Data Validation (DV) Report
for TESS ID 120960812
Sectors 14 - 14

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

11-Feb-2020 05:46:00 Z

Contents

1   Summary

Target Properties	Value	Uncertainty	Units	Provenance
Catalog ID	120960812			
TOI ID	1237			
TESS Name	-			
RA	286.63839305	0	degrees	TIC8
Dec	39.48787721	0	degrees	TIC8
Magnitude	10.2768	0.0061		TIC8
Radius	1.478	0.088	Solar radii	TIC8
Effective Temperature	6212	133	Kelvin	TIC8
log(g)	4.177	0.092489	cm/sec^2	TIC8
[M/H]	-0.010	0.1	Solar metallicity	TIC8
Stellar Density	0.371	0.082	Solar density	TIC8-Derived
Limb Darkening Coefficient 1	0.45626			
Limb Darkening Coefficient 2	0.3712			
Limb Darkening Coefficient 3	-0.23524			
Limb Darkening Coefficient 4	0.033497			
Number of Planet Candidates	1			
TOI Model	csv-file-toi-catalog-02-07-20-edited.csv			
TESS Names Model	-			
External TCE Model	-			
Software Revision	spoc-4.0.18-20200206			
Date Report Generated	11-Feb-2020 05:46:00 Z			

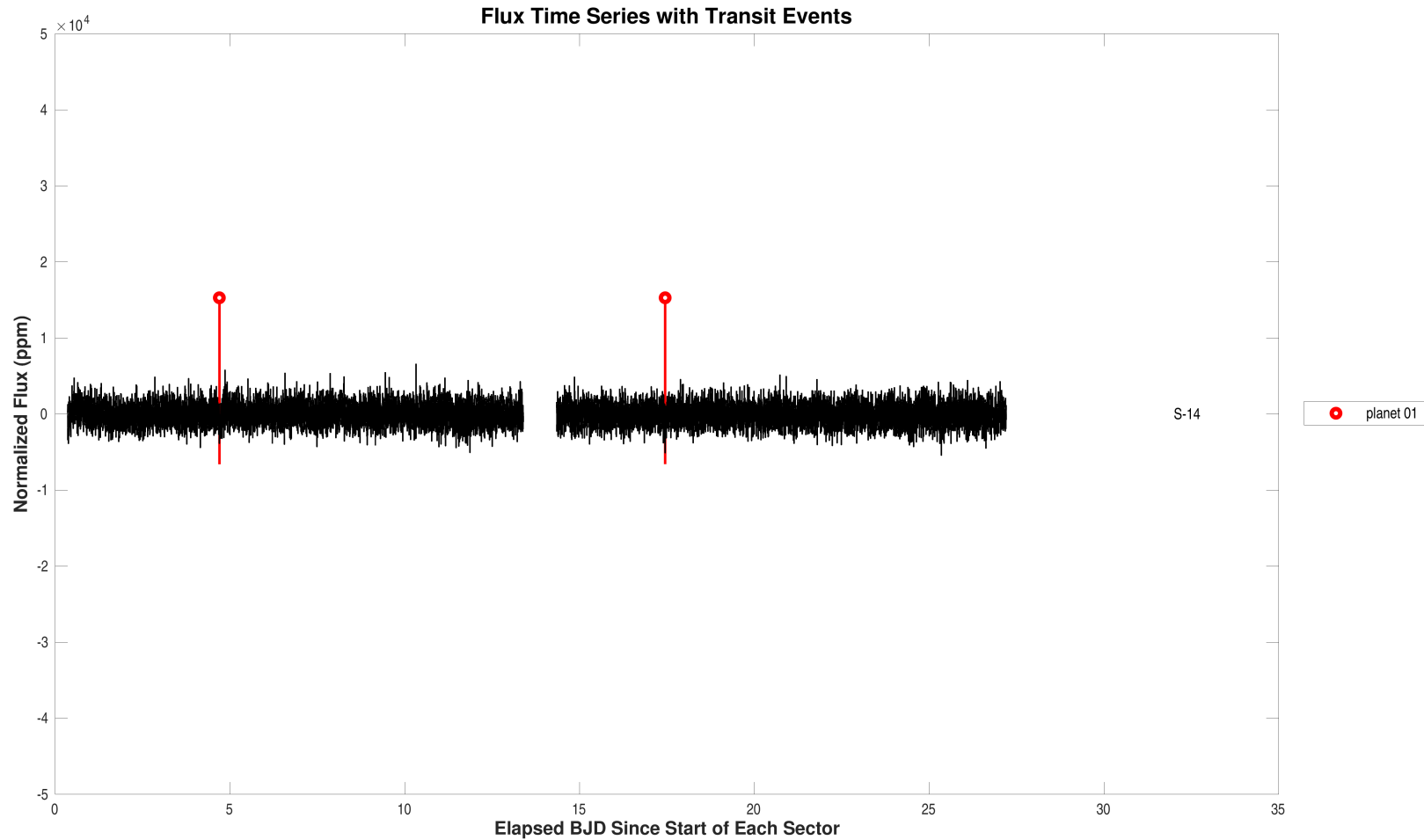| Sector	Target Table	Camera/ CCD	Crowding Metric	Flux Fraction
14	167	2:3	0.8870	0.8967

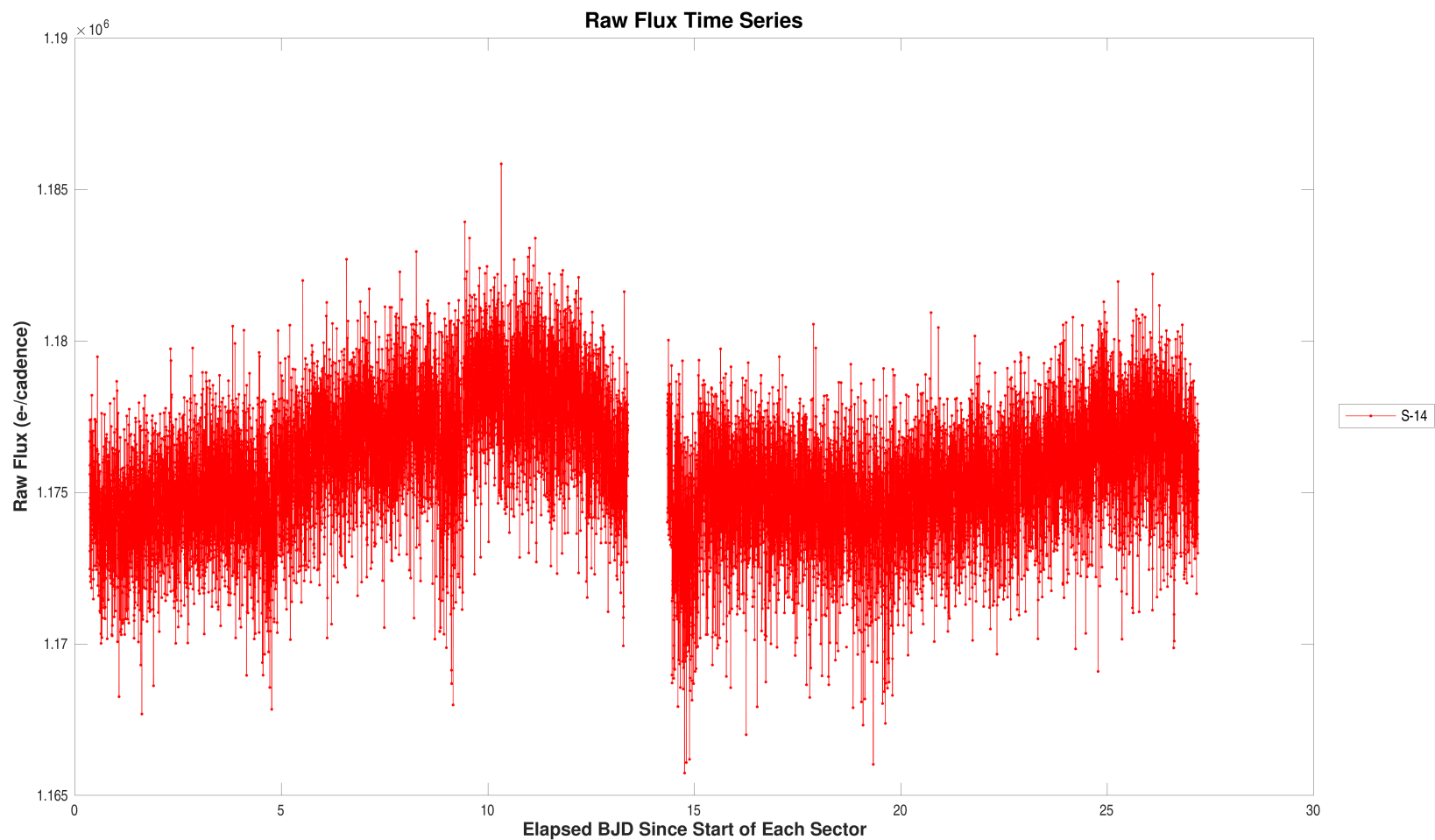| Planet Candidate	TOI ID	TESS Name	TOI Correlation	Period (days)	Period Ratio	Epoch (BTJD)	Semi-major Axis (AU)	Radius (Re)	Seff	Teq (K)	False Alarm	Suspected EB
1	1237.01	-	0.86	12.752	1.00	1687.699	0.11	5.4	226.3	989	1.64e-11	false

2   Survey Image

Digitized Sky Survey (DSS) red image. The 5' x 5' image is centered on the J2000 coordinates of target (120960812).

3   Flux Time Series

Summary plot of sector-stitched flux time series and transits for target 120960812, marked with DV fitted epoch/period (or TPS epoch/period if fit was not successful). Transits of identified planets are labeled with epoch BTJD and orbital period. For the data of sector 14, target table 167, start BJD is 2458683.
Open `./summary-plots/0000000120960812-00-flux-dv-fit-14-167.fig`

Summary plot of raw flux time series. For the data of sector 14, target table 167, start BJD is 2458683.
Open `./summary-plots/0000000120960812-00-raw-flux-14-167.fig`

4   Dashboards

Planet Candidate 1

| Model Fitter | **Stellar Radius**

1.5 ± 0.1 Solar units | **Core Aperture Correlation Statistic**

Value = 3.08
Significance = 99.90%

Halo Aperture Correlation Statistic

Value = 1.65
Significance = 95.10%

Core/Halo Ratio

Ratio = 1.86 | Ghost Diagnostic Test |
| | Period = 12.8 ± 0.0 days
Depth = 1259 ± 180 ppm
Planet Radius = 5.4 ± 4.1 Earth radii
Semi-major Axis = 0.1 ± 0.0 AU
Effective Stellar Flux = 226.3 ± 38.6
Equilibrium Temperature = 989 ± 42 Kelvin
Chi-squared/DoF = 0.9
SNR = 7.4 | | |

| Eclipsing Binary Discrimination Test | **Odd-Even Depth Comparison Statistic**

Value = 9.64e-04
Significance = 97.52% | **Offsets Relative to Out of Transit Centroid**

Source RA Offset = -2.50e+00 ± 3.22e+00 arcsec (-0.78 σ)
Source Dec Offset = -9.81e+00 ± 3.50e+00 arcsec (-2.80 σ)
Source Offset Distance = 1.01e+01 ± 3.48e+00 arcsec (2.91 σ)

Offsets Relative to TIC Position

Source RA Offset = -3.47e+00 ± 3.22e+00 arcsec (-1.08 σ)
Source Dec Offset = -9.36e+00 ± 3.50e+00 arcsec (-2.68 σ)
Source Offset Distance = 9.98e+00 ± 3.46e+00 arcsec (2.88 σ) | Difference Image Centroid Offsets |

| | **Shorter Period Comparison Statistic**

Value = N/A
Significance = N/A | **Longer Period Comparison Statistic**

Value = N/A
Significance = N/A | False Alarm = 1.64e-11
Transit Count = 2
Max Multiple Event Statistic = 7.6 | Bootstrap Test |

Summary of model fitter results and validation test results for target 120960812, 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
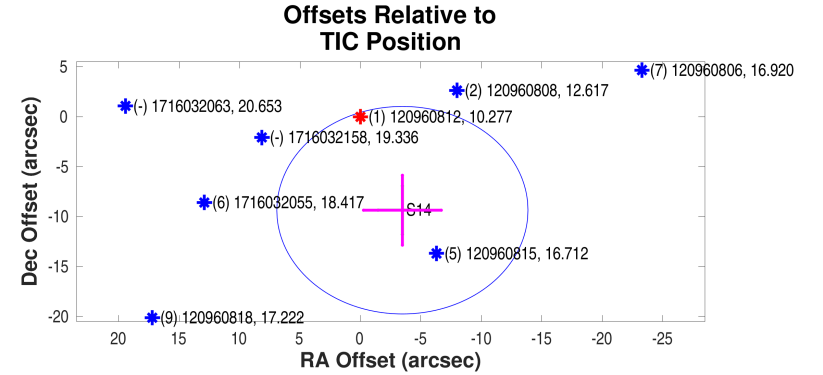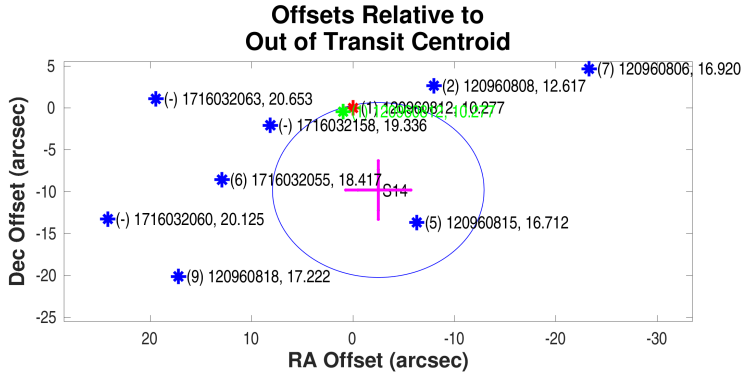
Multi-Sector Average PRF Fit of the Difference Images

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

	RA	Dec	Units
Offset	$-2.4968 \pm 3.22e+00$	$-9.8056 \pm 3.50e+00$	arcseconds
Offset/σ	-0.78	-2.80	
Offset Distance	$10.1185 \pm 3.48e+00$		arcseconds
Offset Distance/σ	2.91		
3σ Radius	10.4398		arcseconds

Mean offset from the TIC RA and Dec

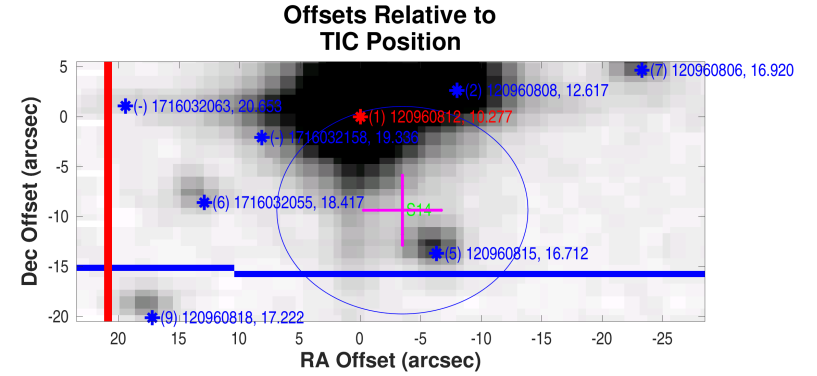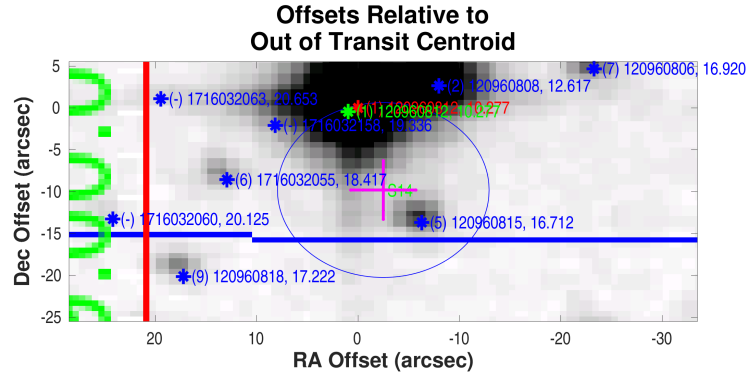|	RA	Dec	Units
Offset	$-3.4728 \pm 3.22e+00$	$-9.3575 \pm 3.50e+00$	arcseconds
Offset/σ	-1.08	-2.68	
Offset Distance	$9.9811 \pm 3.46e+00$		arcseconds
Offset Distance/σ	2.88		
3σ Radius	10.3907		arcseconds

Planet Candidate 1

Difference image centroid offsets for target 120960812, 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 (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/0000000120960812-01-difference-image-centroid-offsets.fig`
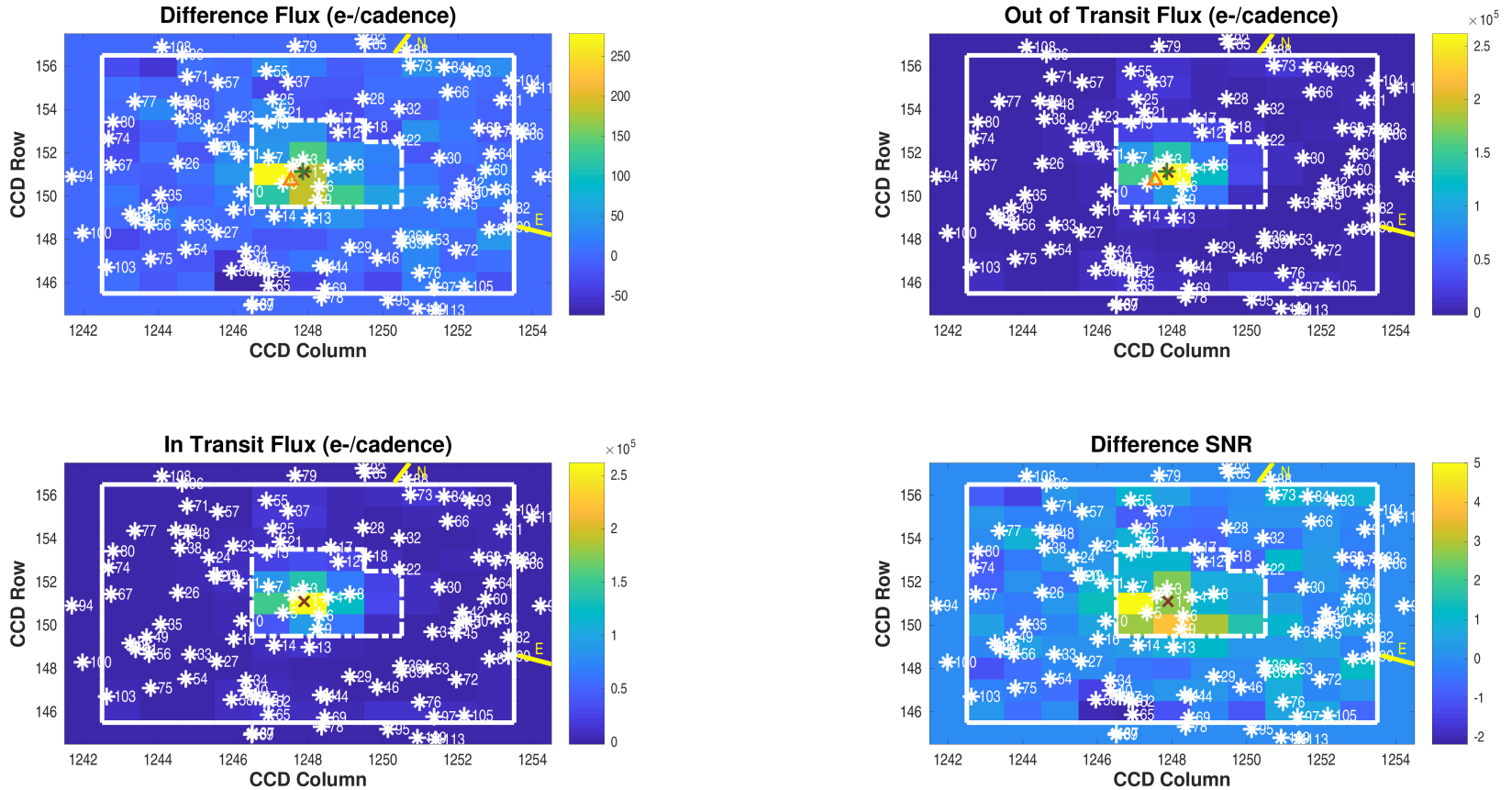
Planet Candidate 1

Difference image centroid offsets for target 120960812, 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 (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/0000000120960812-01-difference-image-centroid-offsets-survey.fig`

Difference Image Summary Metrics

Number of Difference Images	Number of Metrics	Number of Good Metrics	Fraction of Good Metrics	Quality Threshold
1	1	1	1.0000	0.70

Difference Image
Planet Candidate 1 / Sector 14 / Target Pixel Table 167

Difference image for target 120960812, 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 = 2; number of valid in-transit cadences = 105; number of in-transit cadence gaps = 0; number of valid out-of-transit cadences = 254; number of out-of-transit cadence gaps = 0. Difference image quality metric = 0.87 (good).
Open ./planet-01/difference-image/0000000120960812-01-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	$151.14 \pm 7.35e-05$	$1247.86 \pm 7.85e-05$	pixels	$286.63803855 \pm 9.34e-07$	$39.48803525 \pm 9.31e-07$	degrees
Difference Image Centroid	$150.72 \pm 1.12e-01$	$1247.54 \pm 1.34e-01$	pixels	$286.63713988 \pm 7.28e-04$	$39.48531146 \pm 6.79e-04$	degrees
Offset	$-0.4124 \pm 1.12e-01$	$-0.3145 \pm 1.34e-01$	pixels	$-2.4968 \pm 2.02e+00$	$-9.8056 \pm 2.44e+00$	arcseconds
Offset/σ	-3.69	-2.35		-1.23	-4.01	
Offset Distance	$0.5186 \pm 1.24e-01$		pixels	$10.1185 \pm 2.50e+00$		arcseconds
Offset Distance/σ	4.17			4.04		

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

	Row	Column	Units	RA	Dec	Units
TIC Reference Centroid	$151.10 \pm 1.45e-04$	$1247.89 \pm 1.44e-04$	pixels	$286.63838985 \pm 0.00e+00$	$39.48791077 \pm 0.00e+00$	degrees
Difference Image Centroid	$150.72 \pm 1.12e-01$	$1247.54 \pm 1.34e-01$	pixels	$286.63713988 \pm 7.28e-04$	$39.48531146 \pm 6.79e-04$	degrees
Offset	$-0.3722 \pm 1.12e-01$	$-0.3490 \pm 1.34e-01$	pixels	$-3.4728 \pm 2.02e+00$	$-9.3575 \pm 2.44e+00$	arcseconds
Offset/σ	-3.33	-2.61		-1.72	-3.83	
Offset Distance	$0.5102 \pm 1.27e-01$		pixels	$9.9811 \pm 2.51e+00$		arcseconds
Offset Distance/σ	4.02			3.98		

5.2 Difference Image TIC Key

Index	Catalog ID	Mag	RA (degrees)	Dec (degrees)	Distance (arcsec)
1	120960812	10.277	286.63838985	39.48791077	0.00
2	120960808	12.617	286.63551505	39.48864436	8.41
3	1716032157	17.732	286.63648114	39.49074950	11.51
4	120960803	17.390	286.64214747	39.49030990	13.55
5	120960815	16.712	286.63612613	39.48410912	15.06
6	1716032055	18.417	286.64303898	39.48552787	15.51
7	120960806	16.920	286.63000468	39.48920853	23.76
8	1716032159	18.000	286.64559635	39.49225297	25.40
9	120960818	17.222	286.64458715	39.48232041	26.49
10	120960821	17.271	286.62983419	39.47983092	37.56
11	120960810	18.154	286.62413748	39.48827112	39.62
12	1716032160	19.057	286.63910672	39.49898812	39.93
13	1716032053	18.307	286.64560100	39.47774465	41.72
14	120960825	15.510	286.63904133	39.47610704	42.53
15	120960796	16.090	286.62502768	39.49697606	49.43
16	1716032136	19.022	286.63085177	39.47523592	50.21
17	120960787	15.672	286.63578653	39.50184629	50.69
18	1716032162	18.814	286.64335967	39.50182408	51.96
19	120960807	14.312	286.61923633	39.48874154	53.30
20	1716032155	17.887	286.61865479	39.48853628	54.88
21	1716032167	18.457	286.62597919	39.50019215	56.07
22	1716032161	18.780	286.65115046	39.50077277	58.32
23	1716032166	18.895	286.61805341	39.49649735	64.40
24	120960801	17.452	286.61527038	39.49247261	66.30
25	1716032168	18.993	286.62271119	39.50280974	69.10
26	120960817	18.222	286.61446347	39.48262509	69.15
27	1716032035	17.907	286.63086161	39.46914907	70.71
28	120960774	18.359	286.63889679	39.50814490	72.86
29	120960828	17.235	286.65691617	39.47335531	73.45
30	1716032266	18.179	286.66082395	39.49899957	74.02
31	120960811	17.272	286.66561682	39.48836276	75.66
32	1716032163	18.766	286.64683644	39.50792339	75.77
33	1716032135	18.514	286.62511479	39.46920063	76.79
34	120960838	16.094	286.63872672	39.46649240	77.11
35	120960826	16.595	286.61570896	39.47439740	79.61
36	120960823	18.198	286.66456396	39.47881894	79.75
37	120960778	12.927	286.62310401	39.50770011	82.94
38	1716032153	18.342	286.60873105	39.49294920	84.37

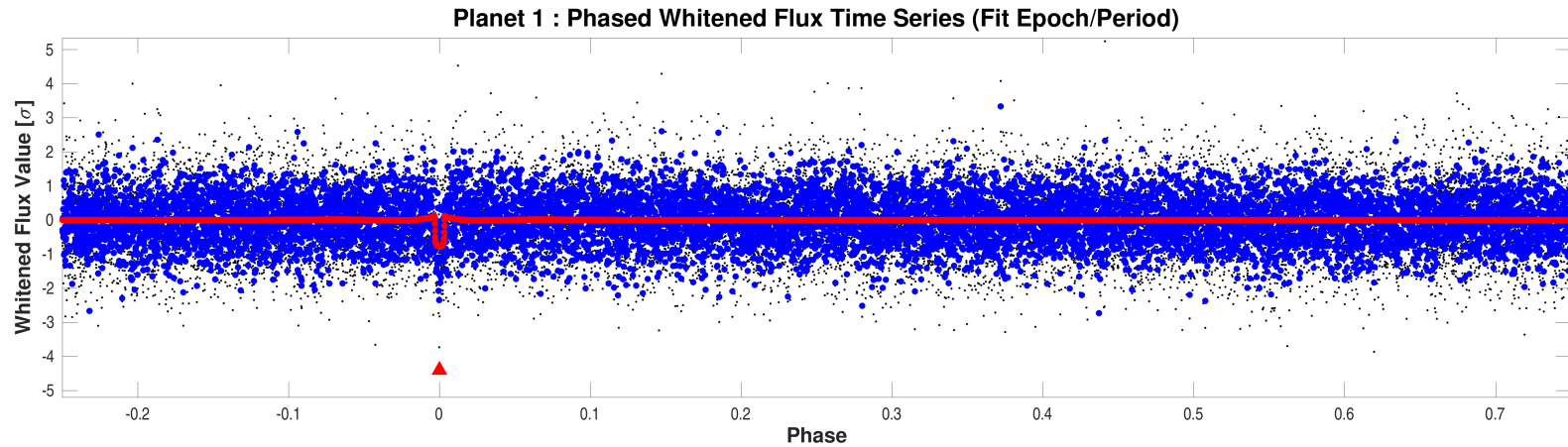| Index	Catalog ID	Mag	RA (degrees)	Dec (degrees)	Distance (arcsec)
39	121012218	17.987	286.66565120	39.47735652	84.74
40	1716032039	16.578	286.64016131	39.46422821	85.40
41	1716032047	17.499	286.65418162	39.46745815	85.71
42	121012255	18.937	286.66834801	39.49460235	86.65
43	1716032268	18.989	286.66920934	39.49201623	86.89
44	1716032044	18.841	286.65551949	39.46742076	87.78
45	120960805	17.207	286.67011149	39.48947269	88.31
46	120960829	17.513	286.66326293	39.47252135	88.57
47	120960842	13.965	286.64269626	39.46333006	89.30
48	1716032181	18.588	286.60821861	39.49672906	89.64
49	120960831	16.106	286.61493710	39.47067178	89.98
50	120960800	17.938	286.67026835	39.49283563	90.33
51	1716032043	17.780	286.64472904	39.46312250	90.96
52	120960844	17.617	286.64574295	39.46297330	92.07
53	1716032050	18.668	286.66983175	39.47962944	92.30
54	120960841	15.601	286.62770220	39.46337448	93.19
55	1716032195	18.591	286.61777449	39.50885891	94.70
56	120960836	15.246	286.61772461	39.46693450	94.86
57	120960782	16.647	286.61055319	39.50346344	95.48
58	120960847	16.179	286.63878037	39.46121644	96.11
59	120960797	15.240	286.60552809	39.49679156	96.74
60	120960791	18.552	286.67074901	39.49895920	98.31
61	1716032132	18.685	286.61462931	39.46720096	99.58
62	1716032133	18.468	286.61280029	39.46833822	100.10
63	120960775	14.538	286.66381200	39.50813524	101.44
64	120960783	17.649	286.66955265	39.50292645	102.07
65	1716032046	17.831	286.64747069	39.45996066	103.74
66	120960768	16.010	286.65324314	39.51453794	104.36
67	1716032146	18.804	286.60263618	39.47841709	105.05
68	121012257	18.760	286.67527157	39.49504059	105.64
69	1716032042	18.401	286.65796233	39.46256857	106.21
70	120960772	17.458	286.66731648	39.50831793	108.89
71	120960784	17.927	286.60427823	39.50301487	109.26
72	121012222	17.447	286.67645707	39.47887793	110.65
73	1716032357	18.933	286.64295432	39.51846880	110.74
74	1716032151	18.993	286.59857182	39.48431226	111.38
75	120960852	17.382	286.62263602	39.45923574	112.13
76	120960830	15.883	286.67291334	39.47155358	112.55

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

6   Phased Light Curves

Phased unwhitened flux time series is plotted in black dots. When all transits fit completed with full or secondary convergence, the phase is determined with the fitted epoch and period; otherwise, the phase is determined with the TPS epoch and period. The values of the phased unwhitened flux time series averaged in one cadence wide bins are plotted in bigger blue dots. When all transits fit completes with full or secondary convergence, the averaged values of the phased unwhitened fitted model light curve are plotted in red dots. Transit event markers in different colors indicate the locations of the transits of all planet candidates. The transits of the same planet candidate are labeled with the markers of the same color, for example, blue markers for transits of plane candidate #1, red markers for transits of planet candidate #2, etc.
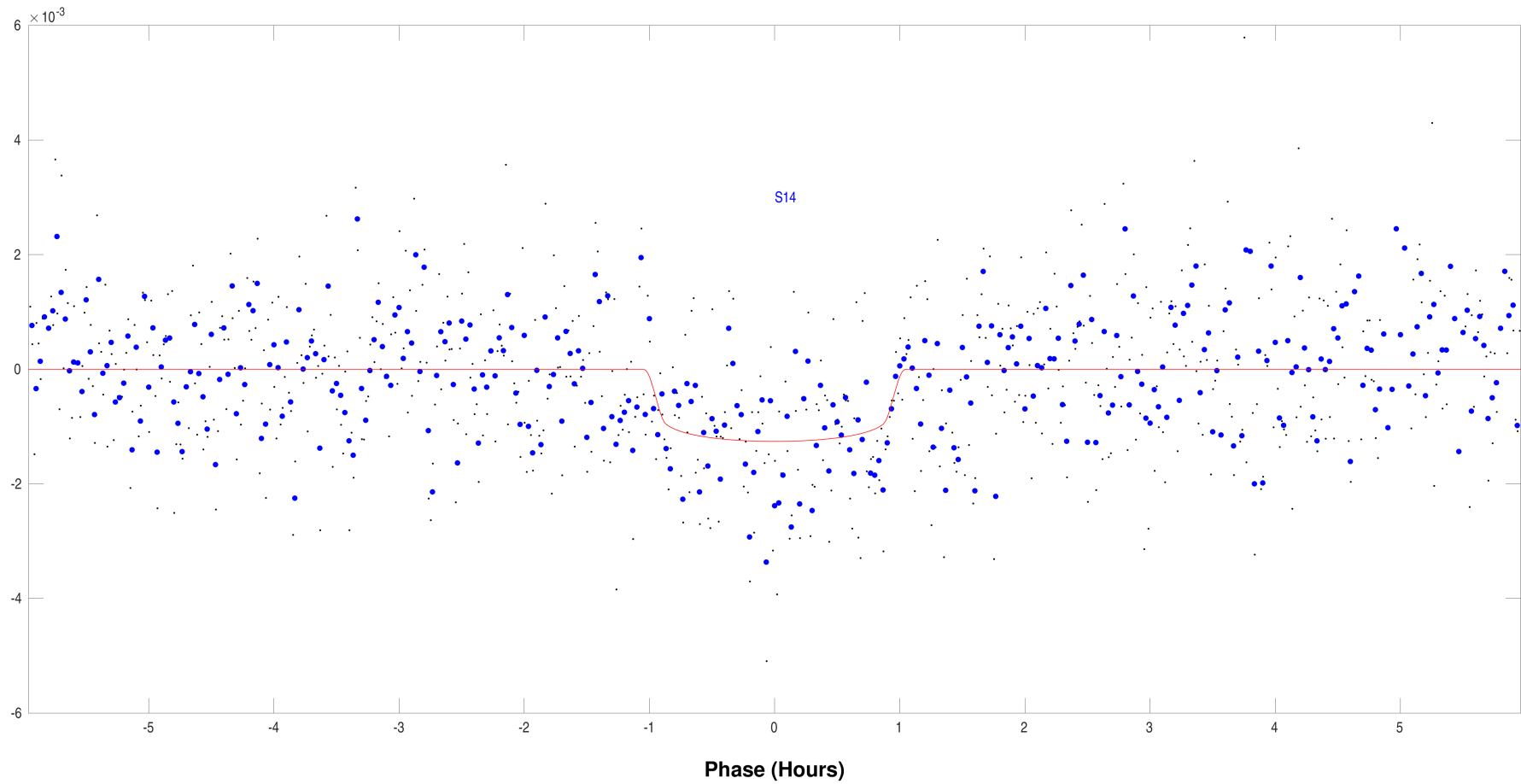
Open `./summary-plots/0000000120960812-01-phased-unwhitened-flux-time-series.fig`

Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)

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/0000000120960812-01-phased-whitened-flux-time-series.fig`

Planet: 1   Phased Unwhitened Flux Time Series by Sector

Phased unwhitened flux time series by sector for target 120960812, planet candidate 1. Period = 12.752 days; transit epoch = 1687.6989 BTJD.
Open `./summary-plots/0000000120960812-01-phased-unwhitened-flux-time-series-by-sector.fig`

7 Planet Candidate 1
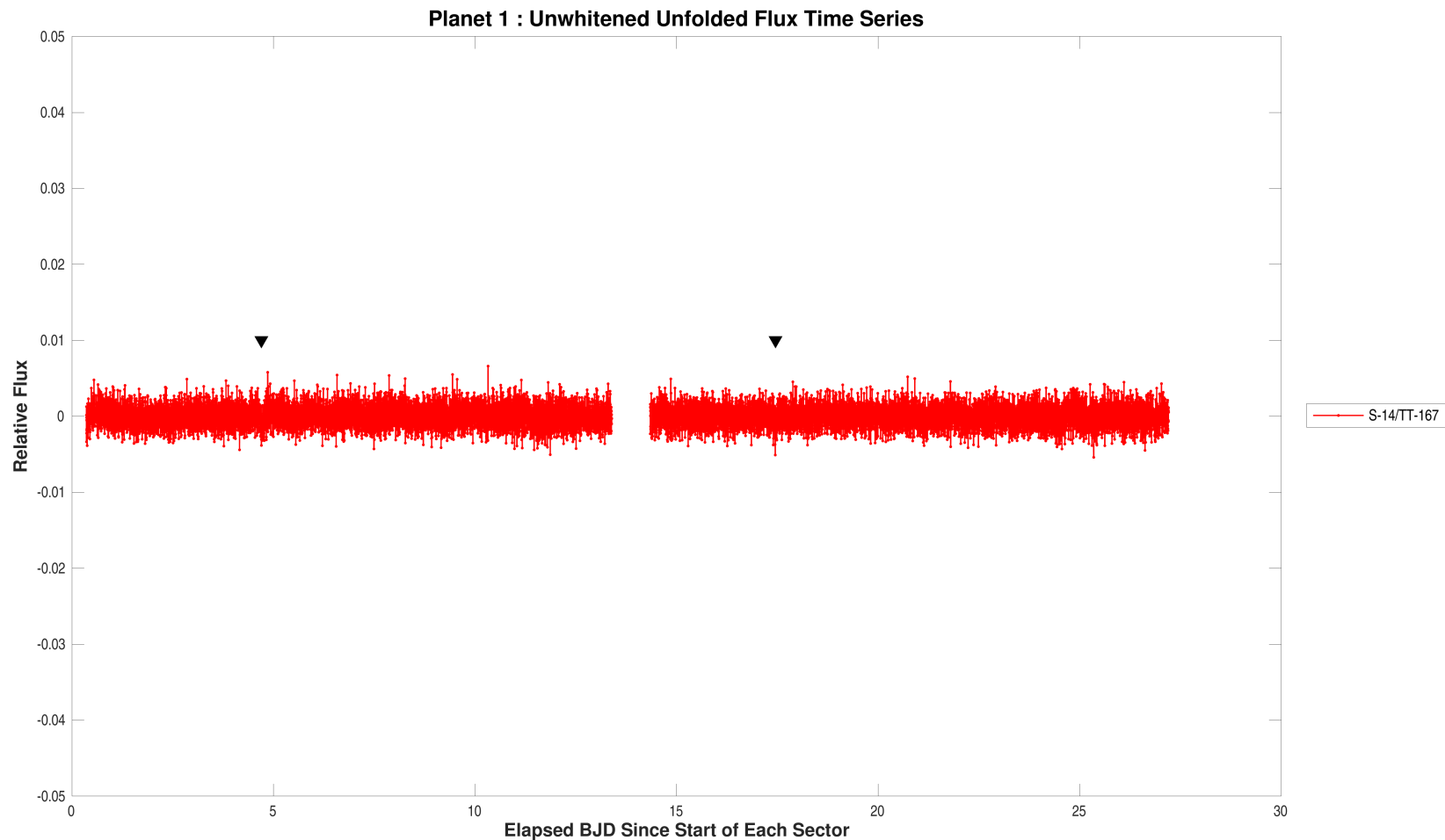
7.1 Model Fitter: All Transits

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	2.0	hours
Transit Epoch	1687.6962843	TJD
Orbital Period	12.7527723	days
Maximum SES	5.5	
Maximum MES	7.6	
Robust Statistic	7.1	
Chi Square Goodness of Fit Statistic (DoF)	102.8 (119)	
Chi Square2 Statistic (DoF)	0.0 (6.0)	
Threshold for Desired PFA		

DoF: Degrees of Freedom

Parameter	Value	Uncertainty	Units
SNR	7.4		
Orbital Period	12.7520050	4.1812e-03	days
Transit Epoch	1687.6989351	2.9380e-03	BTJD
Impact Parameter	0.2953	1.4971e+01	
Planet Radius to Star Radius Ratio	0.0333254	2.5626e-02	
Semi-major Axis to Star Radius Ratio	48.5518	2.3408e+02	
Planet Radius	5.3760	4.1462e+00	Earth radii
Semi-major Axis	0.1135	9.2241e-03	AU
Effective Stellar Flux	226.3391	3.8571e+01	Goldilocks
Equilibrium Temperature	989	4.2145e+01	Kelvin
Stellar Density	9.4557	1.3677e+02	Solar density
Transit Depth	1259	1.7995e+02	ppm
Transit Duration	1.9871	6.8706e-01	hours
Transit Ingress Duration	0.0700	7.3084e-01	hours
Eccentricity	0.0000	0.0000e+00	
Peri Longitude	0.0000	0.0000e+00	degrees
Model Chi Square Statistic (DoF)	499.5 (574.0)		
Model Chi Square Goodness of Fit Statistic (DoF)	66.2 (125)		
Model Chi Square2 Statistic (DoF)	0.0 (1)		

DoF: Degrees of Freedom

Planet 1 : Unwhitened Unfolded Flux Time Series
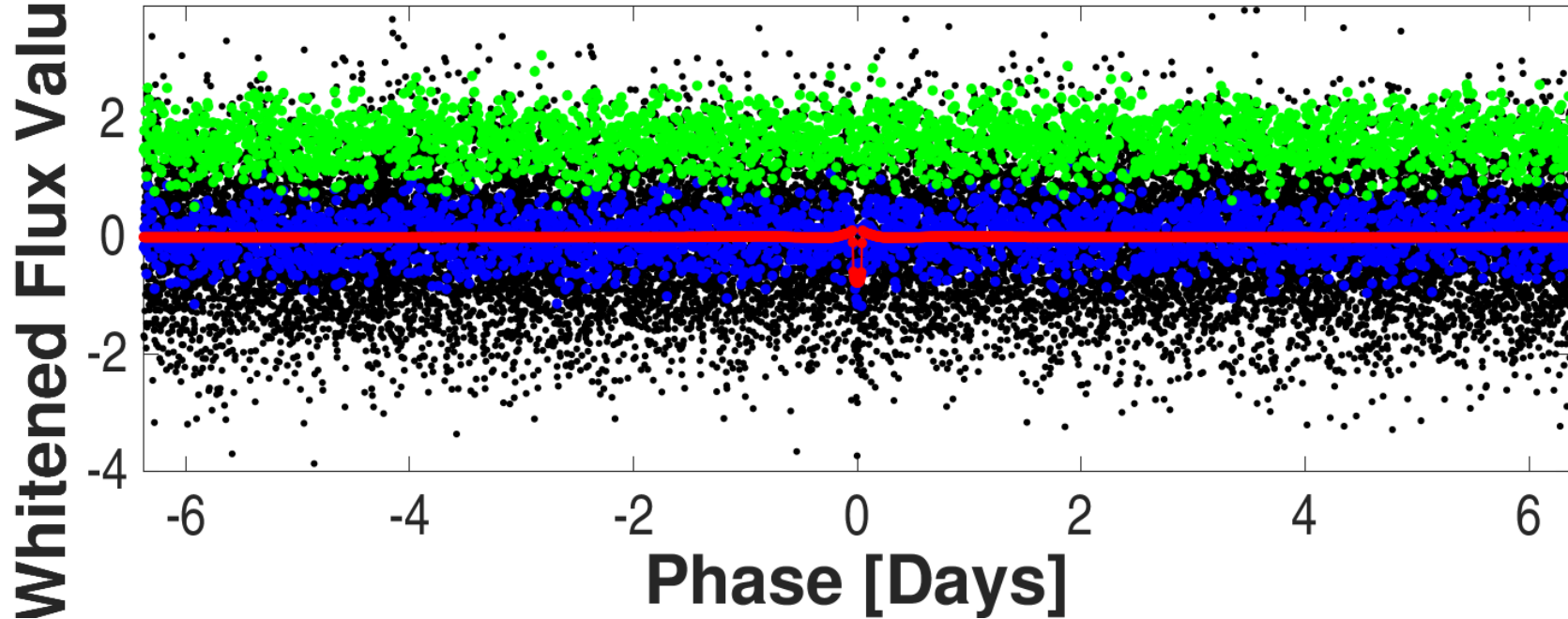
Flux time series for CatId 120960812, Planet candidate 1 in the unwhitened domain. For the data of Sector-14/TargetTableId-167, start BJD is 2458683. Transit event markers indicate the location of transits of the given planet candidate. All transits fit completed with full convergence.
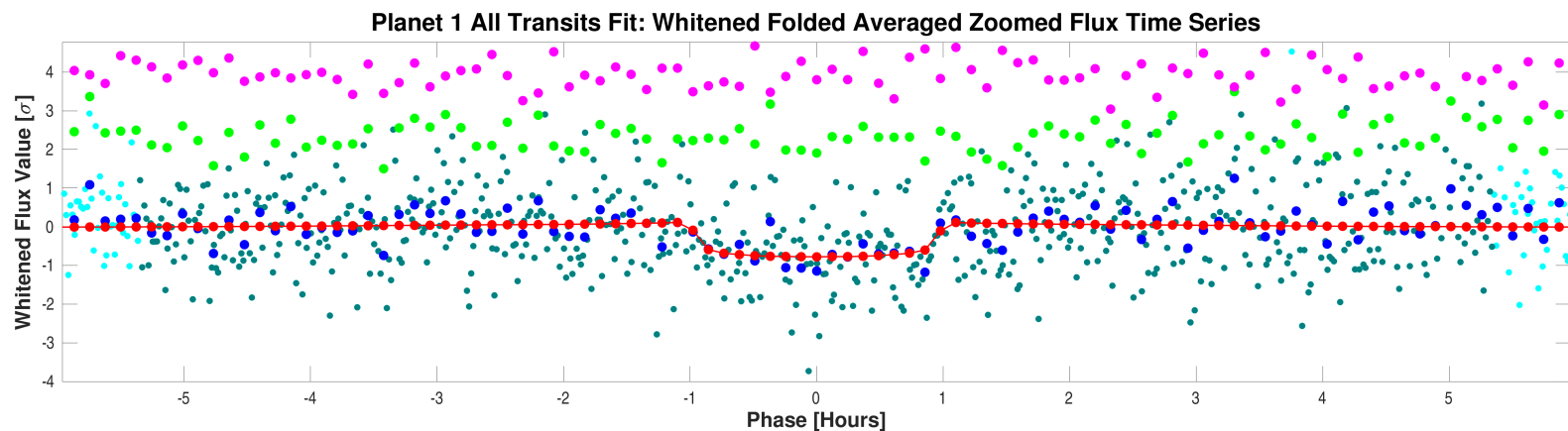
Open ./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000120960812-01-all-unwhitened-14-167.fig

Folded flux time series for CatId 120960812, 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/0000000120960812-01-all-whitened.fig

Folded flux time series for CatId 120960812, 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
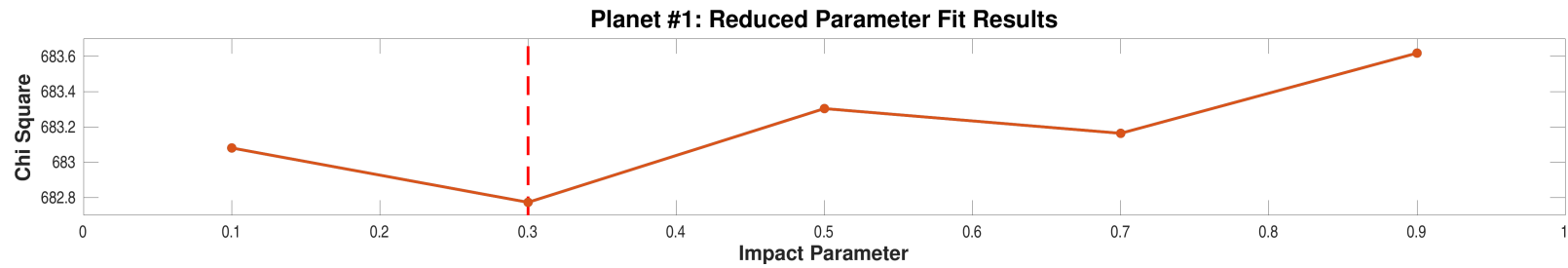
time series; the red dots represent the averaged values of the fitted model light curve of the all transits fit; the green dots are the averaged folded fit residuals, vertically offset for clarity. Magenta dots are the averaged values of the folded flux time series, with a phase shift of 0.5 relative 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/0000000120960812-01-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	7.8	683.1	0.0330996	2.2487e-03	50.4318	2.7260e+00	1258	1.7009e+02	1.9864	1.0682e-01
0.30	7.7	682.8	0.0332717	2.2509e-03	48.5751	2.5544e+00	1255	1.6889e+02	1.9831	1.0378e-01
0.50	7.7	683.3	0.0336777	2.3125e-03	43.5945	2.4795e+00	1247	1.7038e+02	2.0220	1.1445e-01
0.70	7.7	683.2	0.0348226	2.3804e-03	36.2042	2.1138e+00	1255	1.7071e+02	2.0514	1.1928e-01
0.90	7.5	683.6	0.0372377	2.6996e-03	22.2833	1.8658e+00	1235	1.7809e+02	2.2565	1.9142e-01

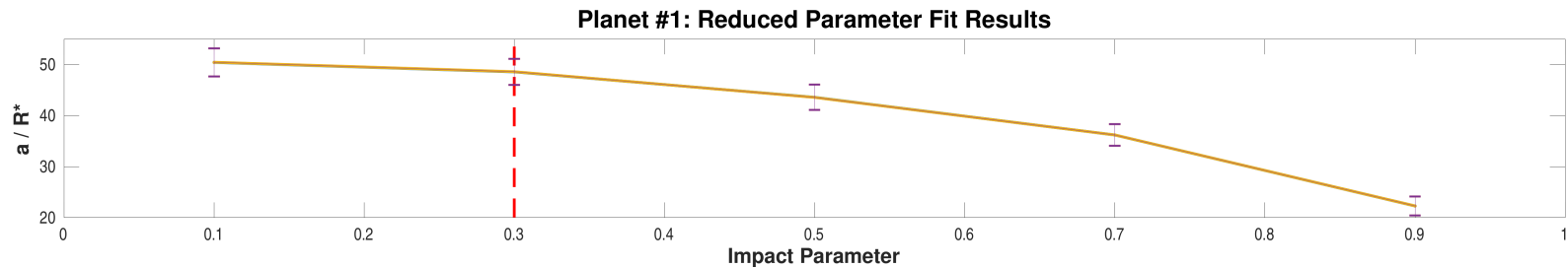Highlighted row is the best reduced-parameter model fit.

Model chi squares of reduced parameter fits vs. impact parameter for CatId 120960812, 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/0000000120960812-01-reduced-fits-chi-square.fig

Ratios of planet radius to star radius of reduced parameter fits vs. impact parameter for CatId 120960812, 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/0000000120960812-01-reduced-fits-rp-over-rstar.fig

Ratios of semimajor axis to star radius of reduced parameter fits vs. impact parameter for CatId 120960812, 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/0000000120960812-01-reduced-fits-a-over-rstar.fig
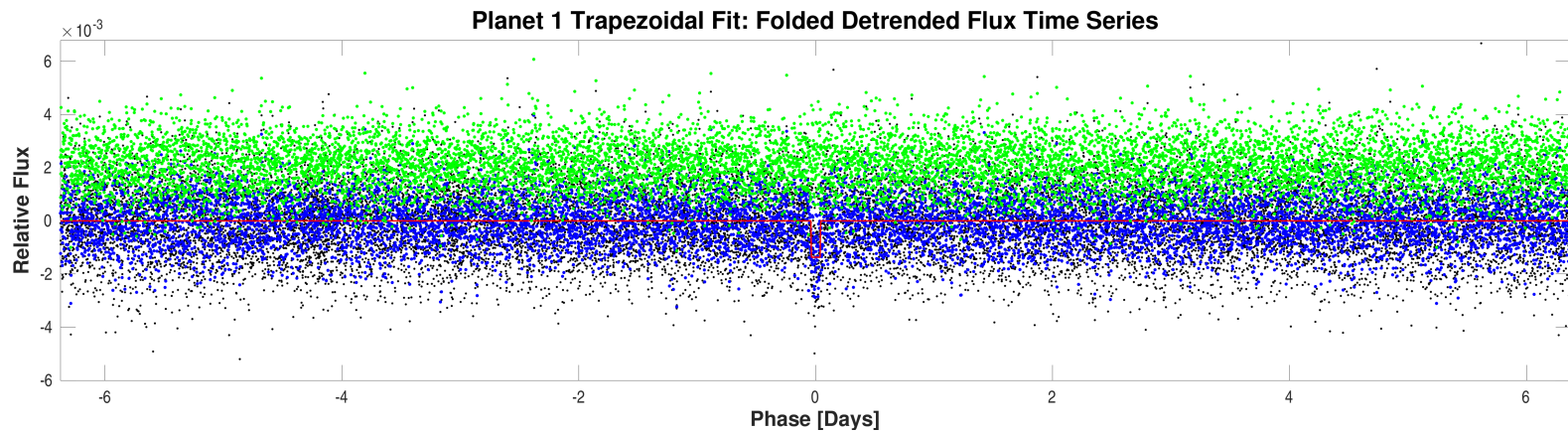
7.3   Model Fitter: Trapezoidal Fit Results

Model Characteristic	Name
Transit Model	trapezoidal_model
Limb Darkening Model	

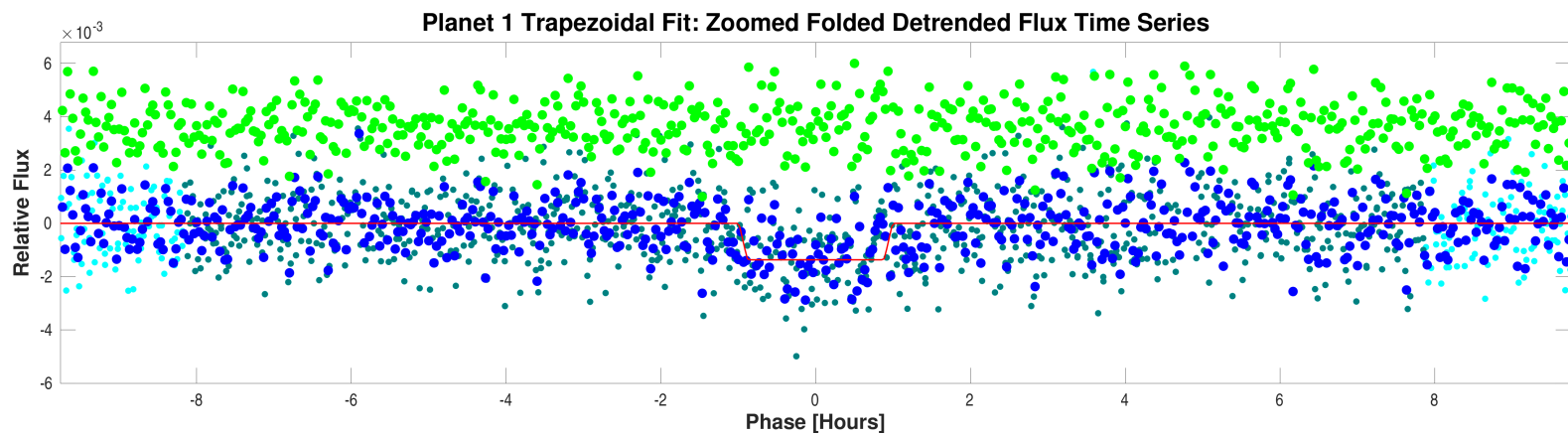| TCE Parameter	Value	Units
Trial Transit Pulse Duration	2.0	hours
Transit Epoch	1687.6962843	TJD
Orbital Period	12.7527723	days
Maximum SES	5.5	
Maximum MES	7.6	
Robust Statistic	7.1	
Chi Square Goodness of Fit Statistic (DoF)	102.8 (119)	
Chi Square2 Statistic (DoF)	0.0 (6.0)	
Threshold for Desired PFA		

DoF: Degrees of Freedom

Parameter	Value	Uncertainty	Units
SNR	8.6		
Orbital Period	12.7527723		days
Transit Epoch	1687.7059812		BTJD
Transit Depth	1368		ppm
Transit Duration	3.2532		hours
Transit Ingress Duration	1.3769		hours
Model Chi Square Statistic (DoF)	18825.2 (940)		

DoF: Degrees of Freedom

Planet 1 Trapezoidal Fit: Folded Detrended Flux Time Series

Folded detrended flux time series for CatId 120960812, Planet candidate 1 and folded trapezoidal model light curve.
Open ./planet-01/planet-search-and-model-fitting-results/trapezoidal-model-fit/0000000120960812-01-all-trapezoidal.fig

Planet 1 Trapezoidal Fit: Zoomed Folded Detrended Flux Time Series

Zoomed folded detrended flux time series for CatId 120960812, Planet candidate 1 and folded trapezoidal model light curve.
Open ./planet-01/planet-search-and-model-fitting-results/trapezoidal-model-fit/0000000120960812-01-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	12.7528		days		
Transit Duration	2		hours		
Maximum MES	7.6				
Secondary Phase	3.7153		days		
Secondary MES	3.8				
Minimum Phase	8.8389		days		
Minimum MES	-3.4				
Median MES	0.1				
MAD MES	0.70535				
Robust Statistic	3.8				
Secondary Depth	664.0	1.6109e+02	ppm		
Geometric Albedo	162.7	2.5443e+02		0.6355	26.25
Planet Effective Temperature	5463	2.1294e+03	Kelvin	2.1003	1.78

7.4.2   Eclipsing Binary Discrimination Test

Result	Value	Value in Sigmas	Significance (%)
Odd Even Transit Depth Comparison Statistic	9.6381e-04	0.0310	97.52

7.4.3   Bootstrap Test

Result	Value
False Alarm Probability	1.6356e-11
Bootstrap Threshold for Desired PFA	6.2
MES Mean	-0.34
MES Standard Deviation	1.19
Transit Count	2

7.4.4   Ghost Diagnostic Test

Result	Value	Significance (%)
Maximum MES	7.6	
SNR	7.4	
Core Aperture Statistic	3.0797e+00	99.90
Halo Aperture Statistic	1.6542e+00	95.10
Ratio of Core/Halo Aperture Statistics	1.8617e+00	

7.4.5   Validation Test Figures

Planet 1 : Secondary MES vs. Phase

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. The maximum secondary MES and corresponding phase are 3.8263 and 3.7153 days respectively. The minimum secondary MES and corresponding phase are -3.3856 and 8.8389 days respectively.

Open `./planet-01/report-summary/0000000120960812-01-weak-secondary-diagnostic.fig`

Bootstrap Results for Planet 1
Max Multiple Event Sigma=7.6, False Alarm=1.64e-11

Bootstrap results for target 120960812, 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 6.6338. The threshold on this distribution that achieves the same false alarm rate as a 7.1 sigma threshold on a Gaussian distribution is 6.2239.
Open `./planet-01/bootstrap-results/0000000120960812-01-bootstrap-false-alarm.fig`

Planet 1 : Cotrended Folded Core Aperture Flux Time Series
Correlation Statistic = 3.08, Significance = 99.90%

Optical ghost diagnostic core aperture flux time series for target 120960812, 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.

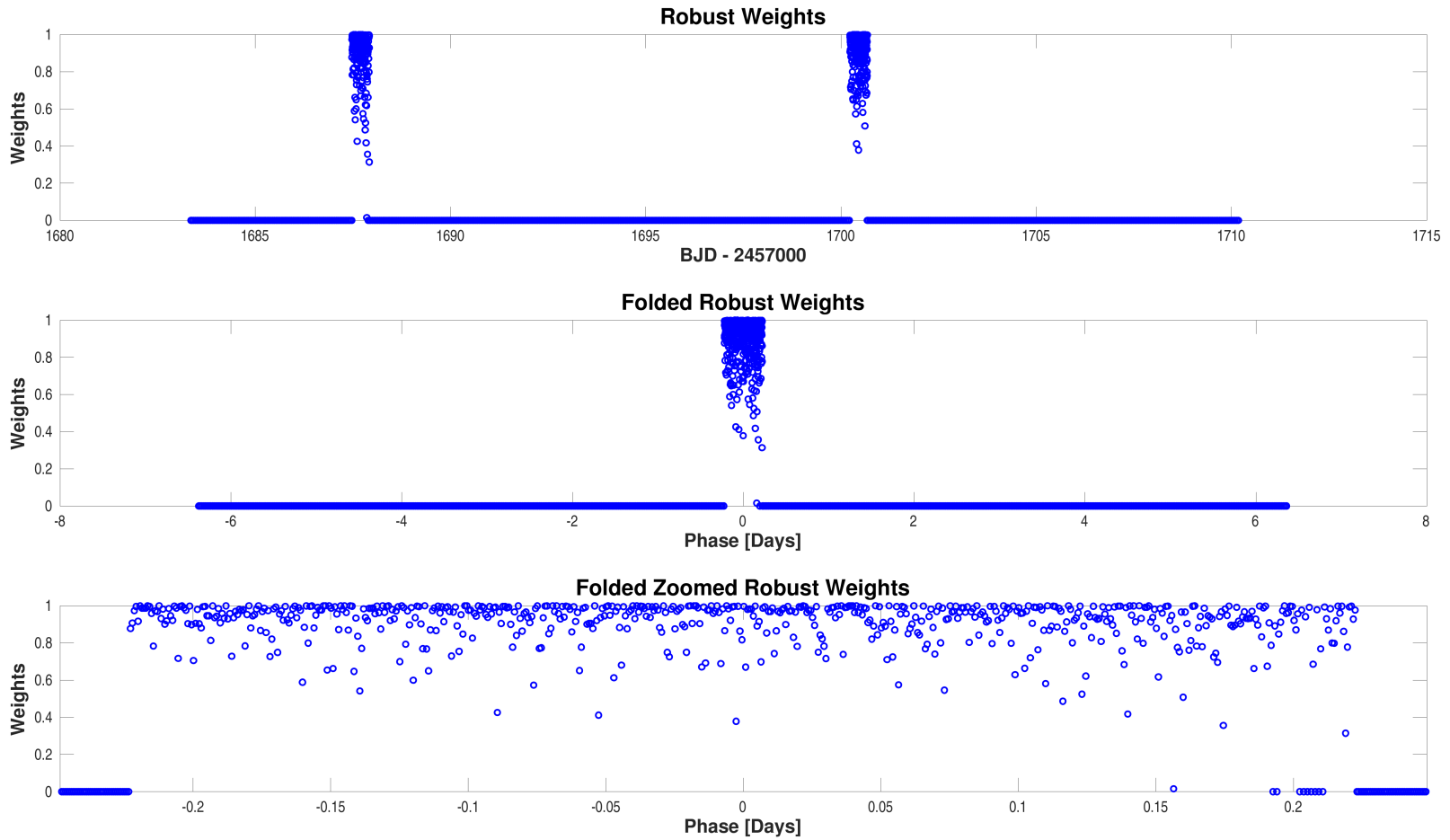Open ./planet-01/ghost-diagnostic-results/0000000120960812-01-core-unwhitened-cotrended-zoomed-model.fig

Planet 1 : Cotrended Folded Halo Aperture Flux Time Series
Correlation Statistic = 1.65, Significance = 95.10%

Optical ghost diagnostic halo aperture flux time series for target 120960812, 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.

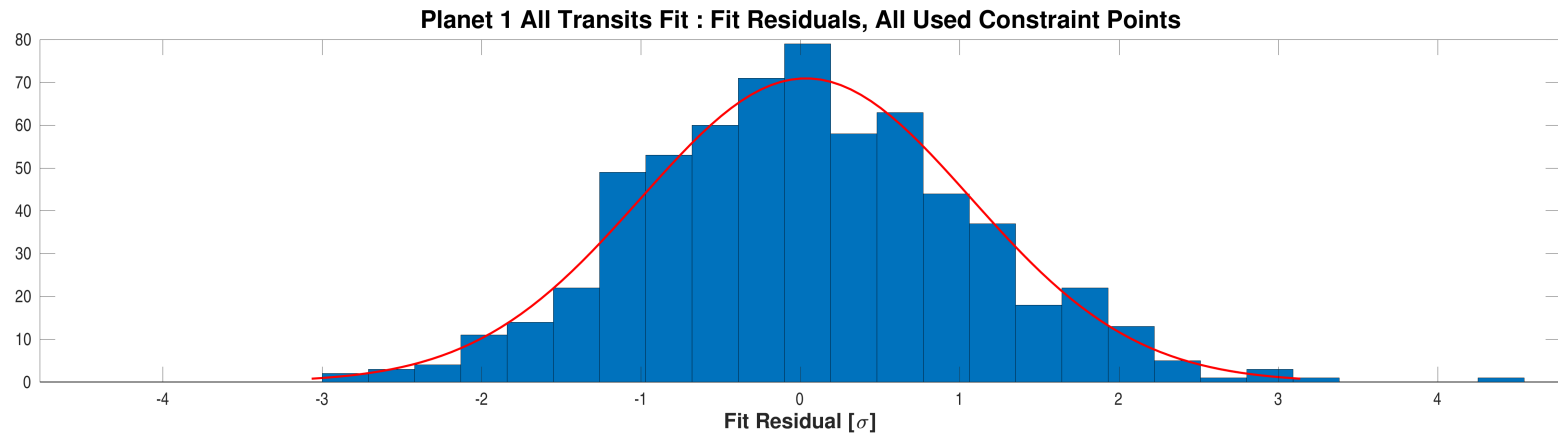Open ./planet-01/ghost-diagnostic-results/0000000120960812-01-halo-unwhitened-cotrended-zoomed-model.fig

Appendix A   Planet Candidate 1
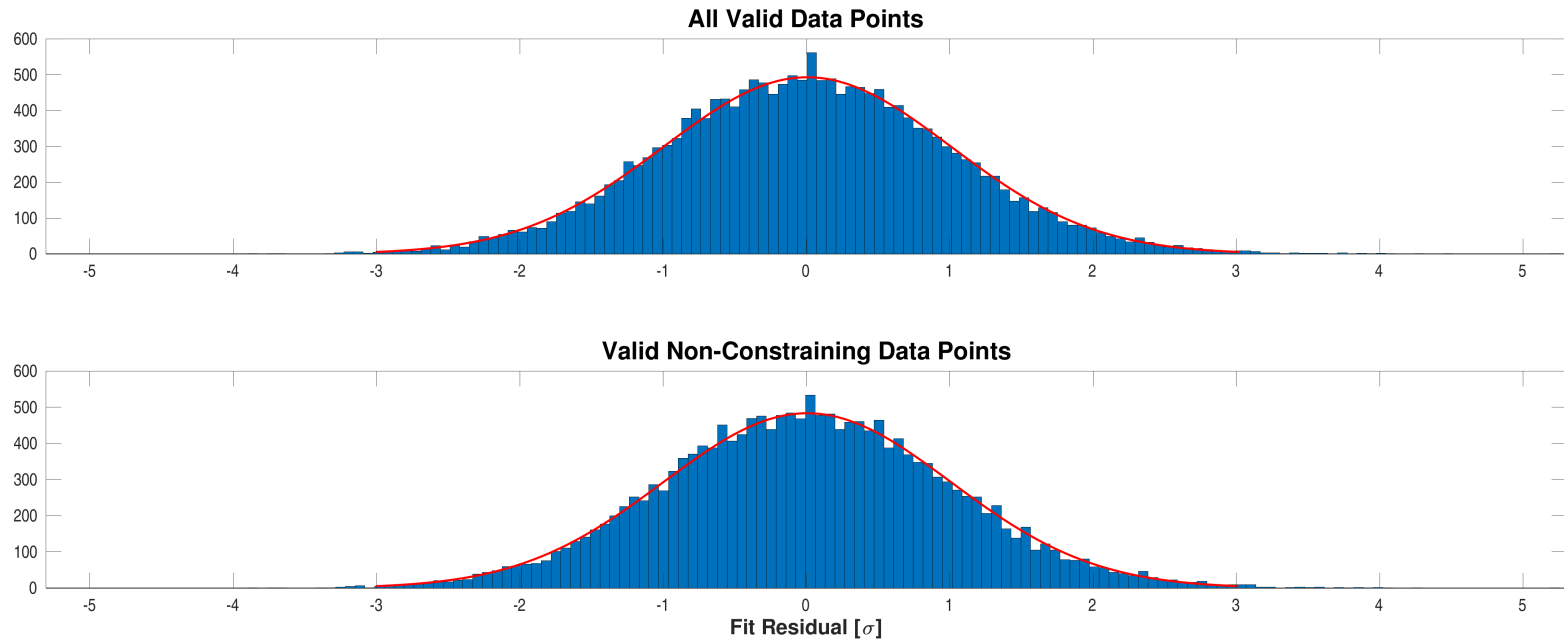
A.1   Model Fitter: All Transits

Robust weights distribution for CatId 120960812, 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/0000000120960812-01-all-robust-weights.fig`

Fit residuals distribution for CatId 120960812, 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/0000000120960812-01-all-histo-used.fig
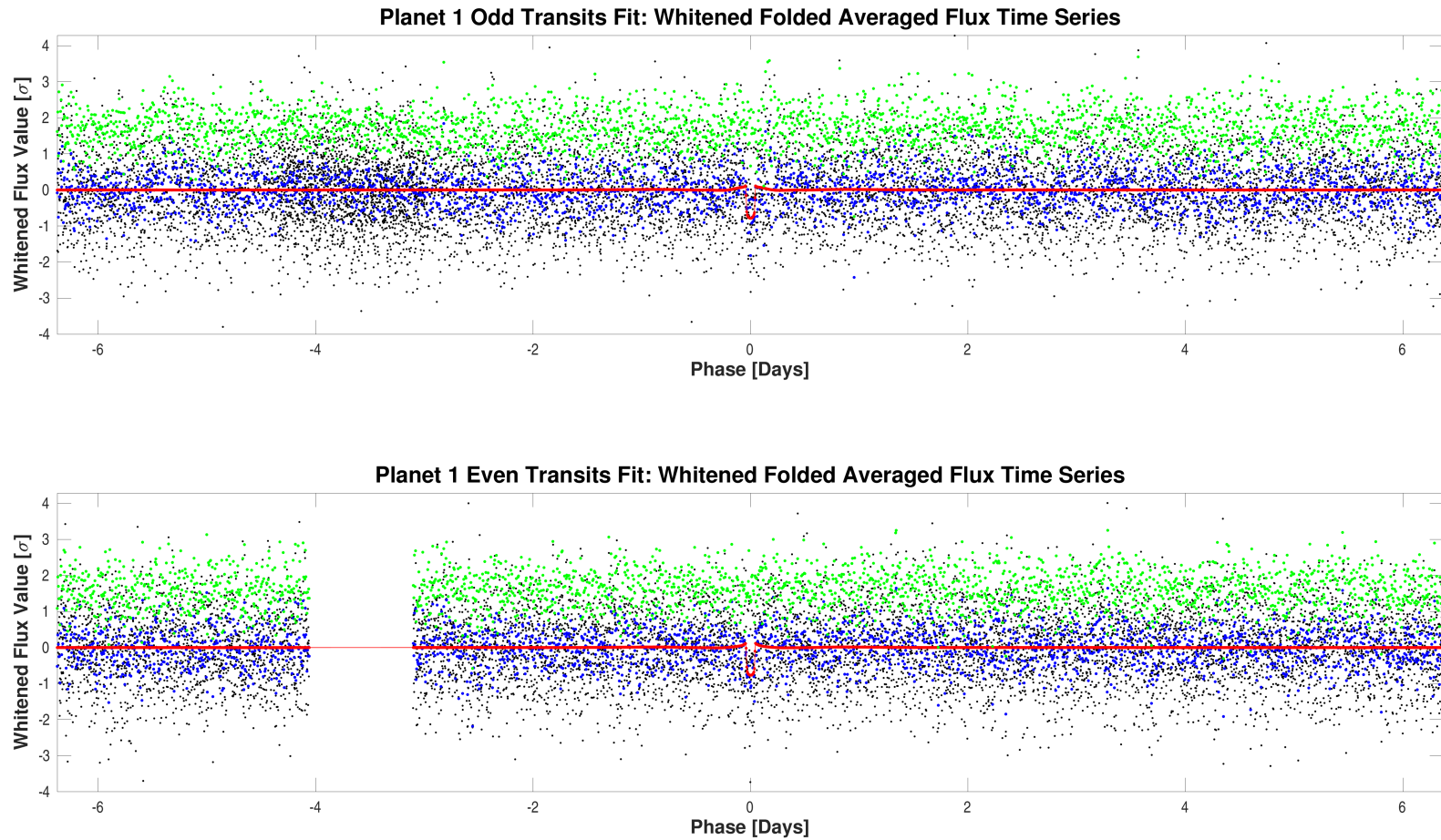

Fit residuals distribution for CatId 120960812, Planet candidate 1. Top plot: all valid data. Bottom plot: valid data not used to constrain fit (due to distance from a transit). Gaussian fits to the histograms are shown in red.
Open ./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000120960812-01-all-histo-all-and-unused.fig
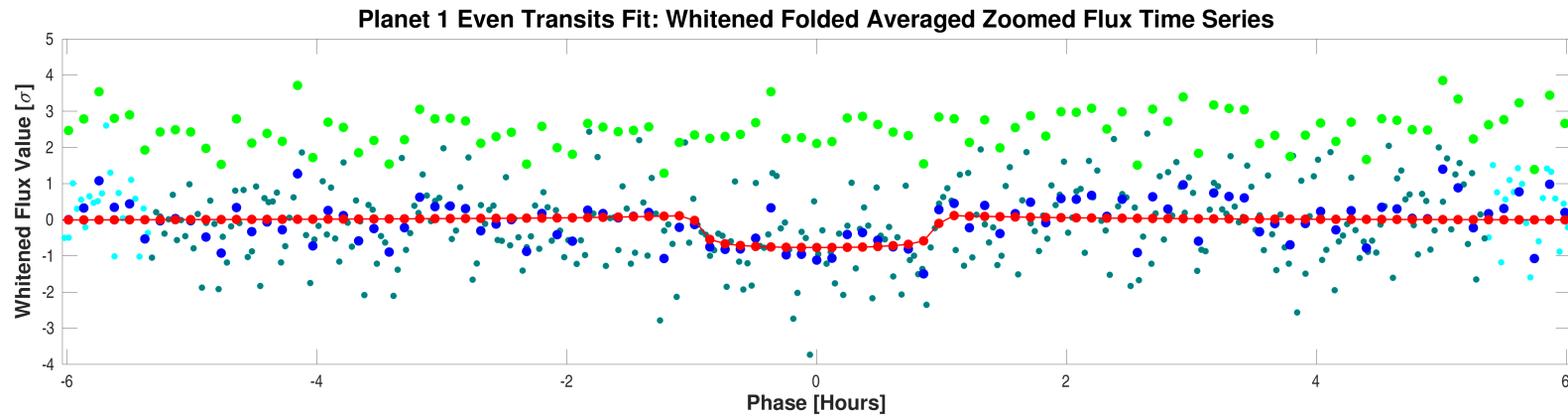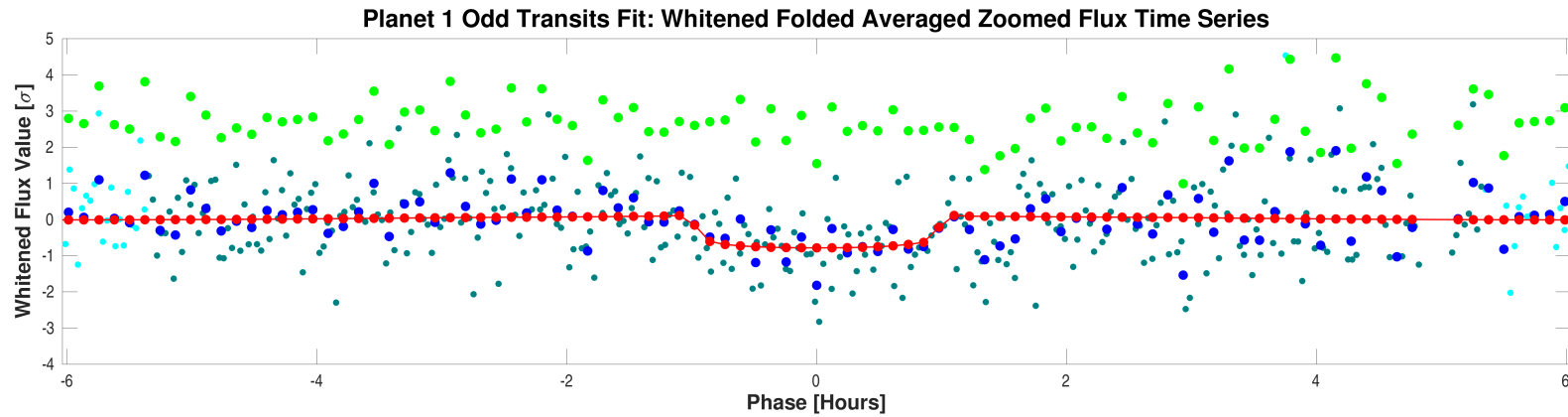
A.2 Model Fitter: Odd & Even Transits

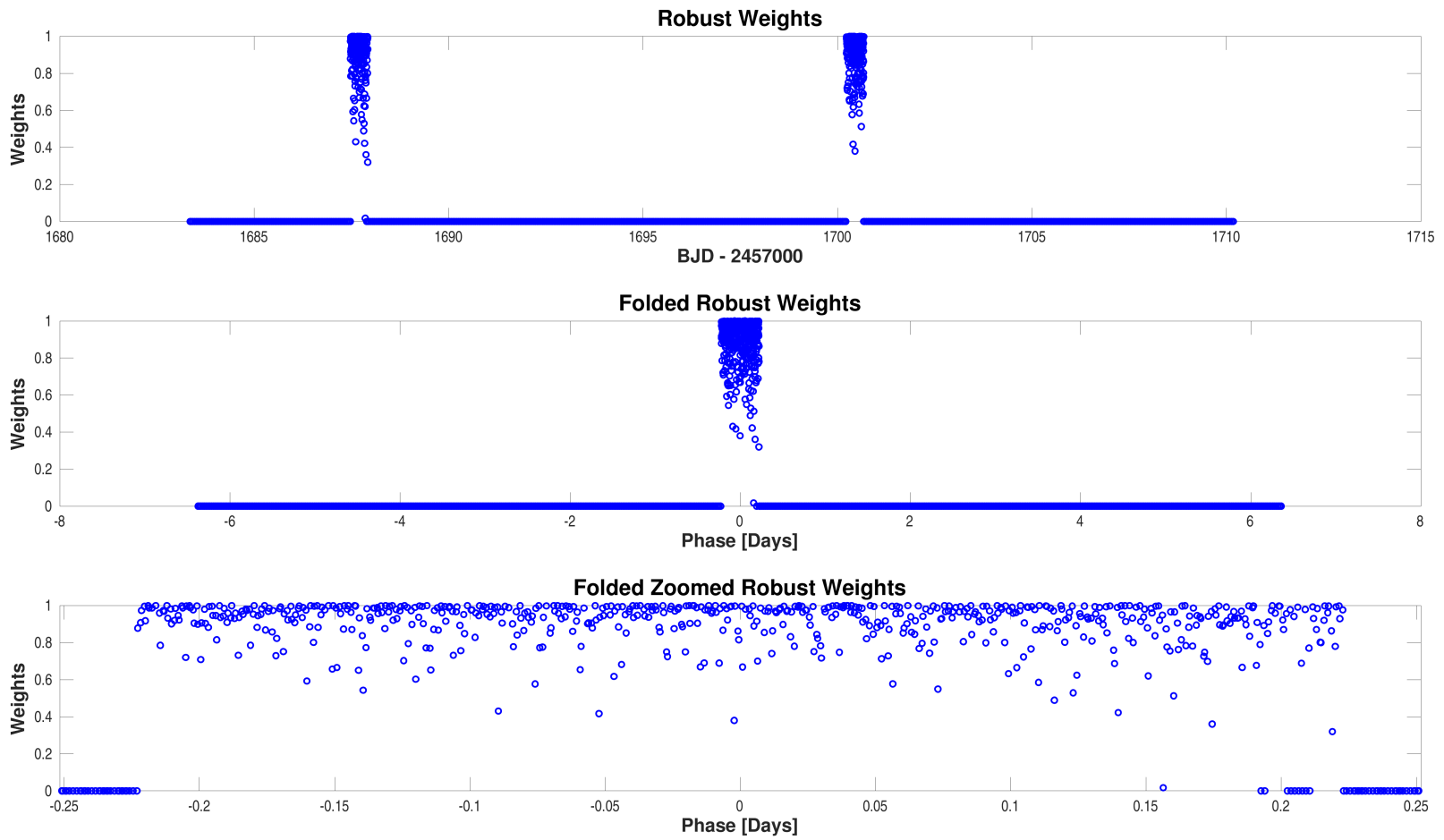| Parameter	Odd Transits Value	Odd Transits Uncertainty	Even Transits Value	Even Transits Uncertainty	Units	Difference ‖Uncertainty‖
SNR	5.4		5.1			
Orbital Period	12.7516047	0.0000e+00	12.7516047	0.0000e+00	days	
Transit Epoch	1687.6989484	3.0196e-03	1700.4512271	2.9899e-03	BTJD	6.4400e-02
Impact Parameter	0.2058	3.6188e+01	0.2277	3.2548e+01		4.5029e-04
Planet Radius to Star Radius Ratio	0.0331127	4.0788e-02	0.0332881	4.1228e-02		3.0240e-03
Semi-major Axis to Star Radius Ratio	49.0018	3.7934e+02	50.0897	3.9023e+02		1.9990e-03
Planet Radius	5.3417	6.5874e+00	5.3700	6.6584e+00	Earth radii	3.0205e-03
Semi-major Axis	0.1134	9.2239e-03	0.1134	9.2239e-03	AU	0.0000e+00
Effective Stellar Flux	226.3485	3.8572e+01	226.3485	3.8572e+01	Goldilocks	0.0000e+00
Equilibrium Temperature	989	4.2146e+01	989	4.2146e+01	Kelvin	0.0000e+00
Stellar Density	9.7217	2.2578e+02	10.3837	2.4269e+02	Solar density	1.9971e-03
Transit Depth	1253	2.5251e+02	1264	2.6255e+02	ppm	3.1045e-02
Transit Duration	2.0128	1.0593e+00	1.9603	1.0705e+00	hours	3.4872e-02
Transit Ingress Duration	0.0673	1.1275e+00	0.0665	1.1208e+00	hours	4.9205e-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)	501.2 (571.4)		501.2 (571.4)			

DoF: Degrees of Freedom

Folded flux time series for CatId 120960812, 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/0000000120960812-01-odd-even-whitened.fig`

Planet 1 Odd Transits Fit: Whitened Folded Averaged Zoomed Flux Time Series

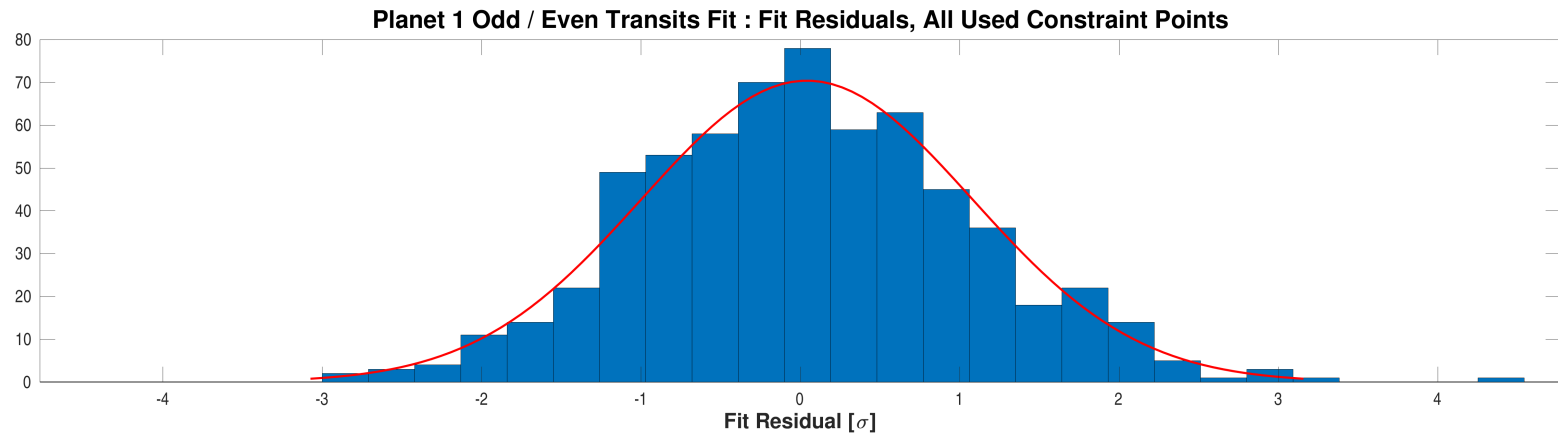**Planet 1 Even Transits Fit: Whitened Folded Averaged Zoomed Flux Time Series**

Folded flux time series for CatId 120960812, 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/0000000120960812-01-odd-even-whitened-zoomed.fig
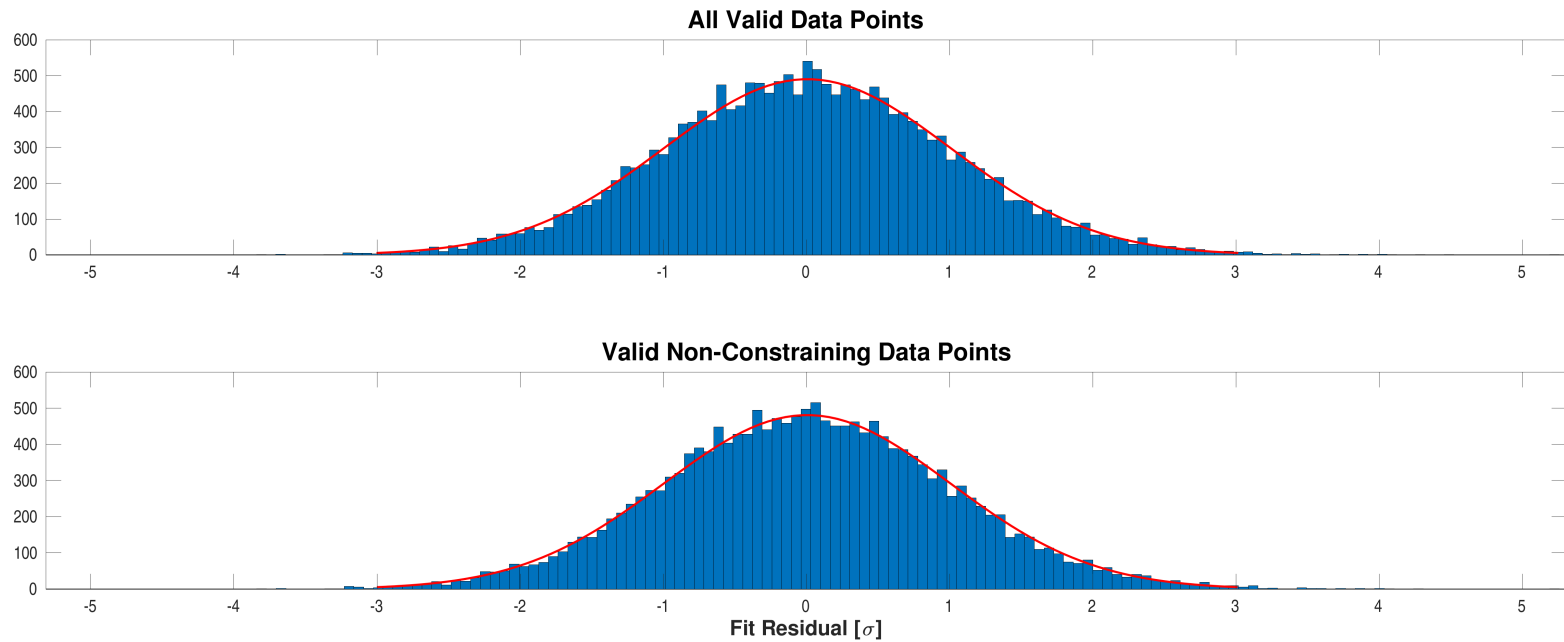
Robust weights distribution for CatId 120960812, Planet candidate 1. Top plot: all data points. Middle plot: all data points, folded per the fitted period and epoch. Bottom plot: all data points, folded and zoomed.

Open `./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000120960812-01-odd-even-robust-weights.fig`

Planet 1 Odd / Even Transits Fit : Fit Residuals, All Used Constraint Points

Fit residuals distribution for CatId 120960812, 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.
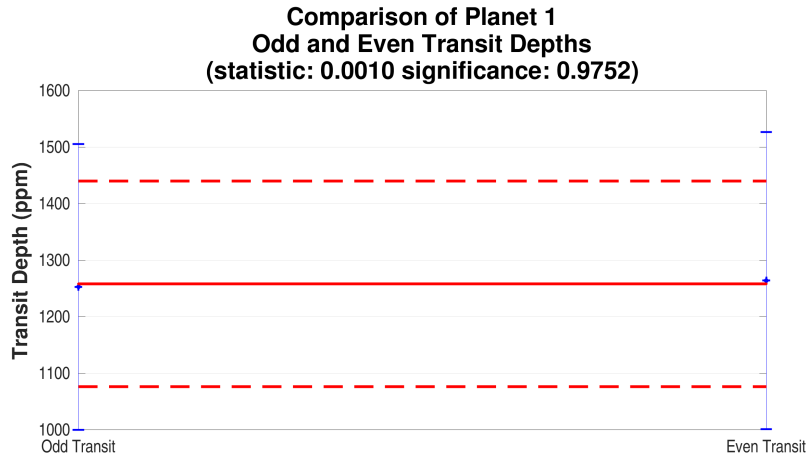Open ./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000120960812-01-odd-even-histo-used.fig

All Valid Data Points

Valid Non-Constraining Data Points

Fit residuals distribution for CatId 120960812, 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/0000000120960812-01-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 120960812, planet 1. A significance level close to 1/0 favors a transiting planet/an eclipsing binary. Open `./planet-01/binary-discrimination-test-results/0000000120960812-01-eclipsing-binary-discrimination-tests.fig`

Appendix B　Alerts

This target did not trigger any alerts.