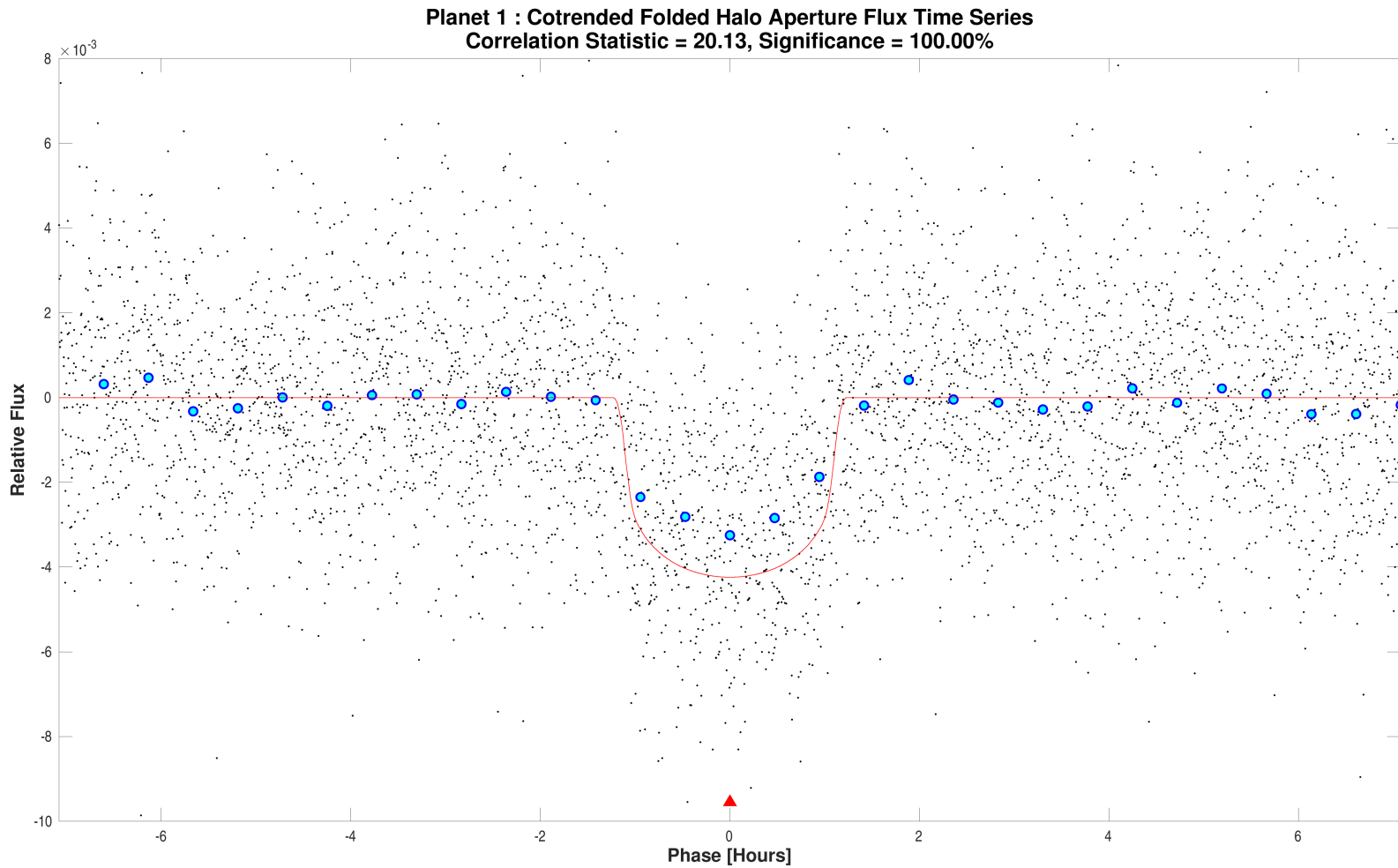
Bootstrap results for target 28230919, planet 1. Cumulative sum of the probabilities (derived from the histogram of counts) from upper tail to the search transit threshold; false alarm probability is indicated by the star. The Gaussian equivalent threshold for this false alarm probability is Inf. The threshold on this distribution that achieves the same false alarm rate as a 7.1 sigma threshold on a Gaussian distribution is 8.0629.

Open `./planet-01/bootstrap-results/0000000028230919-01-bootstrap-false-alarm.fig`



Optical ghost diagnostic core aperture flux time series for target 28230919, 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/0000000028230919-01-core-unwhitened-cotrended-zoomed-model.fig`

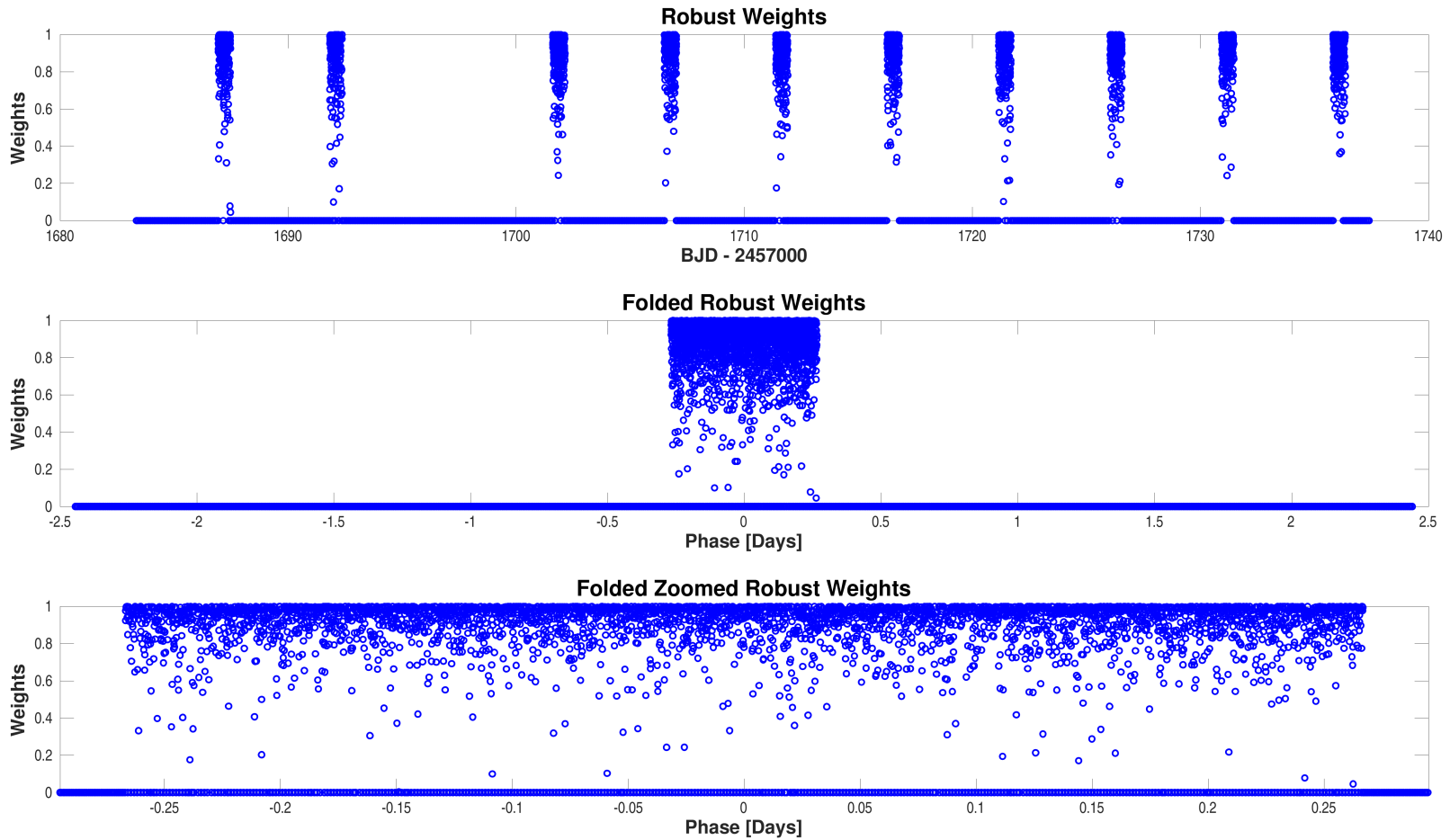


Optical ghost diagnostic halo aperture flux time series for target 28230919, planet candidate 1. The unwhitened time series is phase folded at the orbital period associated with the planet candidate and centered on the epoch of the first transit. The time series was first cotrended against spacecraft 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/0000000028230919-01-halo-unwhitened-cotrended-zoomed-model.fig`

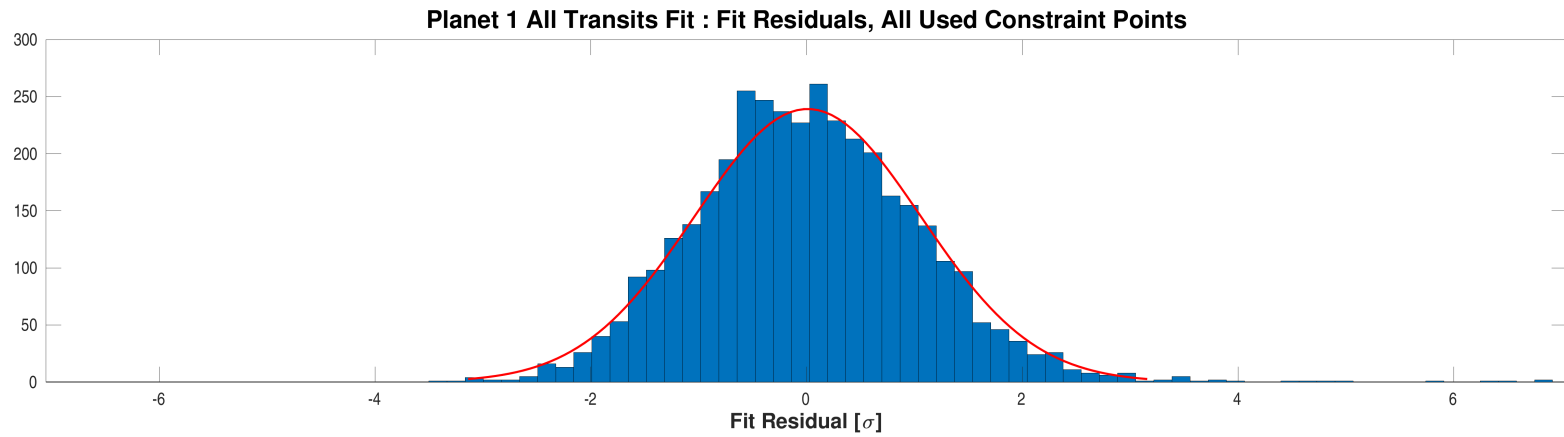
Appendix A Planet Candidate 1

A.1 Model Fitter: All Transits



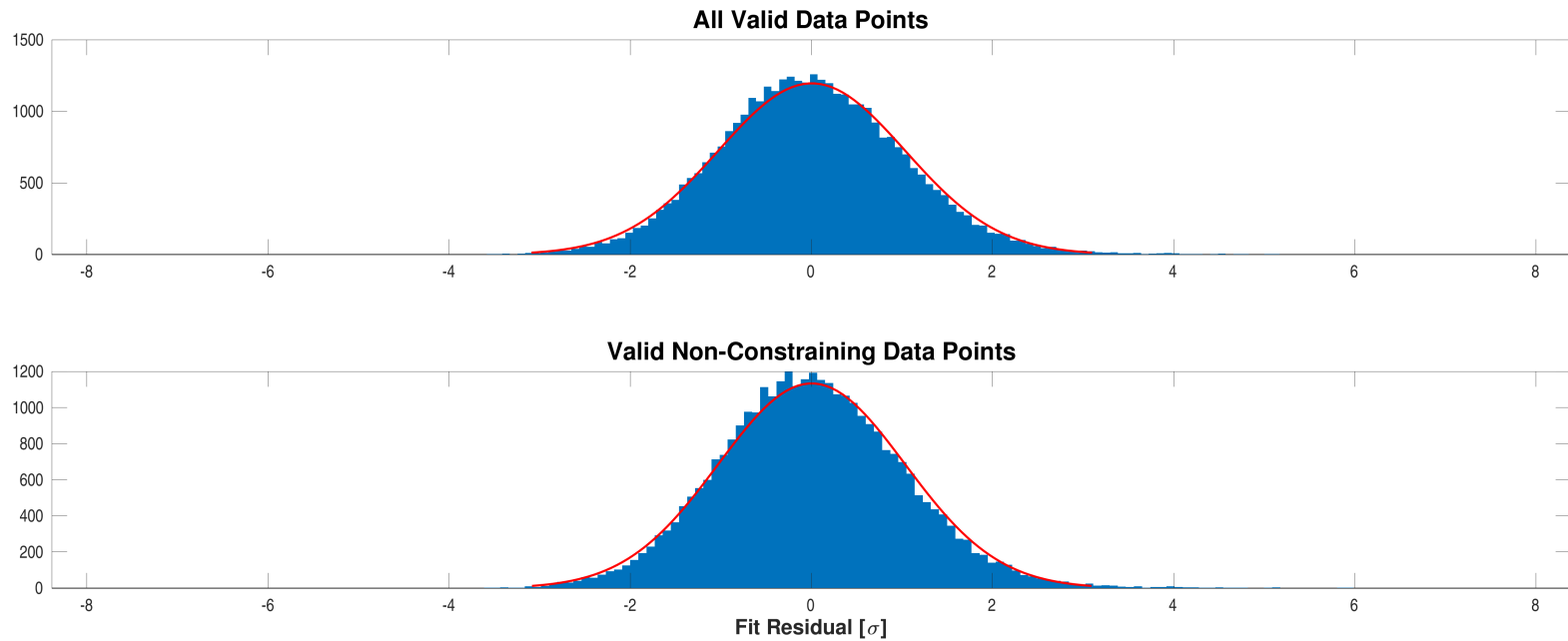
Robust weights distribution for CatId 28230919, Planet candidate 1. Top plot: all data points. Middle plot: all data points, folded per the fitted period and epoch. Bottom plot: all data points, folded and zoomed.

Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000028230919-01-all-robust-weights.fig`



Fit residuals distribution for CatId 28230919, 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/000000028230919-01-all-histo-used.fig`



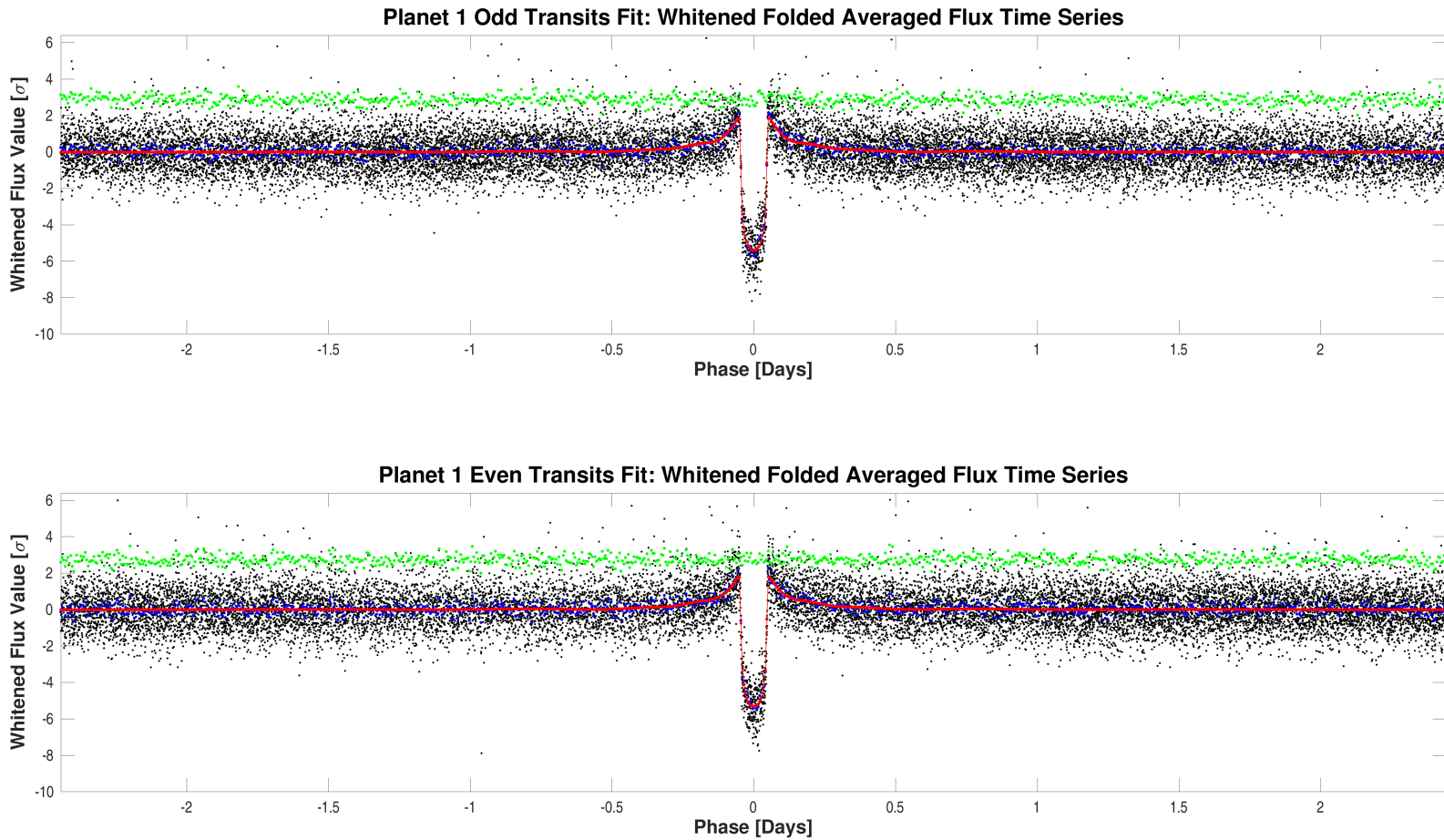
Fit residuals distribution for CatId 28230919, Planet candidate 1. Top plot: all valid data. Bottom plot: valid data not used to constrain fit (due to distance from a transit). Gaussian fits to the histograms are shown in red.

Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/000000028230919-01-all-histo-all-and-unused.fig`

A.2 Model Fitter: Odd & Even Transits

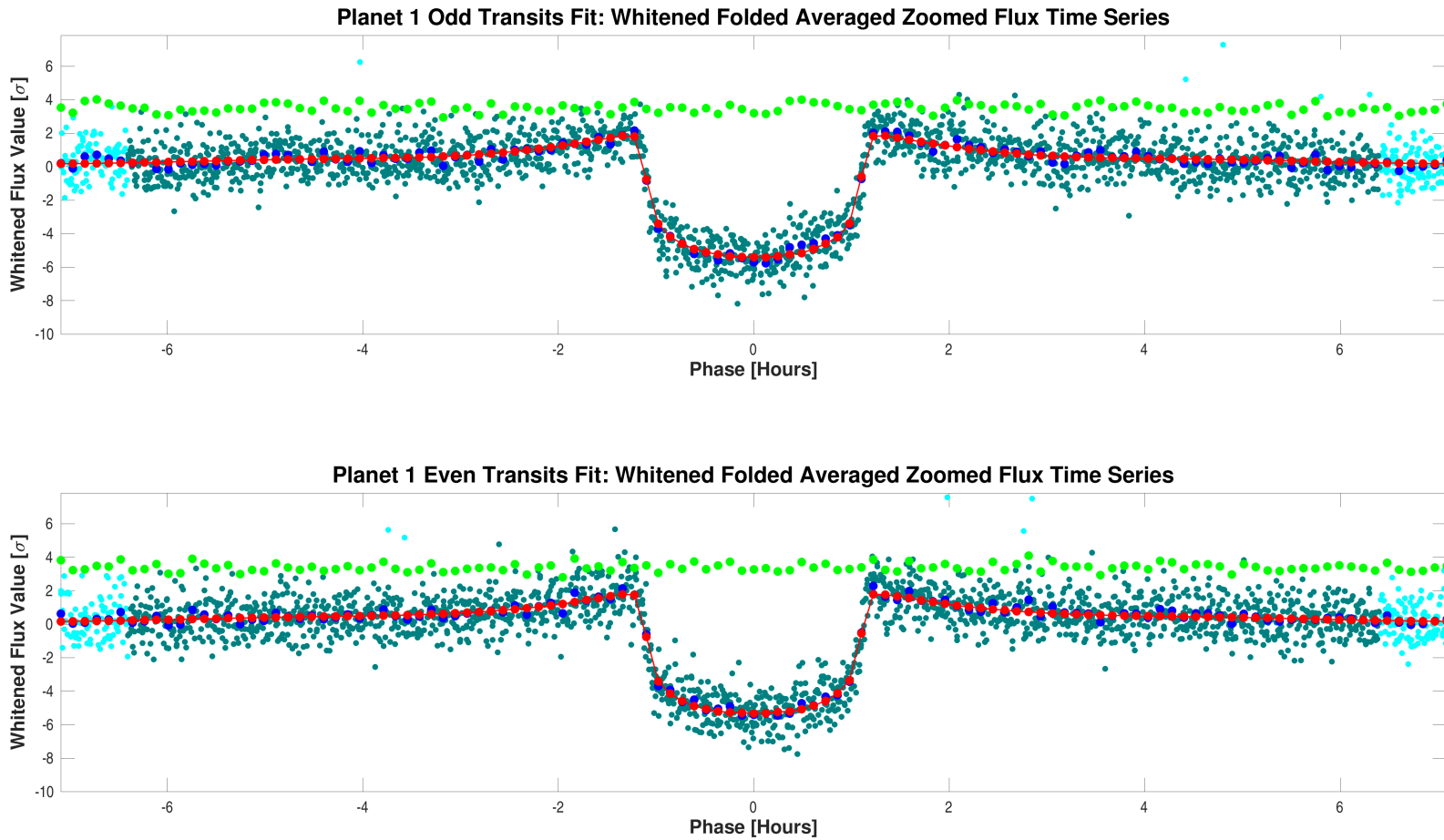
Parameter	Odd Transits Value	Odd Transits Uncertainty	Even Transits Value	Even Transits Uncertainty	Units	$\frac{\text{Difference}}{\ \text{Uncertainty}\ }$
SNR	87.6		85.9			
Orbital Period	4.8878345	5.7254e-05	4.8878075	7.1139e-05	days	2.9583e-01
Transit Epoch	1687.2060892	3.7406e-04	1692.0939679	3.4884e-04	BTJD	1.0905e-01
Impact Parameter	0.1111	1.6319e+00	0.1063	1.7822e+00		1.9771e-03
Planet Radius to Star Radius Ratio	0.0588885	2.7654e-03	0.0586887	2.8749e-03		5.0088e-02
Semi-major Axis to Star Radius Ratio	16.6516	3.0046e+00	16.6933	3.1438e+00		9.5729e-03
Planet Radius	4.8850	3.8602e-01	4.8684	3.9065e-01	Earth radii	3.0180e-02
Semi-major Axis	0.0517	4.0715e-03	0.0517	4.0715e-03	AU	3.3078e-05
Effective Stellar Flux	100.8636	1.6986e+01	100.8643	1.6986e+01	Goldilocks	3.0942e-05
Equilibrium Temperature	808	3.4029e+01	808	3.4029e+01	Kelvin	3.0942e-05
Stellar Density	2.5964	1.4055e+00	2.6160	1.4780e+00	Solar density	9.5859e-03
Transit Depth	4252	4.8571e+01	4224	4.9081e+01	ppm	4.0078e-01
Transit Duration	2.3630	4.9020e-02	2.3578	5.0679e-02	hours	7.4656e-02
Transit Ingress Duration	0.1331	5.4828e-02	0.1323	5.6863e-02	hours	1.0814e-02
Eccentricity	0.0000	0.0000e+00	0.0000	0.0000e+00		
Peri Longitude	0.0000	0.0000e+00	0.0000	0.0000e+00	degrees	
Model Chi Square Statistic (DoF)	2872.7 (3462.2)		2872.7 (3462.2)			

DoF: Degrees of Freedom



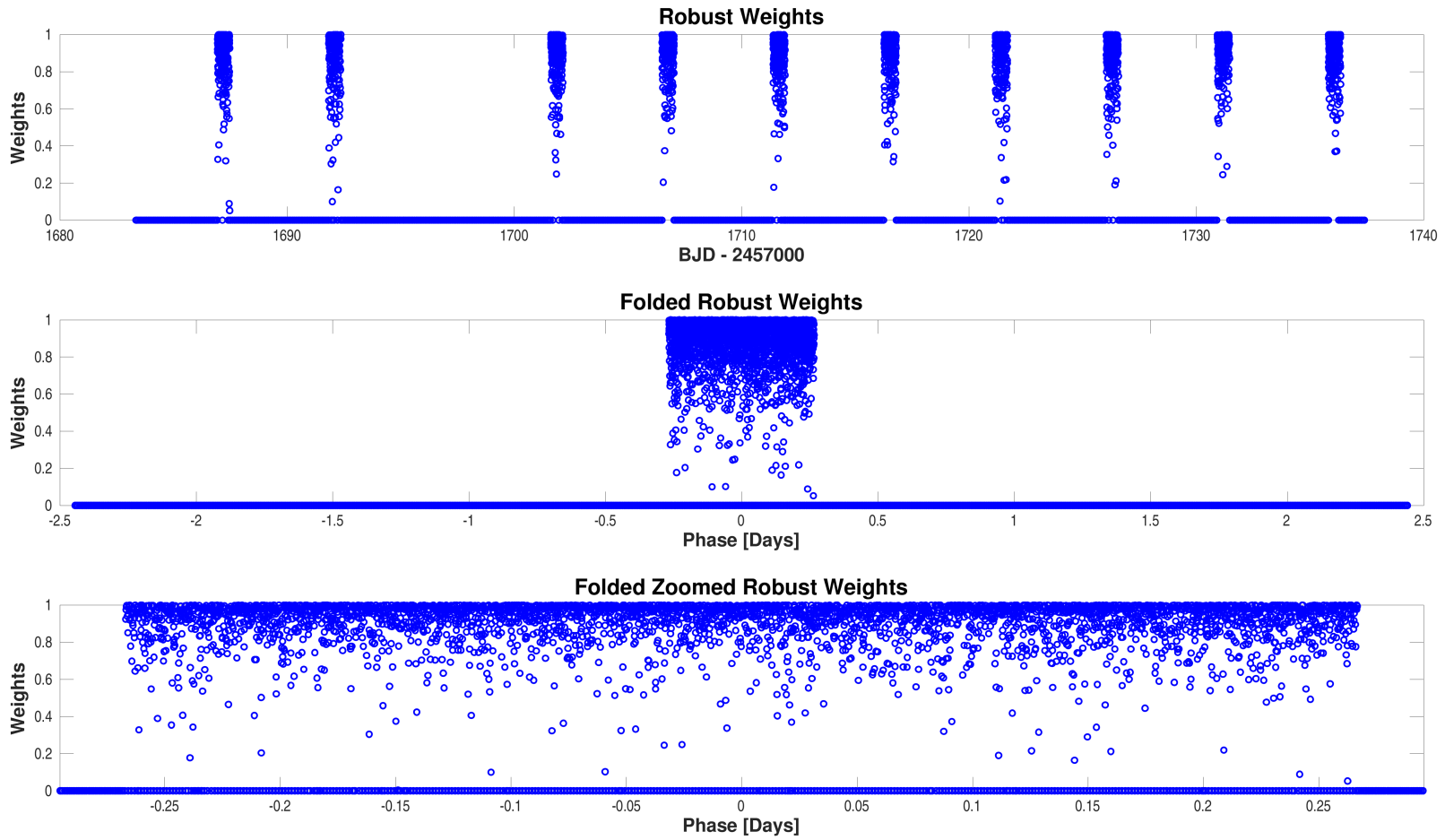
Folded flux time series for CatId 28230919, Planet candidate 1 in the whitened domain is plotted in black dots. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged values of the folded flux time series; the red dots represent the averaged values of the folded model light 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/0000000028230919-01-odd-even-whitened.fig`



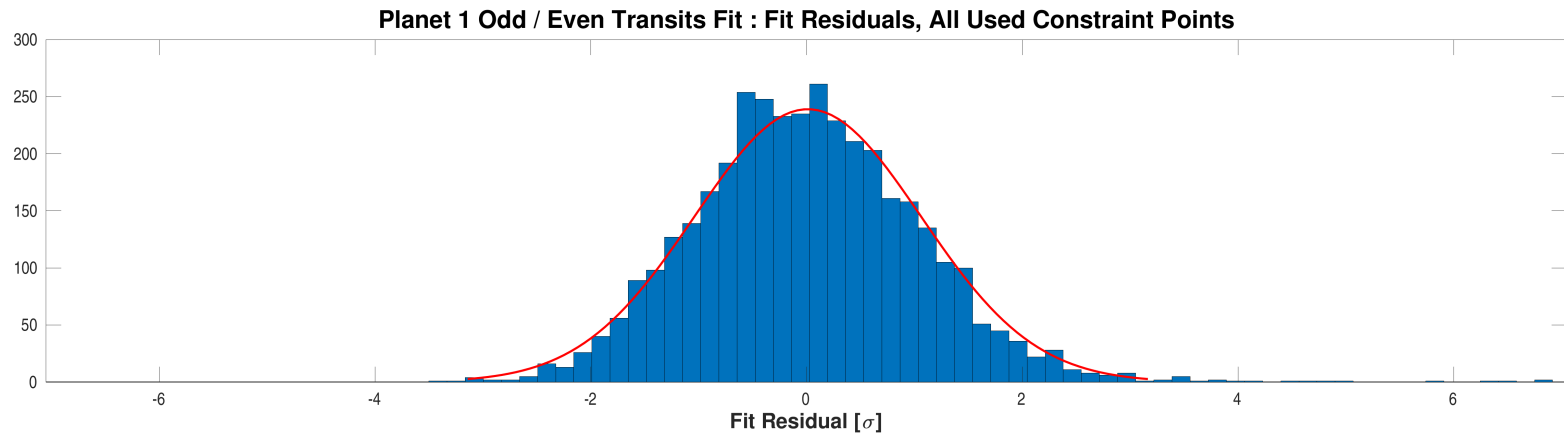
Folded flux time series for CatId 28230919, Planet candidate 1 in the whitened domain, zoomed on the transit. The flux data whose robust weights are larger/smaller than 0.1 are plotted in dark green/cyan dots, respectively. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged 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/0000000028230919-01-odd-even-whitened-zoomed.fig`



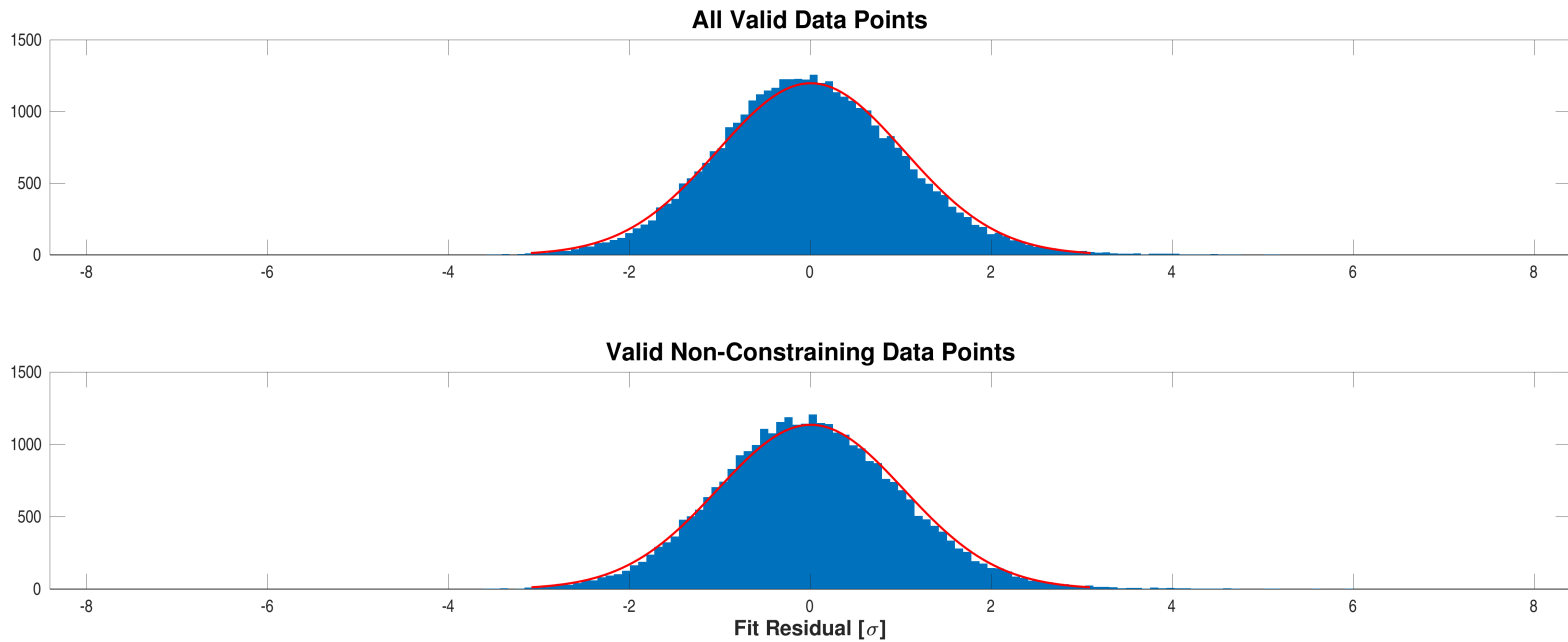
Robust weights distribution for CatId 28230919, Planet candidate 1. Top plot: all data points. Middle plot: all data points, folded per the fitted period and epoch. Bottom plot: all data points, folded and zoomed.

Open `./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000028230919-01-odd-even-robust-weights.fig`



Fit residuals distribution for CatId 28230919, 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.

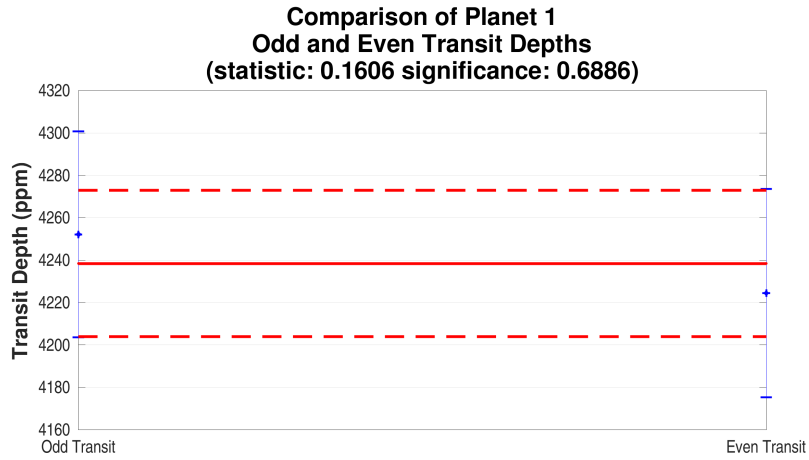
Open `./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000028230919-01-odd-even-histo-used.fig`



Fit residuals distribution for CatId 28230919, 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/0000000028230919-01-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 28230919, planet 1. A significance level close to 1/0 favors a transiting planet/an eclipsing binary. Open `./planet-01/binary-discrimination-test-results/0000000028230919-01-eclipsing-binary-discrimination-tests.fig`

Appendix B Alerts

This target did not trigger any alerts.