



Data Validation (DV) Report

for TESS ID 432549364
Sectors 17 - 17

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

20-Mar-2020 21:40:46 Z

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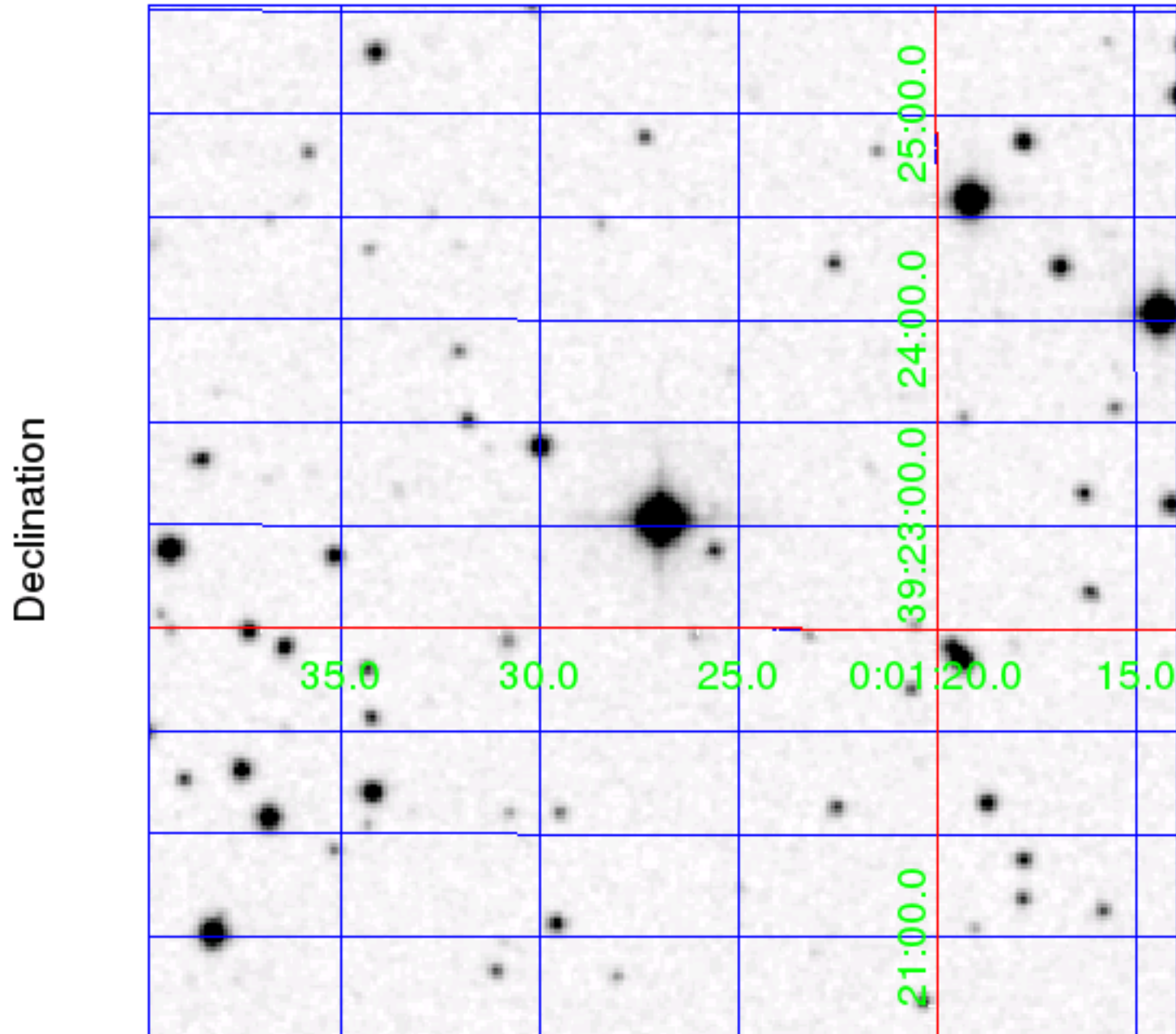
1 Summary

Target Properties	Value	Uncertainty	Units	Provenance
Catalog ID	432549364			
TOI ID	1476			
TESS Name	-			
RA	0.36215389	0	degrees	TIC8
Dec	39.38382837	0	degrees	TIC8
Magnitude	10.2242	0.0061		TIC8
Radius	1.462	0.073	Solar radii	TIC8
Effective Temperature	6596	157	Kelvin	TIC8
log(g)	4.247	0.091689	cm/sec ²	TIC8
[M/H]	0.131	0.009	Solar metallicity	TIC8
Stellar Density	0.440	0.095	Solar density	TIC8-Derived
Limb Darkening Coefficient 1	0.4646			
Limb Darkening Coefficient 2	0.45799			
Limb Darkening Coefficient 3	-0.44187			
Limb Darkening Coefficient 4	0.1332			
Number of Planet Candidates	1			
TOI Model	csv-file-toi-catalog-03-18-20-edited.csv			
TESS Names Model	-			
External TCE Model	-			
Software Revision	spoc-4.0.25-20200311			
Date Report Generated	20-Mar-2020 21:40:46 Z			

Sector	Target Table	Camera/ CCD	Crowding Metric	Flux Fraction
17	176	2:3	0.9850	0.9125

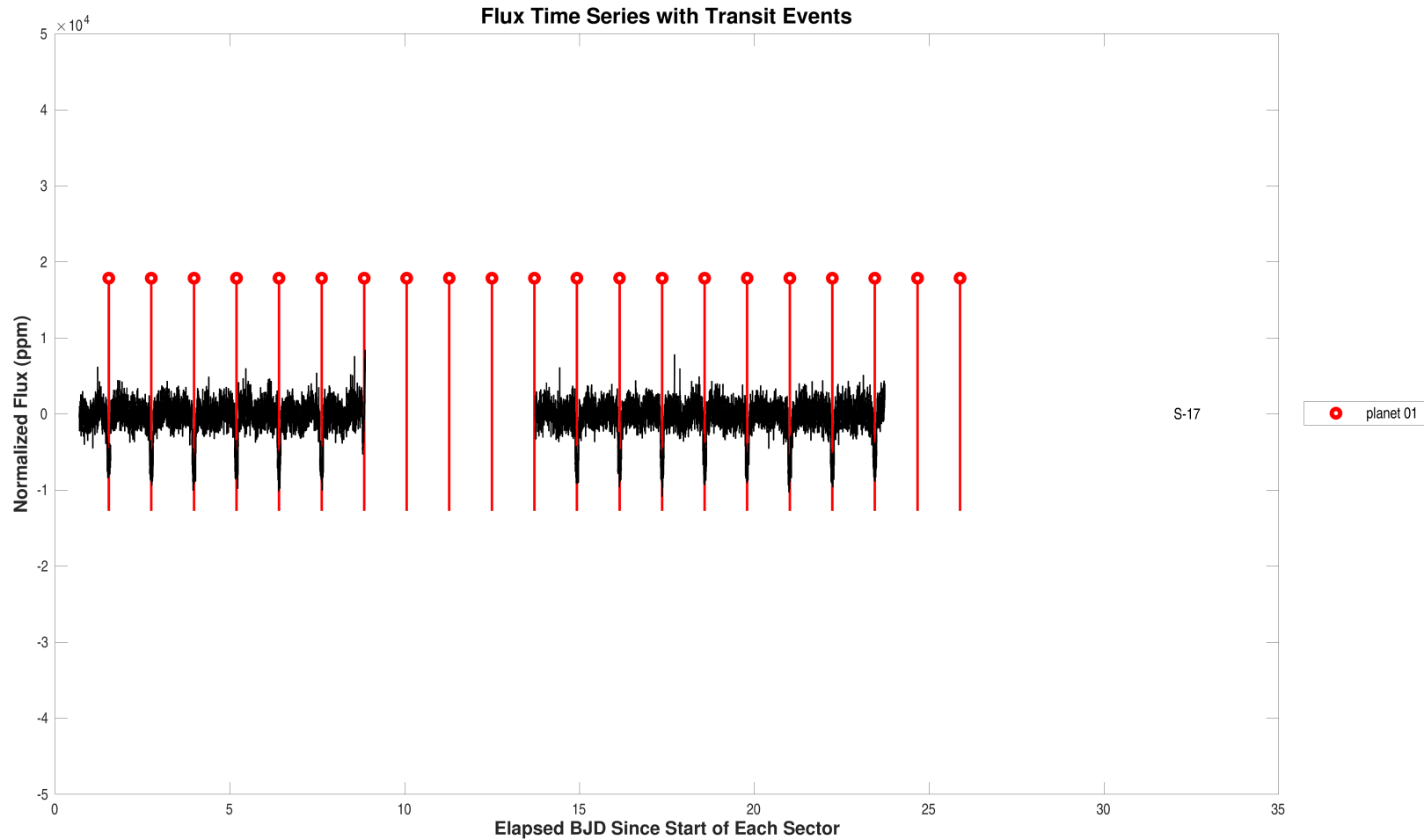
Planet Candidate	TOI ID	TESS Name	TOI Correlation	Period (days)	Period Ratio	Epoch (BTJD)	Semi-major Axis (AU)	Radius (Re)	Seff	Teq (K)	False Alarm	Suspected EB
1	1476.01	-	1.00	1.218	1.00	1765.534	0.02	12.0	5879.5	2233	1.76e-230	false

2 Survey Image

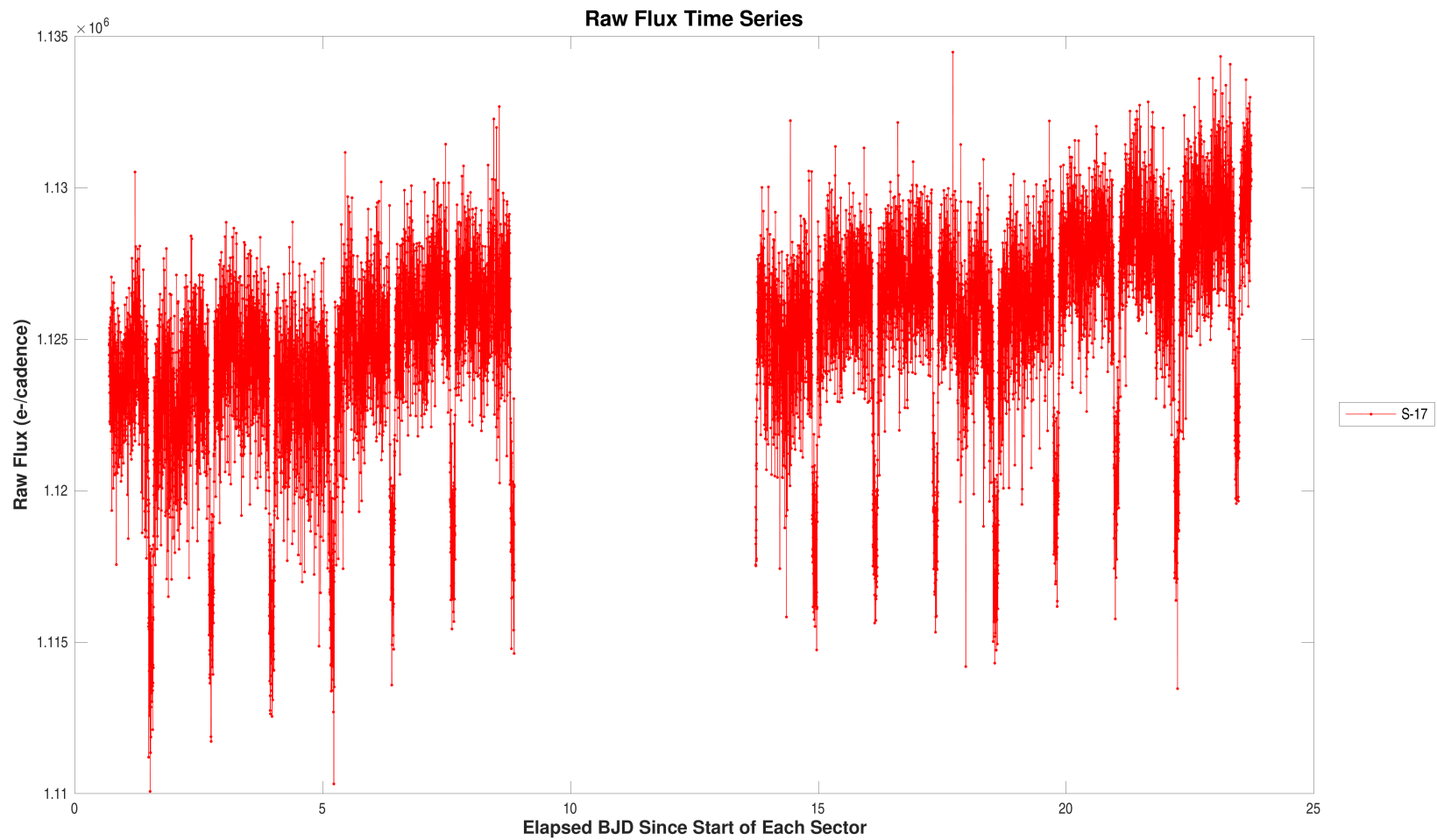


Digitized Sky Survey (DSS) red image. The 5' x 5' image is centered on the J2000 coordinates of target (432549364).

3 Flux Time Series



Summary plot of sector-stitched flux time series and transits for target 432549364, 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 17, target table 176, start BJD is 2458764. Open `./summary-plots/0000000432549364-00-flux-dv-fit-17-176.fig`



Summary plot of raw flux time series. For the data of sector 17, target table 176, start BJD is 2458764.
Open `./summary-plots/000000432549364-00-raw-flux-17-176.fig`

4 Dashboards

Planet Candidate 1

Model Fitter	Stellar Radius 1.5 ± 0.1 Solar units		Core Aperture Correlation Statistic Value = 62.99 Significance = 100.00%		Ghost Diagnostic Test
	Period = 1.2 ± 0.0 days Depth = 6460 ± 82 ppm Planet Radius = 12.0 ± 0.6 Earth radii Semi-major Axis = 0.0 ± 0.0 AU Effective Stellar Flux = 5879.5 ± 1017.2 Equilibrium Temperature = 2233 ± 97 Kelvin Chi-squared/DoF = 0.8 SNR = 77.3		Halo Aperture Correlation Statistic Value = 7.41 Significance = 100.00% Core/Halo Ratio Ratio = 8.51		
Eclipsing Binary Discrimination Test	Odd-Even Depth Comparison Statistic Value = 2.30e+01 Significance = 0.00%		Offsets Relative to Out of Transit Centroid Source RA Offset = -4.39e-01 ± 2.50e+00 arcsec (-0.18 σ) Source Dec Offset = 3.05e-01 ± 2.50e+00 arcsec (0.12 σ) Source Offset Distance = 5.35e-01 ± 2.50e+00 arcsec (0.21 σ) Offsets Relative to TIC Position Source RA Offset = 4.03e-01 ± 2.50e+00 arcsec (0.16 σ) Source Dec Offset = 1.80e+00 ± 2.50e+00 arcsec (0.72 σ) Source Offset Distance = 1.85e+00 ± 2.50e+00 arcsec (0.74 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 = 1.76e-230 Transit Count = 20 Max Multiple Event Statistic = 36.9		

Summary of model fitter results and validation test results for target 432549364, 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

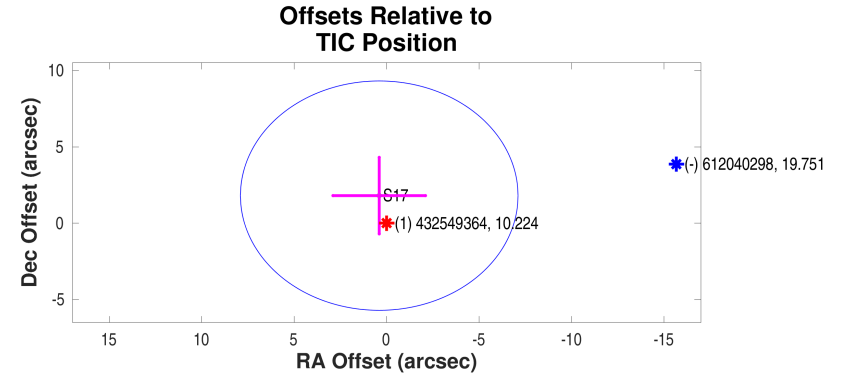
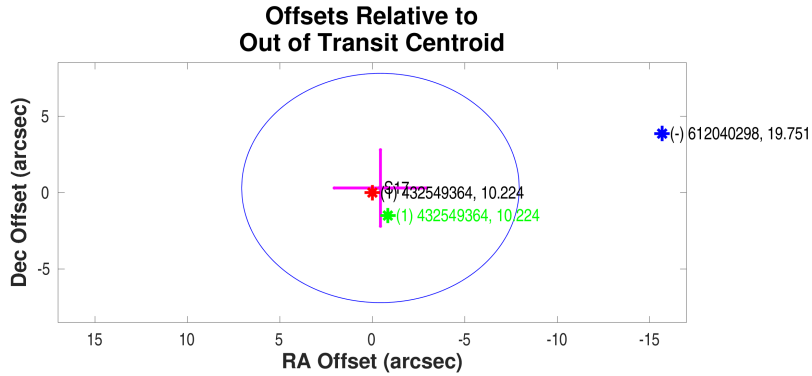
Mean offset from the PRF fit to the out of transit image

	RA	Dec	Units
Offset	$-0.4394 \pm 2.50e + 00$	$0.3054 \pm 2.50e + 00$	arcseconds
Offset/ σ	-0.18	0.12	
Offset Distance	$0.5351 \pm 2.50e + 00$		arcseconds
Offset Distance/ σ	0.21		
3σ Radius	7.5067		arcseconds

Mean offset from the TIC RA and Dec

	RA	Dec	Units
Offset	$0.4029 \pm 2.50e + 00$	$1.8049 \pm 2.50e + 00$	arcseconds
Offset/ σ	0.16	0.72	
Offset Distance	$1.8493 \pm 2.50e + 00$		arcseconds
Offset Distance/ σ	0.74		
3σ Radius	7.5089		arcseconds

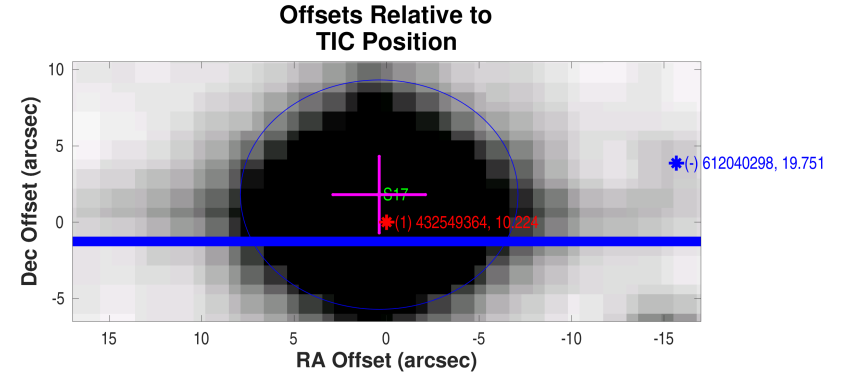
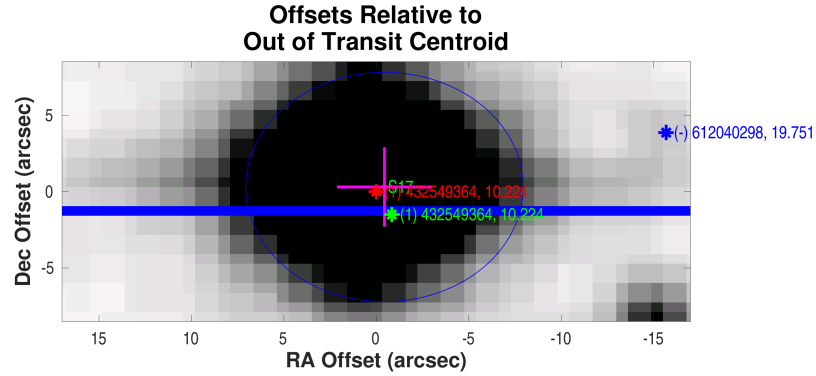
Planet Candidate 1



Difference image centroid offsets for target 432549364, 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/0000000432549364-01-difference-image-centroid-offsets.fig`

Planet Candidate 1



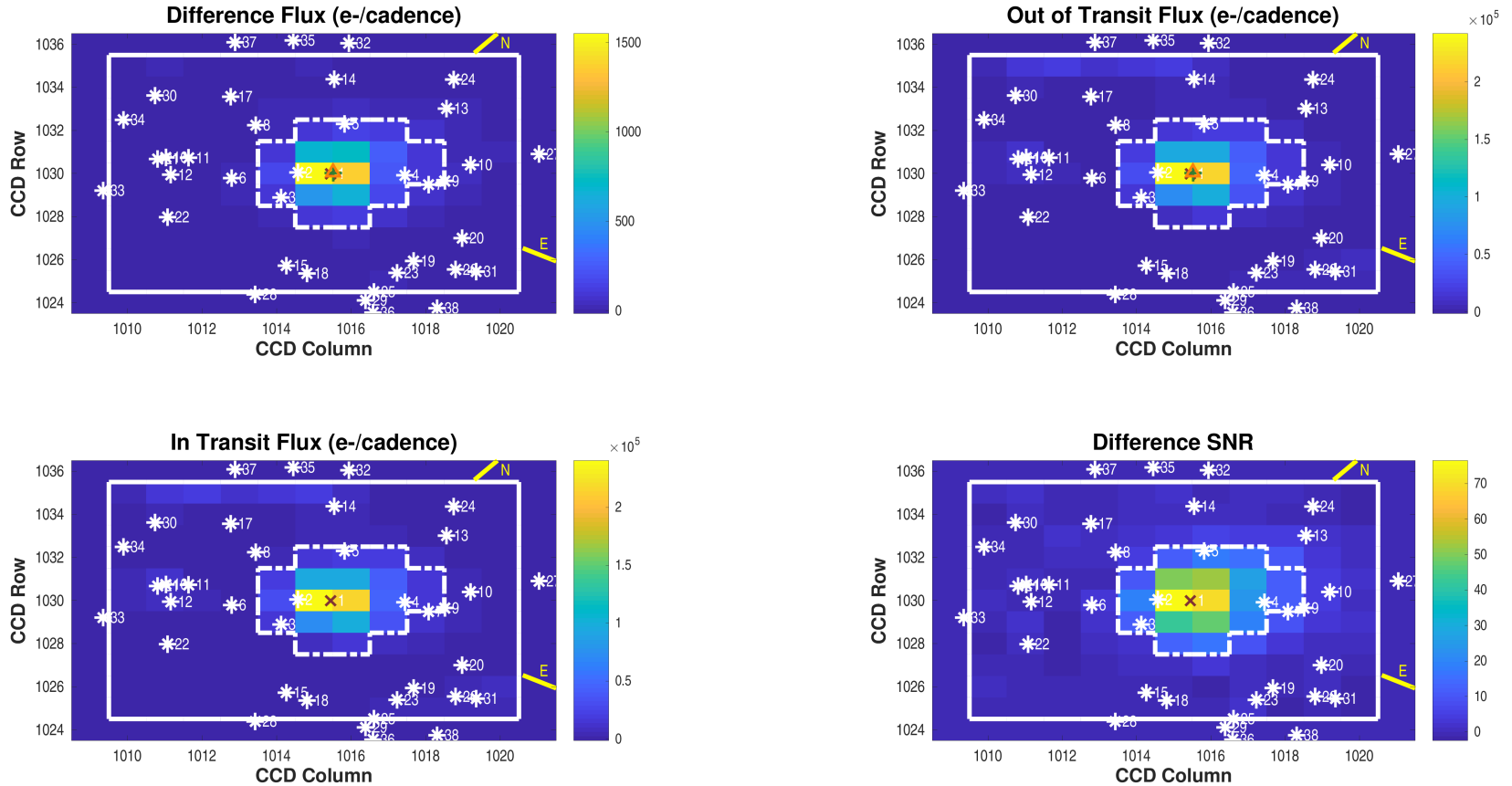
Difference image centroid offsets for target 432549364, planet candidate 1, displayed on survey image for given target. Left: difference image PRF centroid offsets in RA and Dec with respect to the per sector out-of-transit centroids for the given target. Right: difference image PRF centroid offsets 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/0000000432549364-01-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 17 / Target Pixel Table 176



Difference image for target 432549364, planet candidate 1, sector 17, target pixel table 176. Upper left: difference between mean flux out-of-transit and in-transit; upper right: mean out-of-transit flux; lower left: mean in-transit flux; lower right: difference between mean flux out-of-transit and in-transit after normalizing by the uncertainty in the difference for each pixel. The optimal aperture is outlined with a white dash-dotted line in each panel and the target mask is outlined with a solid white line. Symbol key: x: target position from TIC RA and Dec converted to CCD coordinates via motion polynomials; *: position of nearby TIC objects converted to CCD coordinates via motion polynomials; +: PRF-fit location of target from out-of-transit image; triangle: PRF-fit location of transit source from the difference image. Number of transits = 14; number of valid in-transit cadences = 956; number of in-transit cadence gaps = 8; number of valid out-of-transit cadences = 2377; number of out-of-transit cadence gaps = 25. Difference image quality metric = 1.00 (good).

Open `./planet-01/difference-image/0000000432549364-01-difference-image-17-176.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	$1030.03 \pm 2.15e - 05$	$1015.52 \pm 2.06e - 05$	pixels	$0.36238705 \pm 7.33e - 07$	$39.38420267 \pm 6.63e - 07$	degrees
Difference Image Centroid	$1030.05 \pm 6.10e - 03$	$1015.51 \pm 5.88e - 03$	pixels	$0.36222914 \pm 3.44e - 05$	$39.38428749 \pm 3.42e - 05$	degrees
Offset	$0.0242 \pm 6.10e - 03$	$-0.0090 \pm 5.88e - 03$	pixels	$-0.4394 \pm 9.57e - 02$	$0.3054 \pm 1.23e - 01$	arcseconds
Offset/ σ	3.97	-1.54		-4.59	2.48	
Offset Distance	$0.0258 \pm 6.07e - 03$		pixels	$0.5351 \pm 1.07e - 01$		arcseconds
Offset Distance/ σ	4.25			4.98		

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

	Row	Column	Units	RA	Dec	Units
TIC Reference Centroid	$1029.99 \pm 1.07e - 04$	$1015.45 \pm 1.32e - 04$	pixels	$0.36208435 \pm 0.00e + 00$	$39.38378614 \pm 0.00e + 00$	degrees
Difference Image Centroid	$1030.05 \pm 6.10e - 03$	$1015.51 \pm 5.88e - 03$	pixels	$0.36222914 \pm 3.44e - 05$	$39.38428749 \pm 3.42e - 05$	degrees
Offset	$0.0625 \pm 6.10e - 03$	$0.0665 \pm 5.88e - 03$	pixels	$0.4029 \pm 9.57e - 02$	$1.8049 \pm 1.23e - 01$	arcseconds
Offset/ σ	10.24	11.30		4.21	14.68	
Offset Distance	$0.0912 \pm 5.99e - 03$		pixels	$1.8493 \pm 1.21e - 01$		arcseconds
Offset Distance/ σ	15.22			15.29		

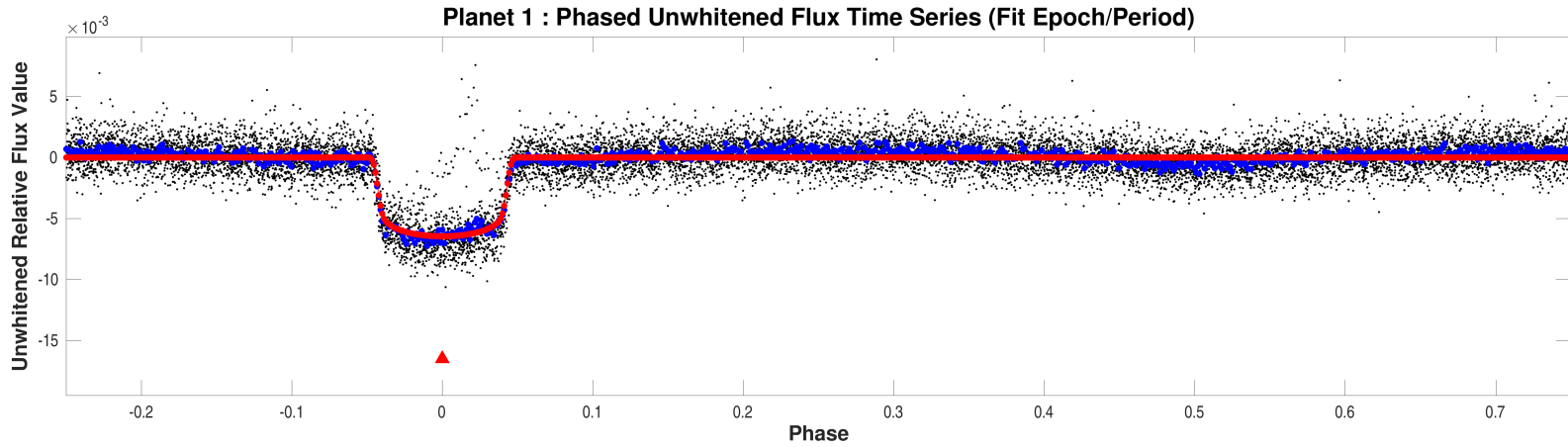
5.2 Difference Image TIC Key

Index	Catalog ID	Mag	RA (degrees)	Dec (degrees)	Distance (arcsec)
1	432549364	10.224	0.36208435	39.38378614	0.00
2	432552602	16.688	0.35646933	39.38128747	18.03
3	612040295	18.559	0.35857747	39.37447030	34.93
4	432549365	14.716	0.37464848	39.38970161	40.94
5	612040297	19.036	0.35459163	39.39579585	48.00
6	432554498	18.165	0.34662104	39.37449010	54.51
7	432550162	18.796	0.38038000	39.38967500	55.15
8	432553411	18.427	0.34019932	39.38801619	62.77
9	432553031	17.092	0.38236676	39.39182522	63.42
10	432553291	17.522	0.38342972	39.39751492	77.27
11	612040296	18.488	0.33552890	39.37527186	80.00
12	432553116	17.204	0.33590174	39.37008702	87.98
13	612040300	18.807	0.36843656	39.40773668	88.01
14	432550556	17.065	0.34414363	39.40460117	90.04
15	432554374	16.972	0.37280416	39.36009095	90.37
16	432549359	14.851	0.33171088	39.37343698	92.36
17	612040301	18.507	0.33048794	39.39212021	92.90
18	432550692	18.294	0.37772666	39.36012471	95.66
19	432554373	17.089	0.39292558	39.37179080	96.07
20	432549367	15.784	0.39645263	39.38087284	96.20
21	432549358	13.951	0.33064198	39.37240159	96.61
22	432554820	16.985	0.34371338	39.36061969	97.82
23	432550087	16.864	0.39246963	39.36785162	102.17
24	432553598	17.294	0.36389828	39.41466429	111.28
25	432549357	14.649	0.39238322	39.36177131	115.71
26	432552604	15.697	0.40152959	39.37350432	115.83
27	612040511	18.398	0.39266820	39.40563331	115.88
28	432554596	15.733	0.37332302	39.35119498	121.42
29	612040272	18.707	0.39269627	39.35919089	122.86
30	432555169	16.401	0.31779841	39.38596397	123.47
31	432549366	15.750	0.40531217	39.37479765	124.56
32	432551721	17.838	0.33944526	39.41371026	124.79
33	432554146	15.878	0.32785957	39.36092466	125.87
34	612040293	16.996	0.31729290	39.37802251	126.35
35	432549363	11.690	0.32974808	39.40962059	129.40
36	432553186	17.048	0.39632897	39.35720562	135.04
37	432549362	15.345	0.32049909	39.40427182	137.21
38	432552603	15.218	0.40605046	39.36356432	142.36

Index	Catalog ID	Mag	RA (degrees)	Dec (degrees)	Distance (arcsec)
39	432552598	14.287	0.40320669	39.35971676	143.53
40	432554412	18.384	0.40320442	39.40797667	143.79
41	432550165	16.626	0.32406884	39.35633605	144.76
42	432554322	17.635	0.39909663	39.41351943	148.54
43	612040282	18.682	0.32924281	39.35084277	149.72
44	432554378	17.136	0.32418152	39.35316990	152.55
45	432552601	15.453	0.32409273	39.41440606	152.73

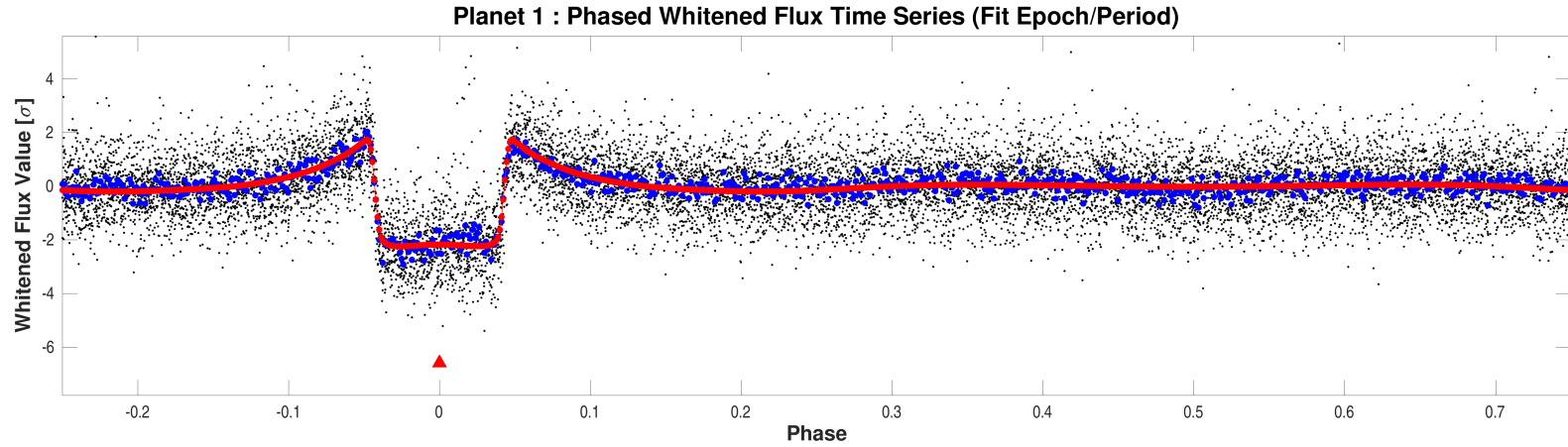
RA, Dec and Distances are corrected for proper motion. This table may not contain all of the objects shown.

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.

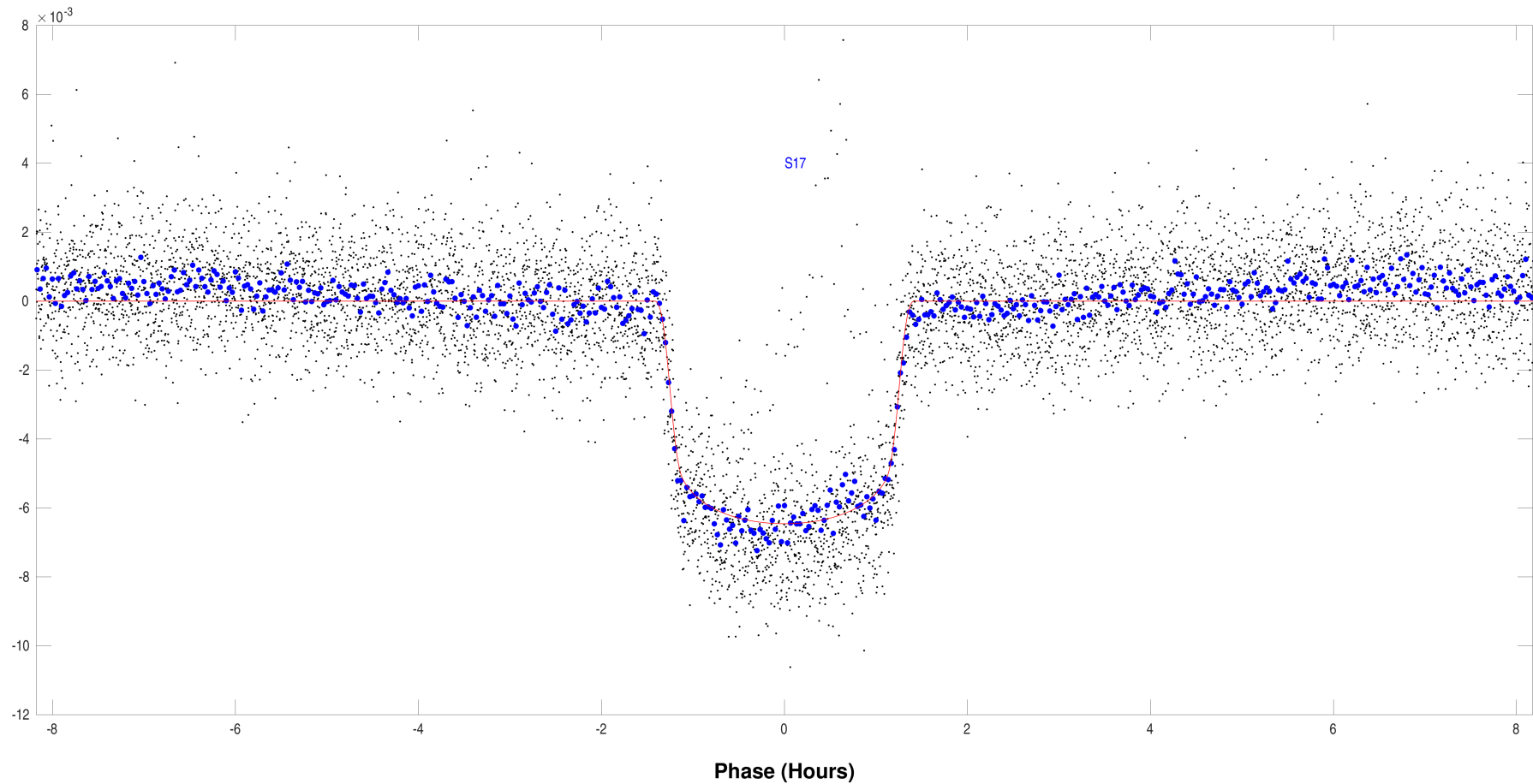
Open `./summary-plots/0000000432549364-01-phased-unwhitened-flux-time-series.fig`



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/0000000432549364-01-phased-whitened-flux-time-series.fig`

Planet: 1 Phased Unwhitened Flux Time Series by Sector



Phased unwhitened flux time series by sector for target 432549364, planet candidate 1. Period = 1.2175 days; transit epoch = 1765.5337 BTJD.
Open `./summary-plots/000000432549364-01-phased-unwhitened-flux-time-series-by-sector.fig`

7 Planet Candidate 1

7.1 Model Fitter: All Transits

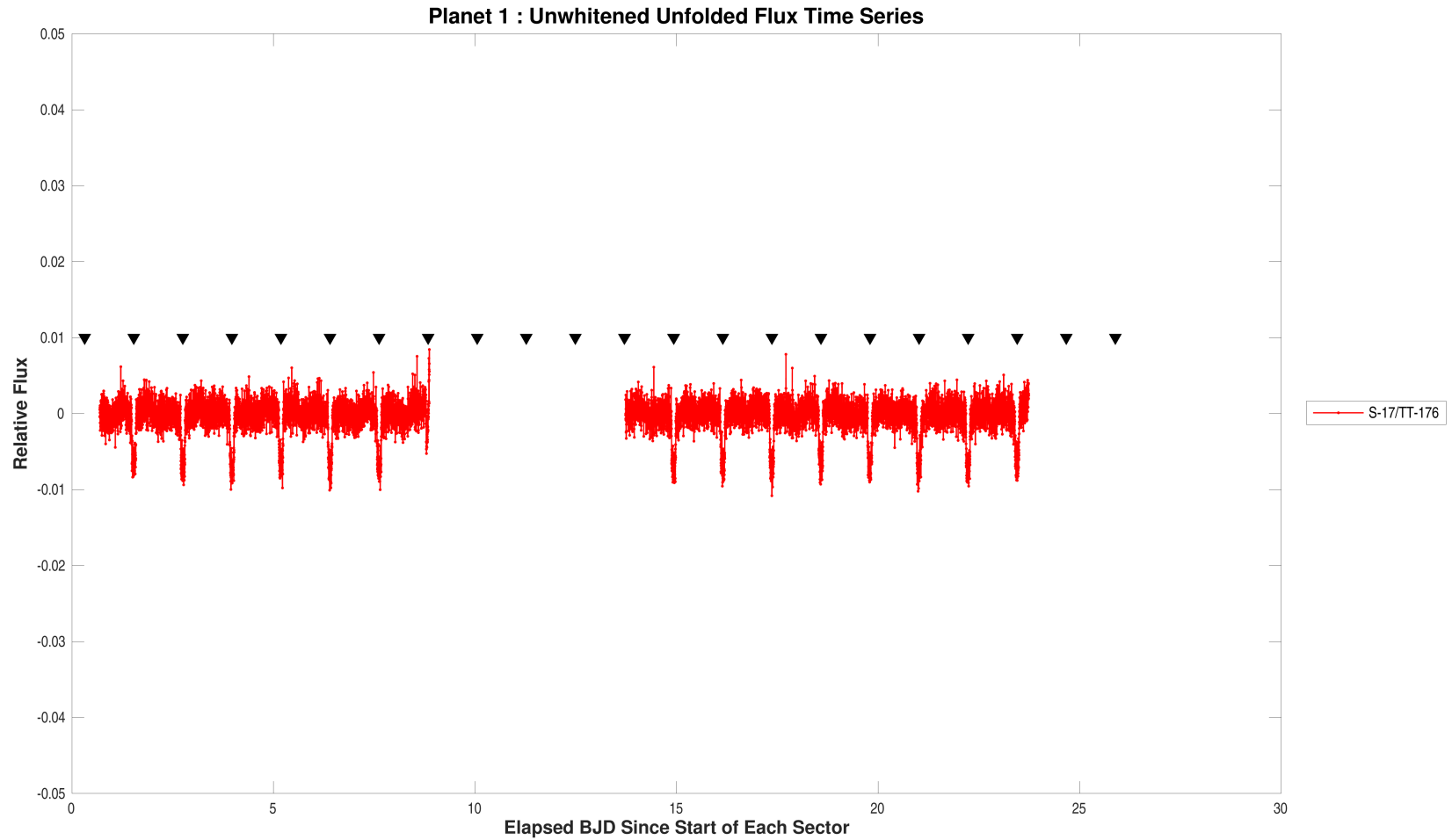
Model Characteristic	Name
Transit Model	mandel-agol_geometric_transit_model
Limb Darkening Model	claret_tess_nonlinear_limb_darkening_model

TCE Parameter	Value	Units
Trial Transit Pulse Duration	2.5	hours
Transit Epoch	1765.5330555	TJD
Orbital Period	1.2170767	days
Maximum SES	14.6	
Maximum MES	36.9	
Robust Statistic	56.9	
Chi Square Goodness of Fit Statistic (DoF)	1250.6 (1029)	
Chi Square2 Statistic (DoF)	221.9 (294.7)	
Threshold for Desired PFA		

DoF: Degrees of Freedom

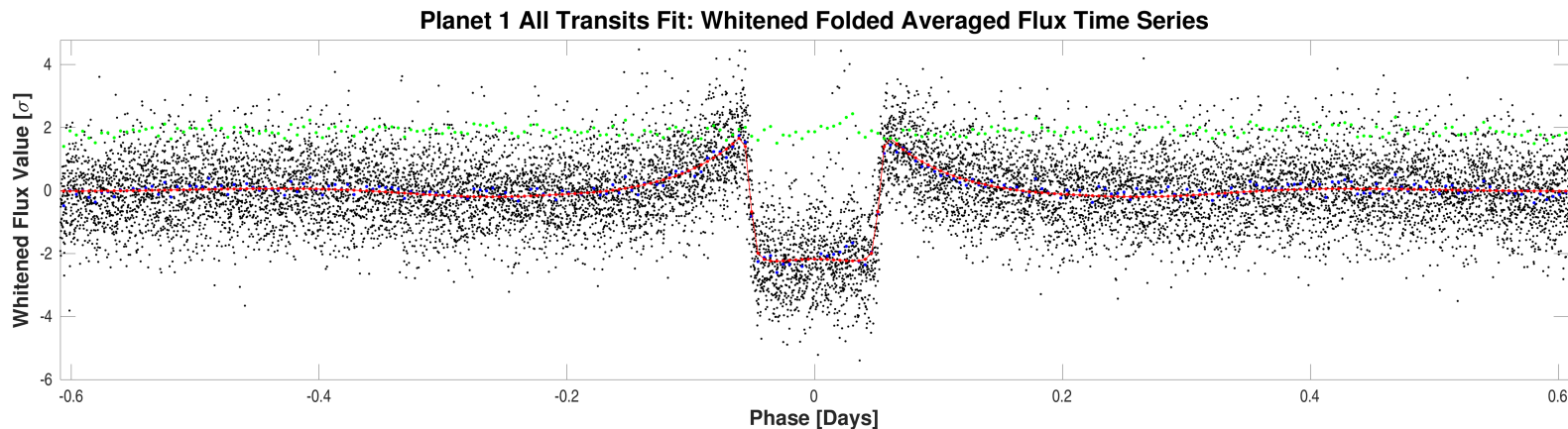
Parameter	Value	Uncertainty	Units
SNR	77.3		
Orbital Period	1.2175164	2.9129e-05	days
Transit Epoch	1765.5336792	3.1934e-04	BTJD
Impact Parameter	0.0100	7.0493e+00	
Planet Radius to Star Radius Ratio	0.0753006	9.8651e-04	
Semi-major Axis to Star Radius Ratio	3.7227	2.4323e-01	
Planet Radius	12.0198	6.1884e-01	Earth radii
Semi-major Axis	0.0248	1.9323e-03	AU
Effective Stellar Flux	5879.5160	1.0172e+03	Goldilocks
Equilibrium Temperature	2233	9.6592e+01	Kelvin
Stellar Density	0.4676	9.1646e-02	Solar density
Transit Depth	6460	8.2399e+01	ppm
Transit Duration	2.7254	3.0081e-02	hours
Transit Ingress Duration	0.1953	2.9866e-02	hours
Eccentricity	0.0000	0.0000e+00	
Peri Longitude	0.0000	0.0000e+00	degrees
Model Chi Square Statistic (DoF)	4708.1 (5815.9)		
Model Chi Square Goodness of Fit Statistic (DoF)	738.9 (1361)		
Model Chi Square2 Statistic (DoF)	40.3 (15)		

DoF: Degrees of Freedom



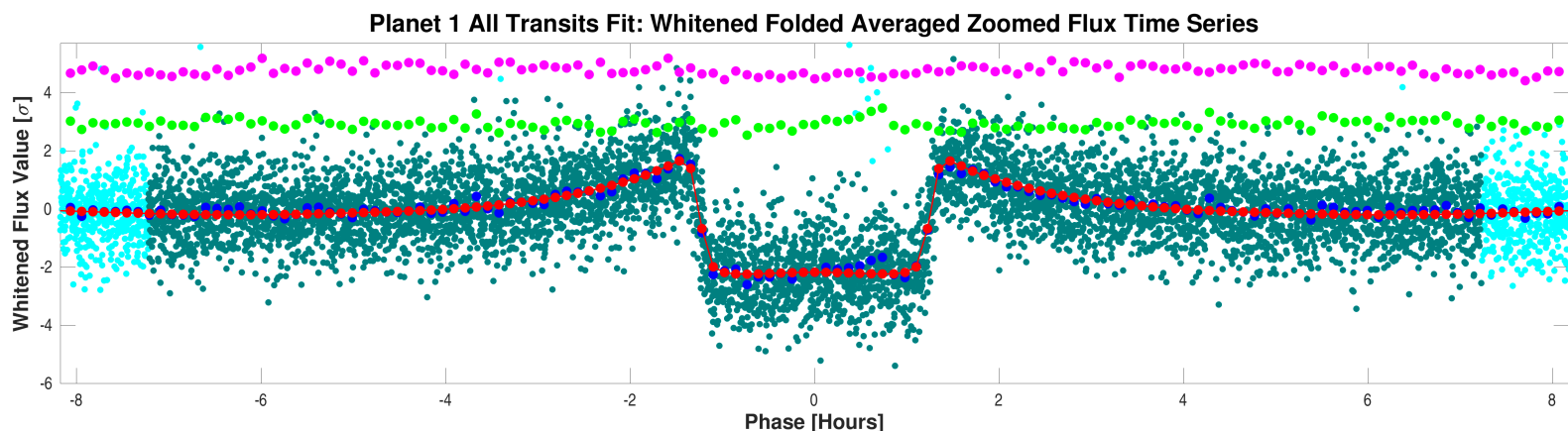
Flux time series for CatId 432549364, Planet candidate 1 in the unwhitened domain. For the data of Sector-17/TargetTableId-176, start BJD is 2458764. Transit event markers indicate the location of transits of the given planet candidate. All transits fit completed with full convergence.

Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000432549364-01-all-unwhitened-17-176.fig`



Folded flux time series for CatId 432549364, 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/0000000432549364-01-all-whitened.fig`



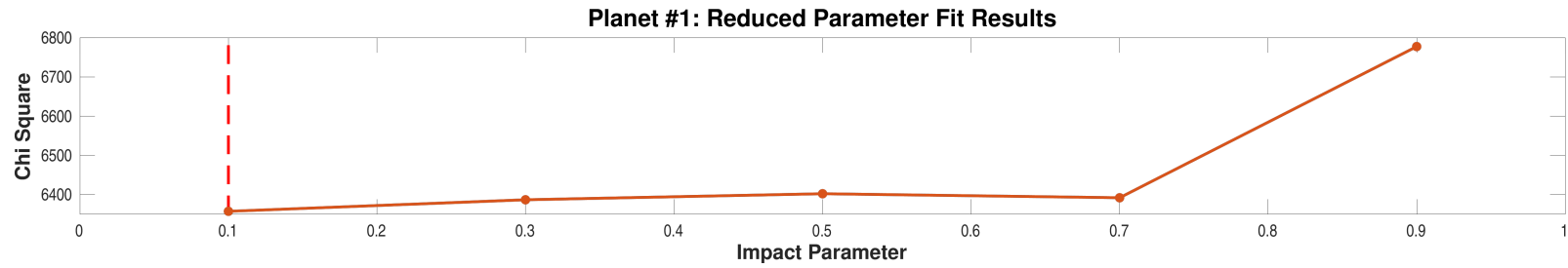
Folded flux time series for CatId 432549364, Planet candidate 1 in the whitened domain, zoomed on the transit. The flux data whose robust weights are larger/smaller than 0.1 are plotted in dark green/cyan dots, respectively. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged 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/0000000432549364-01-all-whitened-zoomed.fig`

7.2 Model Fitter: Reduced Parameter Fit Results

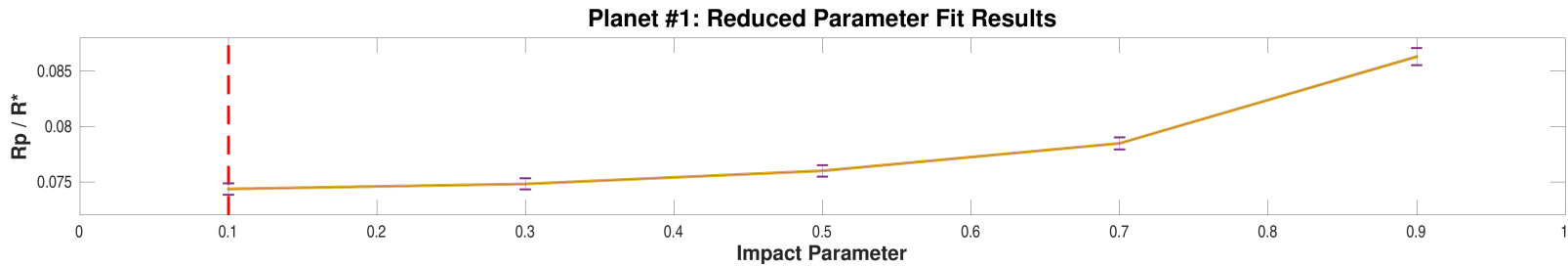
Impact Parameter	SNR	Model Chi Square	Planet Radius to Star Radius	Uncert	Semi-major Axis to Star Radius	Uncert	Transit Depth (ppm)	Uncert	Transit Duration (hours)	Uncert
0.10	76.4	6357.6	0.0743576	5.1049e-04	3.6965	1.2983e-02	6290	8.5906e+01	2.7317	1.0020e-02
0.30	77.5	6387.0	0.0748110	5.0665e-04	3.5556	1.2735e-02	6289	8.4714e+01	2.7493	1.0359e-02
0.50	77.7	6402.4	0.0759969	5.1661e-04	3.2546	1.2330e-02	6308	8.5270e+01	2.7975	1.1393e-02
0.70	76.1	6392.2	0.0784766	5.5008e-04	2.7450	1.1904e-02	6357	8.8539e+01	2.9229	1.4378e-02
0.90	67.3	6777.4	0.0863041	7.6623e-04	1.9121	1.2990e-02	6620	1.1494e+02	3.4310	3.2667e-02

Highlighted row is the best reduced-parameter model fit.



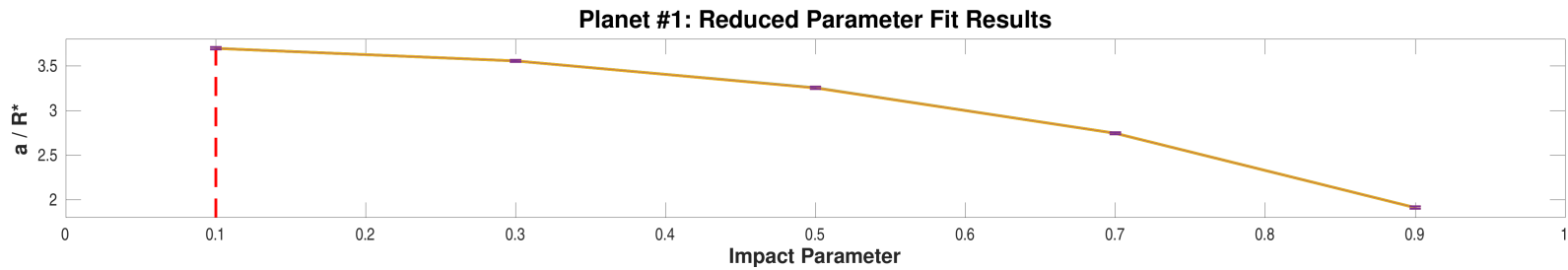
Model chi squares of reduced parameter fits vs. impact parameter for CatId 432549364, Planet candidate 1. The fit result with the minimum chi square is marked with a dashed line in the plot.

Open `./planet-01/planet-search-and-model-fitting-results/reduced-parameter-fits/0000000432549364-01-reduced-fits-chi-square.fig`



Ratios of planet radius to star radius of reduced parameter fits vs. impact parameter for CatId 432549364, 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/0000000432549364-01-reduced-fits-rp-over-rstar.fig`



Ratios of semimajor axis to star radius of reduced parameter fits vs. impact parameter for CatId 432549364, 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/0000000432549364-01-reduced-fits-a-over-rstar.fig`

7.3 Model Fitter: Trapezoidal Fit Results

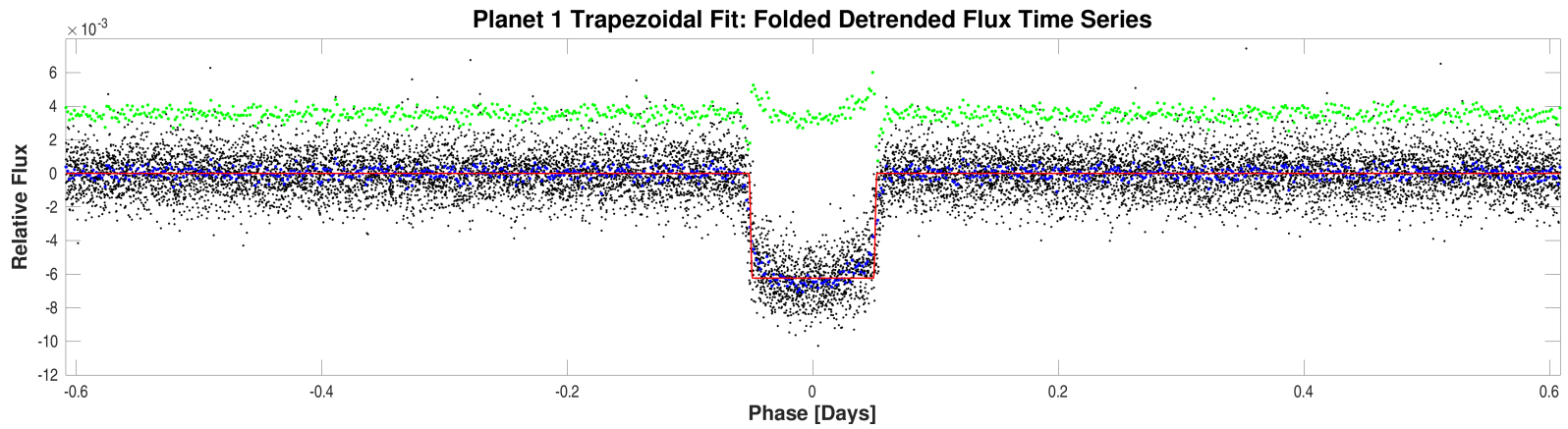
Model Characteristic	Name
Transit Model	trapezoidal_model
Limb Darkening Model	

TCE Parameter	Value	Units
Trial Transit Pulse Duration	2.5	hours
Transit Epoch	1765.5330555	TJD
Orbital Period	1.2170767	days
Maximum SES	14.6	
Maximum MES	36.9	
Robust Statistic	56.9	
Chi Square Goodness of Fit Statistic (DoF)	1250.6 (1029)	
Chi Square2 Statistic (DoF)	221.9 (294.7)	
Threshold for Desired PFA		

DoF: Degrees of Freedom

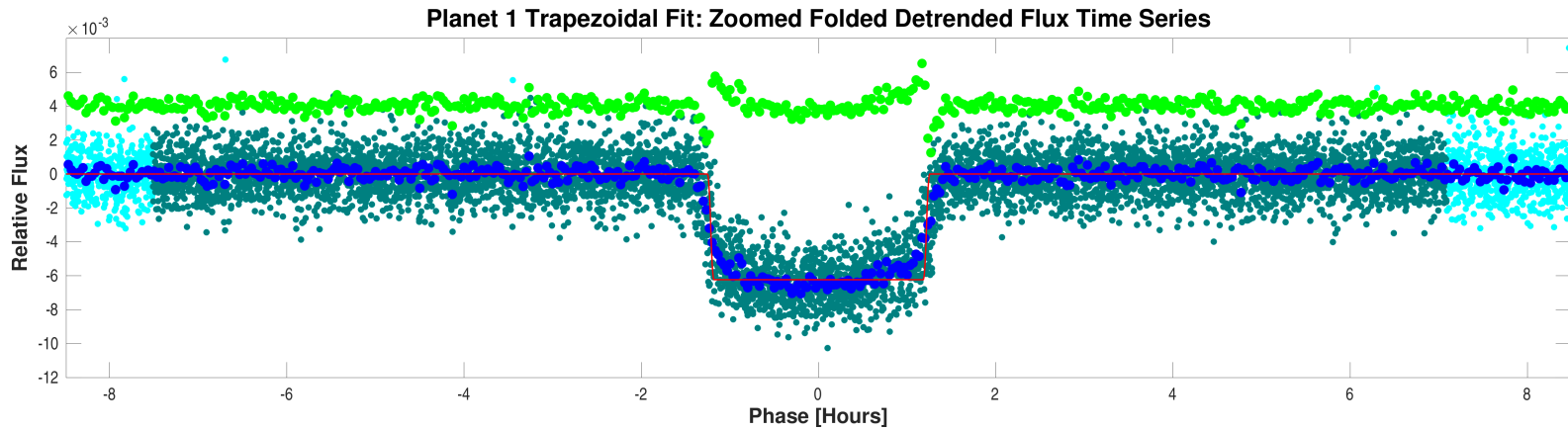
Parameter	Value	Uncertainty	Units
SNR	164.4		
Orbital Period	1.2170767		days
Transit Epoch	1765.5378072		BTJD
Transit Depth	6234		ppm
Transit Duration	2.8304		hours
Transit Ingress Duration	0.3953		hours
Model Chi Square Statistic (DoF)	14331.6 (6475)		

DoF: Degrees of Freedom



Folded detrended flux time series for CatId 432549364, Planet candidate 1 and folded trapezoidal model light curve.

Open `./planet-01/planet-search-and-model-fitting-results/trapezoidal-model-fit/0000000432549364-01-all-trapezoidal.fig`



Zoomed folded detrended flux time series for CatId 432549364, Planet candidate 1 and folded trapezoidal model light curve.

Open `./planet-01/planet-search-and-model-fitting-results/trapezoidal-model-fit/0000000432549364-01-all-trapezoidal-zoomed.fig`

7.4 Validation Tests

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

7.4.1 Weak Secondary Test

Result	Value	Uncertainty	Units	Statistic in Sigmas	Significance (%)
Orbital Period	1.2171		days		
Transit Duration	2.5		hours		
Maximum MES	36.9				
Secondary Phase	0.60458		days		
Secondary MES	6.9				
Minimum Phase	0.50597		days		
Minimum MES	-3.4				
Median MES	-0.2				
MAD MES	0.99649				
Robust Statistic	6.3				
Secondary Depth	549.7	8.0169e+01	ppm		
Geometric Albedo	1.3	2.6726e-01		1.0881	13.83
Planet Effective Temperature	3681	1.6194e+02	Kelvin	7.6749	0.00

7.4.2 Eclipsing Binary Discrimination Test

Result	Value	Value in Sigmas	Significance (%)
Odd Even Transit Depth Comparison Statistic	2.3027e+01	4.7987	0.00

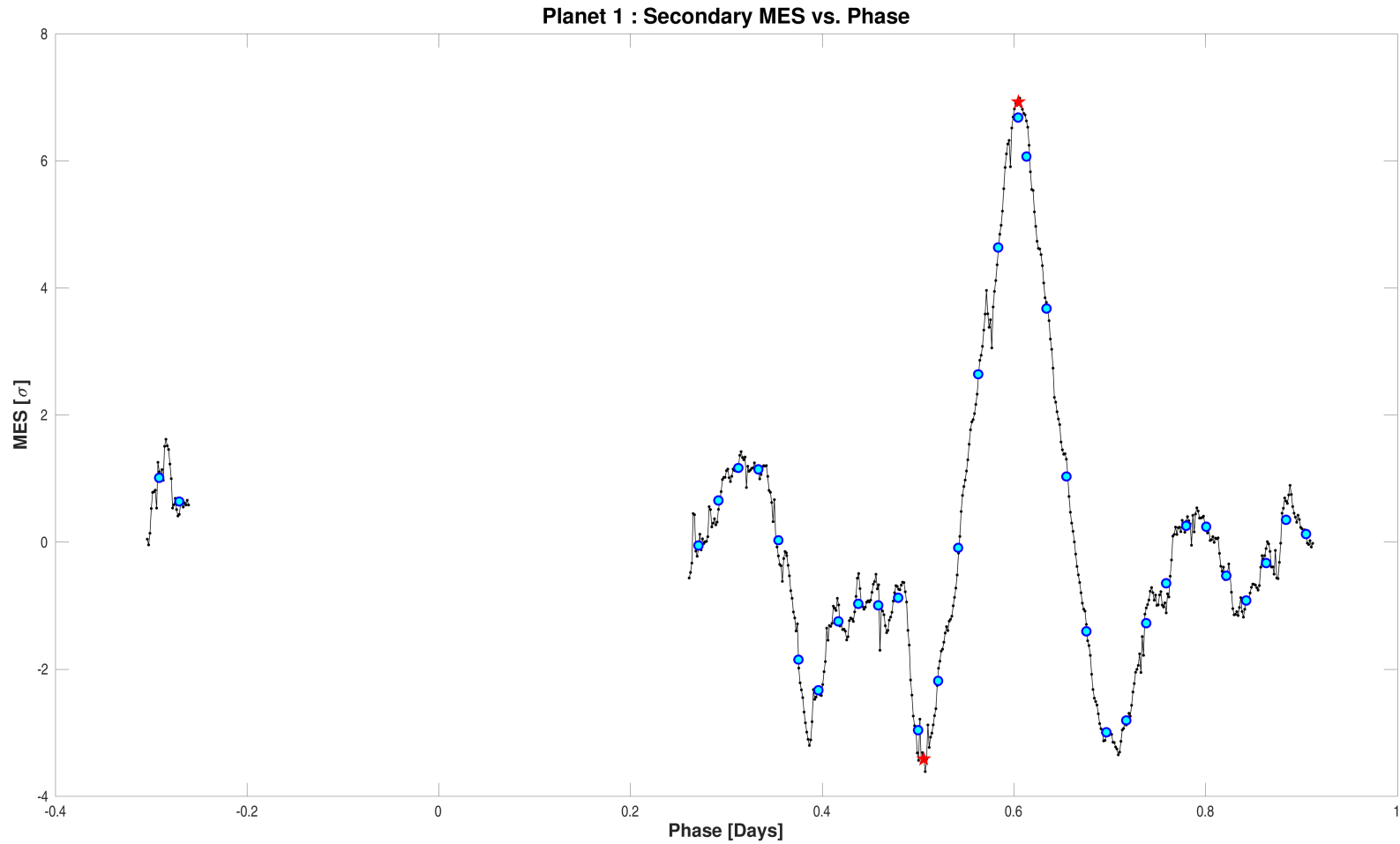
7.4.3 Bootstrap Test

Result	Value
False Alarm Probability	1.7646e-230
Bootstrap Threshold for Desired PFA	7.8
MES Mean	-0.38
MES Standard Deviation	1.15
Transit Count	20

7.4.4 Ghost Diagnostic Test

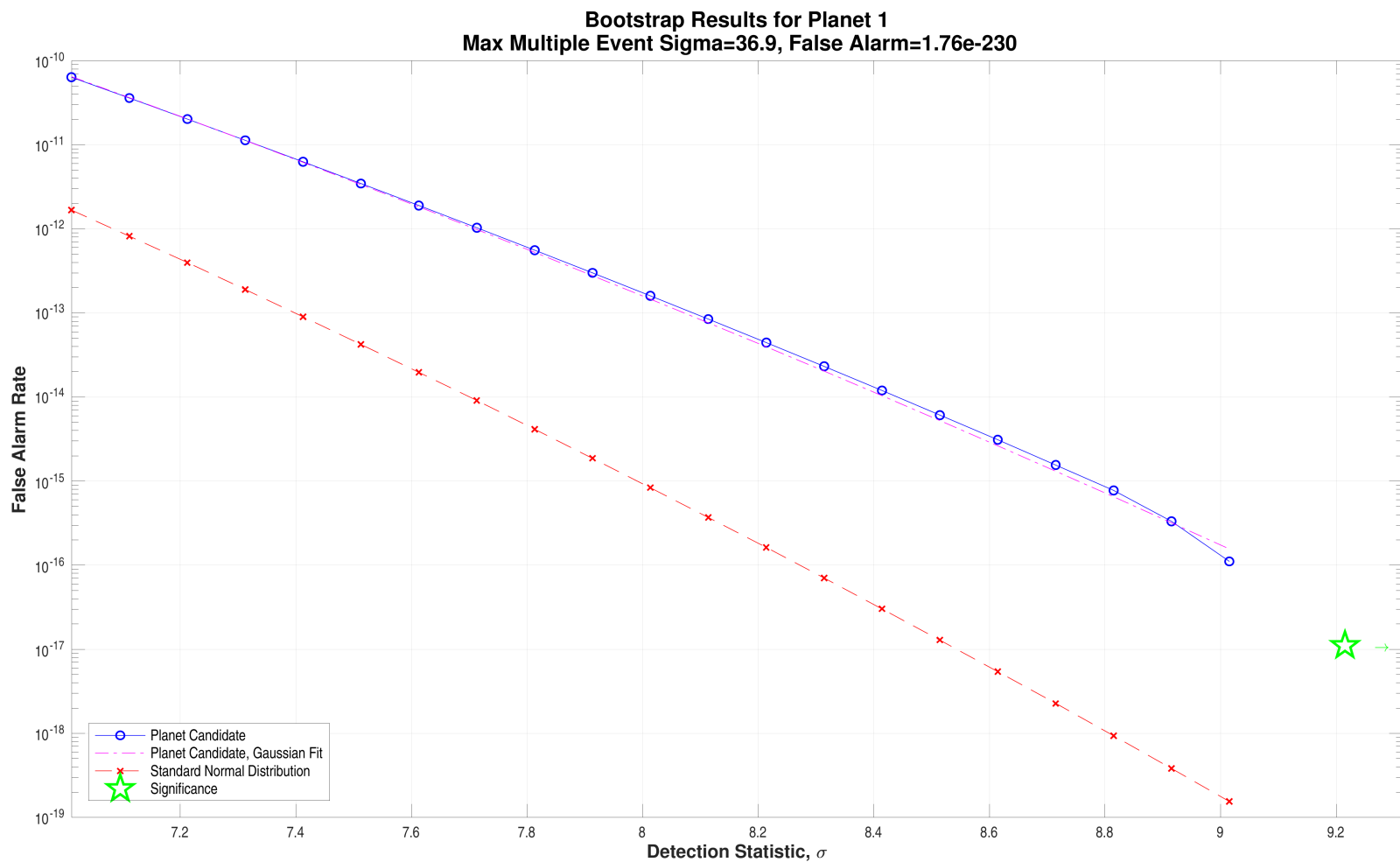
Result	Value	Significance (%)
Maximum MES	36.9	
SNR	77.3	
Core Aperture Statistic	6.2991e+01	100.00
Halo Aperture Statistic	7.4054e+00	100.00
Ratio of Core/Halo Aperture Statistics	8.5061e+00	

7.4.5 Validation Test Figures



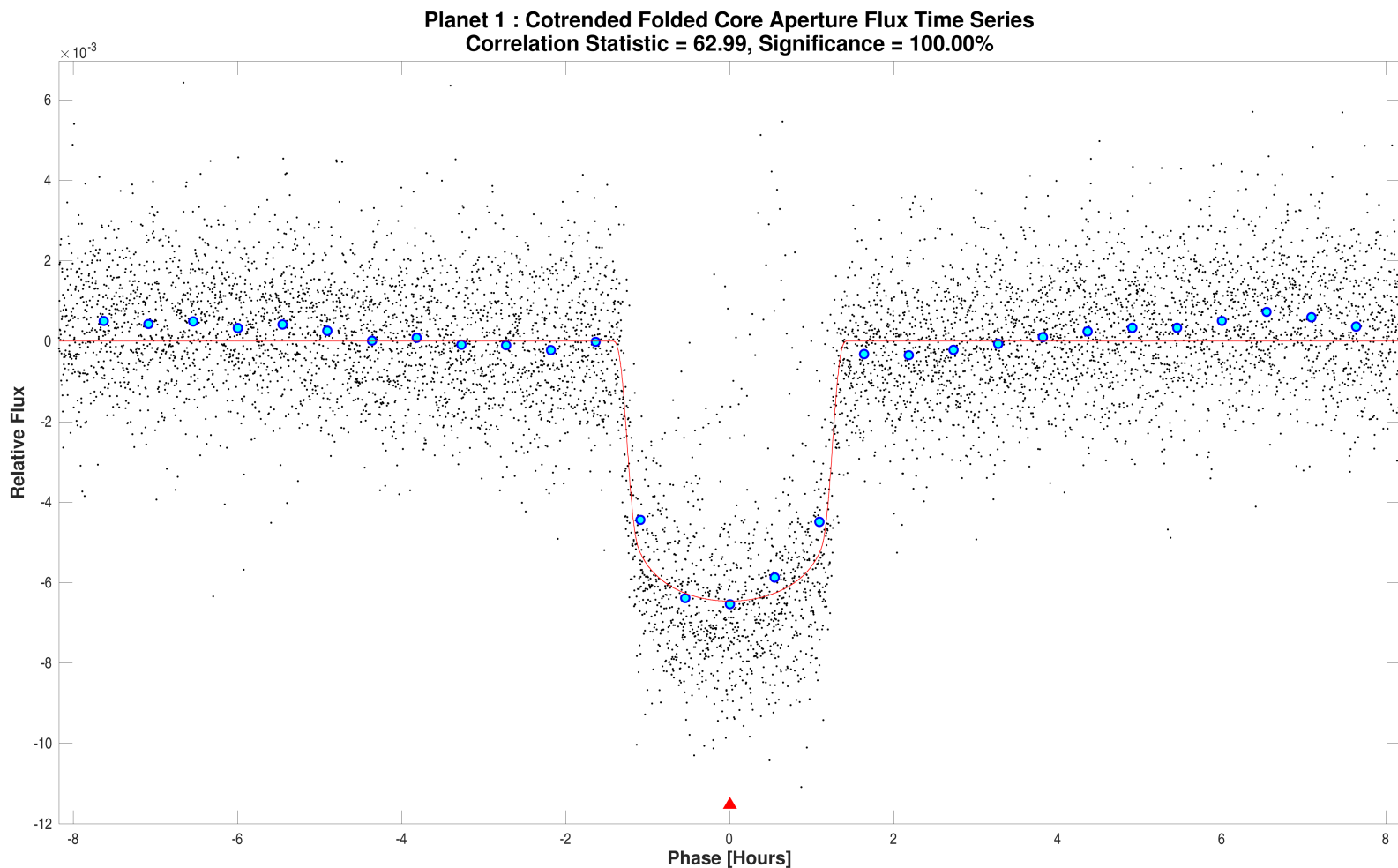
The primary event has been set to zero and both the max and min of the resulting MES vs. Phase are marked with a red star. The best matched pulse duration in hours is 2.5. The maximum secondary MES and corresponding phase are 6.9288 and 0.60458 days respectively. The minimum secondary MES and corresponding phase are -3.4109 and 0.50597 days respectively.

Open `./planet-01/report-summary/0000000432549364-01-weak-secondary-diagnostic.fig`



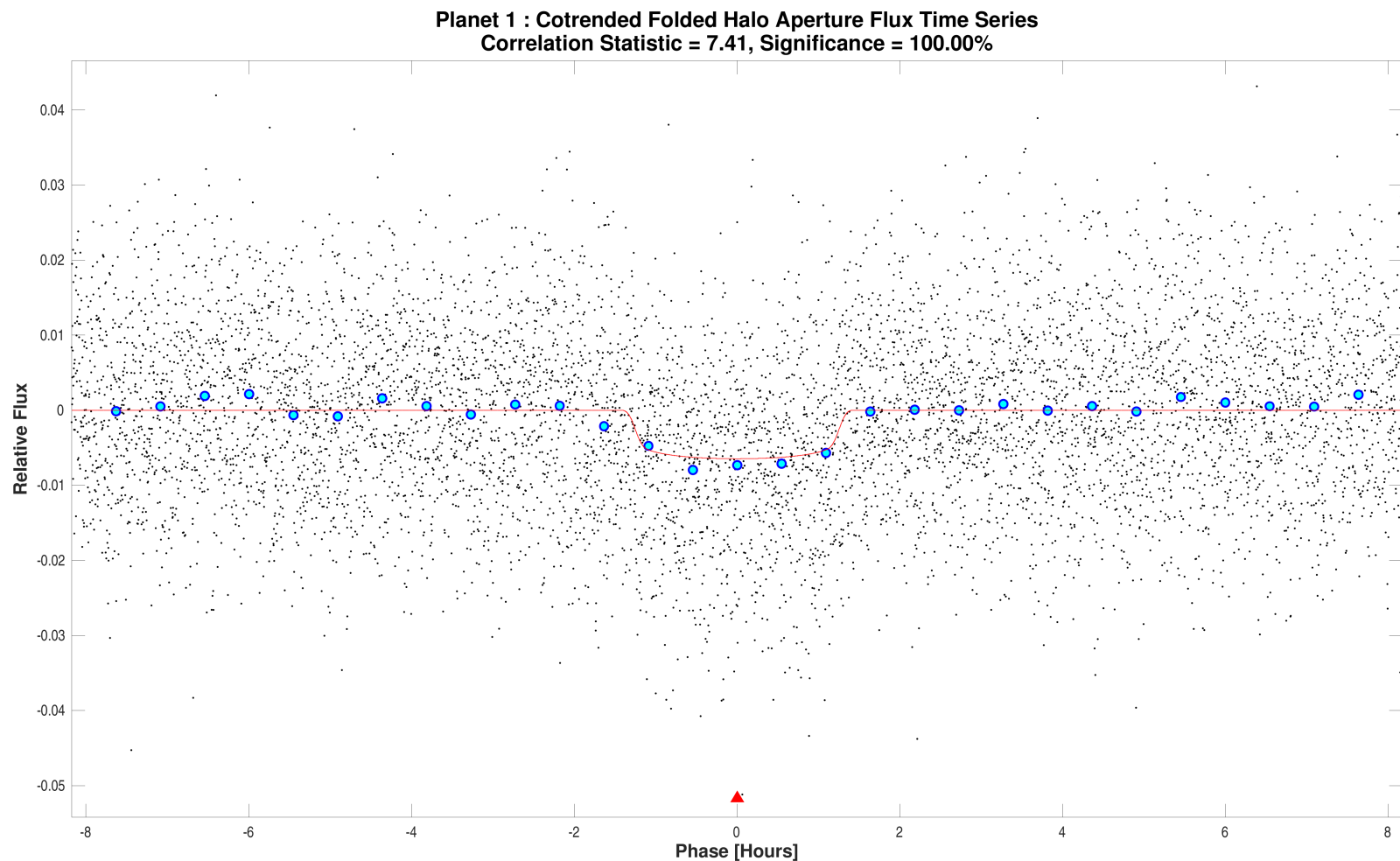
Bootstrap results for target 432549364, planet 1. Cumulative sum of the probabilities (derived from the histogram of counts) from upper tail to the search transit threshold; false alarm probability is indicated by the star. The Gaussian equivalent threshold for this false alarm probability is 32.3922. The threshold on this distribution that achieves the same false alarm rate as a 7.1 sigma threshold on a Gaussian distribution is 7.7994.

Open `./planet-01/bootstrap-results/0000000432549364-01-bootstrap-false-alarm.fig`



Optical ghost diagnostic core aperture flux time series for target 432549364, 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/000000432549364-01-core-unwhitened-cotrended-zoomed-model.fig`

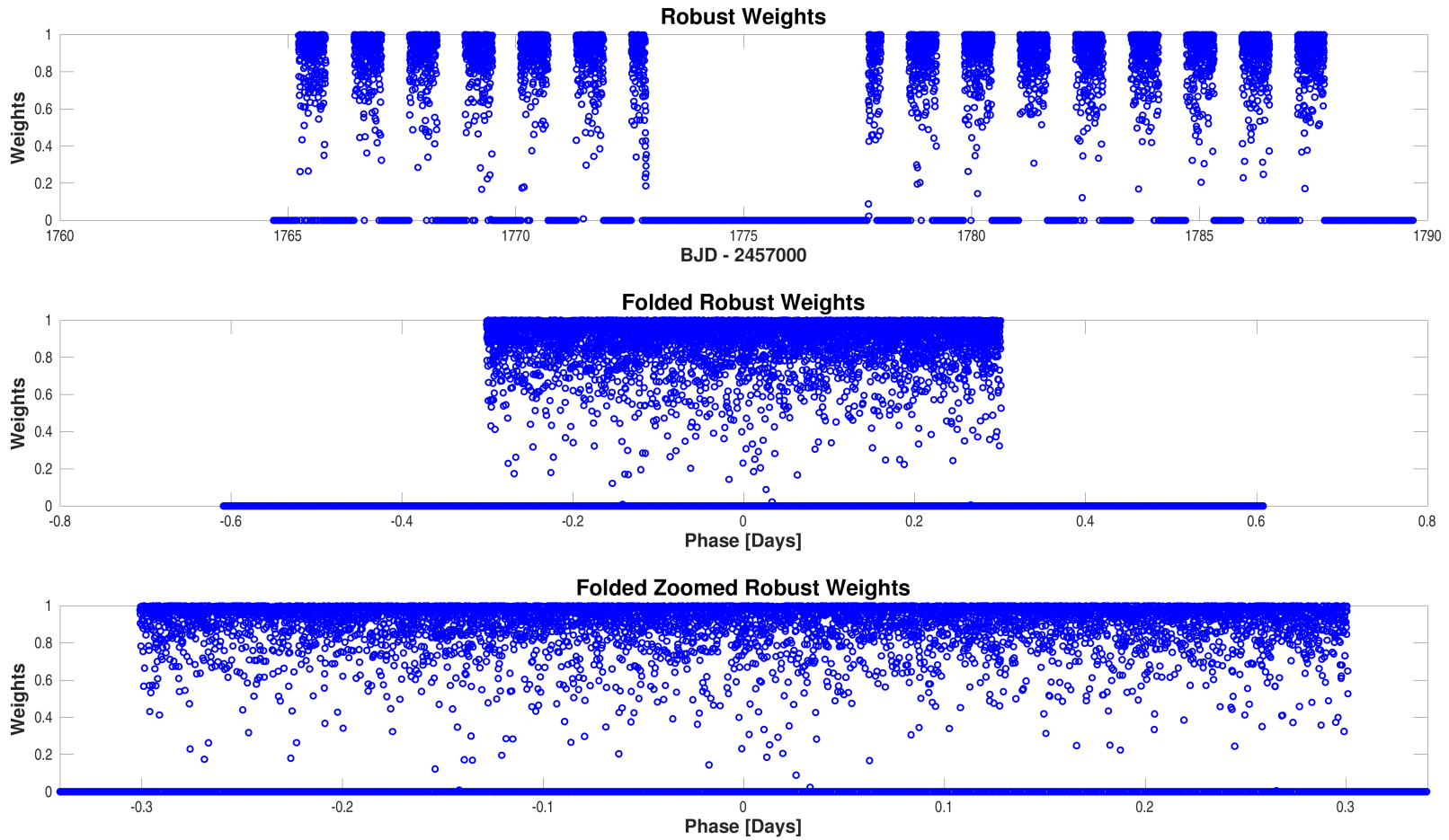


Optical ghost diagnostic halo aperture flux time series for target 432549364, planet candidate 1. The unwhitened time series is phase folded at the orbital period associated with the planet candidate and centered on the epoch of the first transit. The time series was first cotrended against spacecraft 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/000000432549364-01-halo-unwhitened-cotrended-zoomed-model.fig`

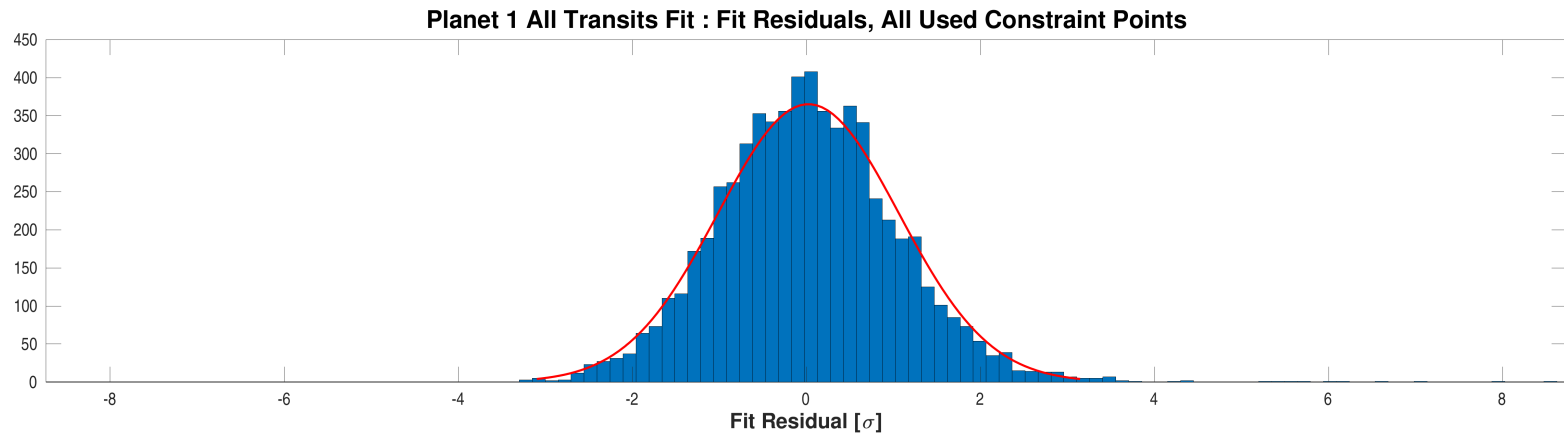
Appendix A Planet Candidate 1

A.1 Model Fitter: All Transits



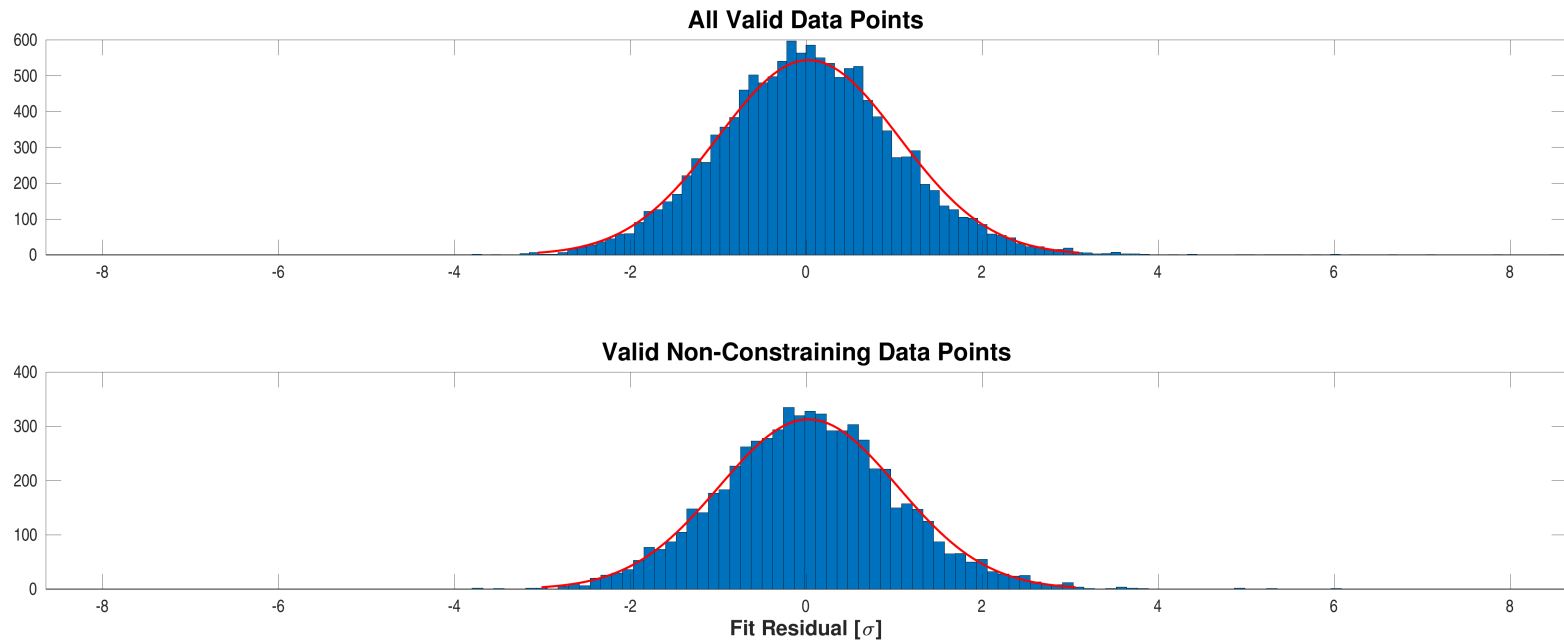
Robust weights distribution for CatId 432549364, Planet candidate 1. Top plot: all data points. Middle plot: all data points, folded per the fitted period and epoch. Bottom plot: all data points, folded and zoomed.

Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/0000000432549364-01-all-robust-weights.fig`



Fit residuals distribution for CatId 432549364, 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/000000432549364-01-all-histo-used.fig`



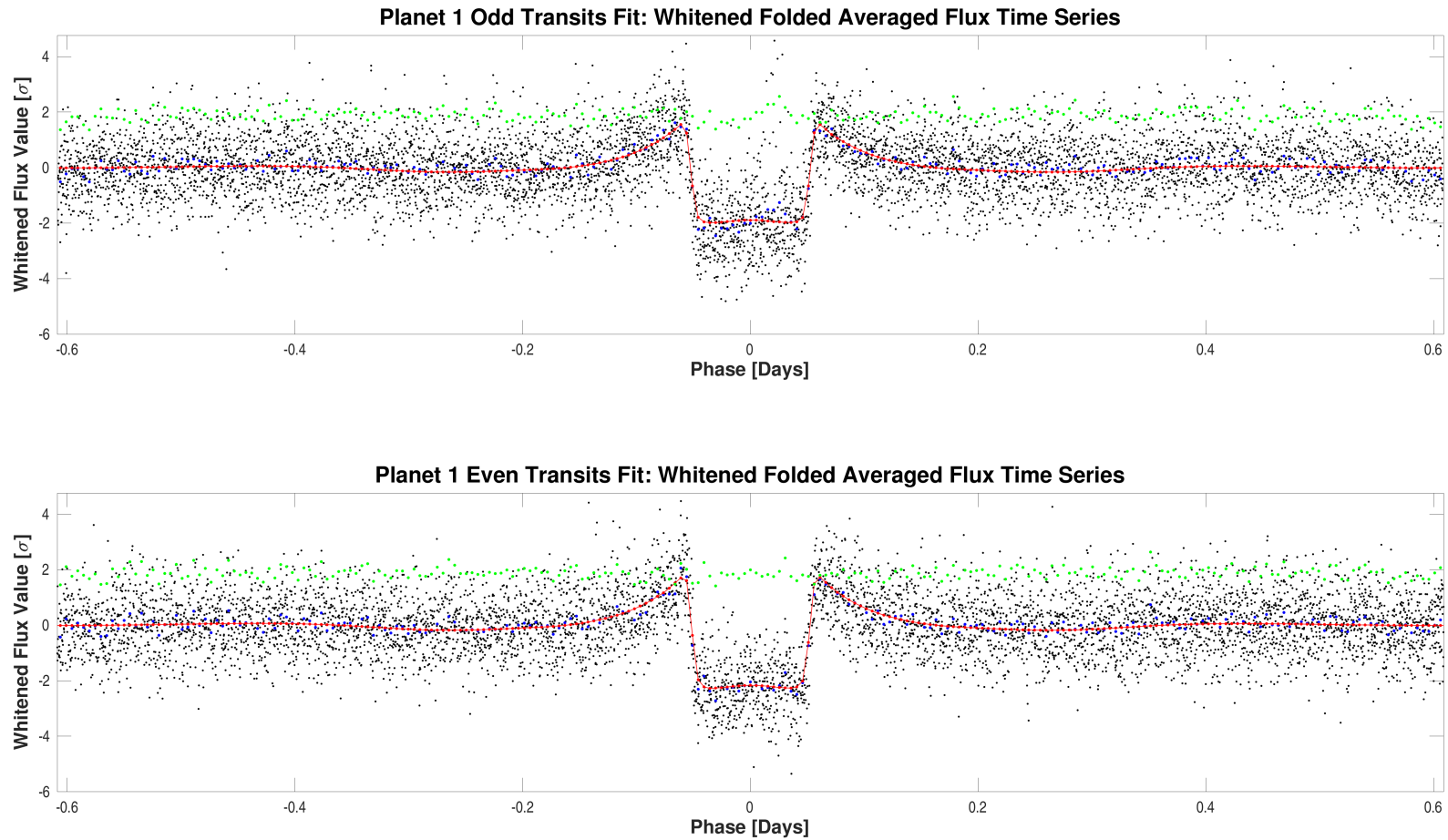
Fit residuals distribution for CatId 432549364, Planet candidate 1. Top plot: all valid data. Bottom plot: valid data not used to constrain fit (due to distance from a transit). Gaussian fits to the histograms are shown in red.

Open `./planet-01/planet-search-and-model-fitting-results/all-transits-fit/000000432549364-01-all-histo-all-and-unused.fig`

A.2 Model Fitter: Odd & Even Transits

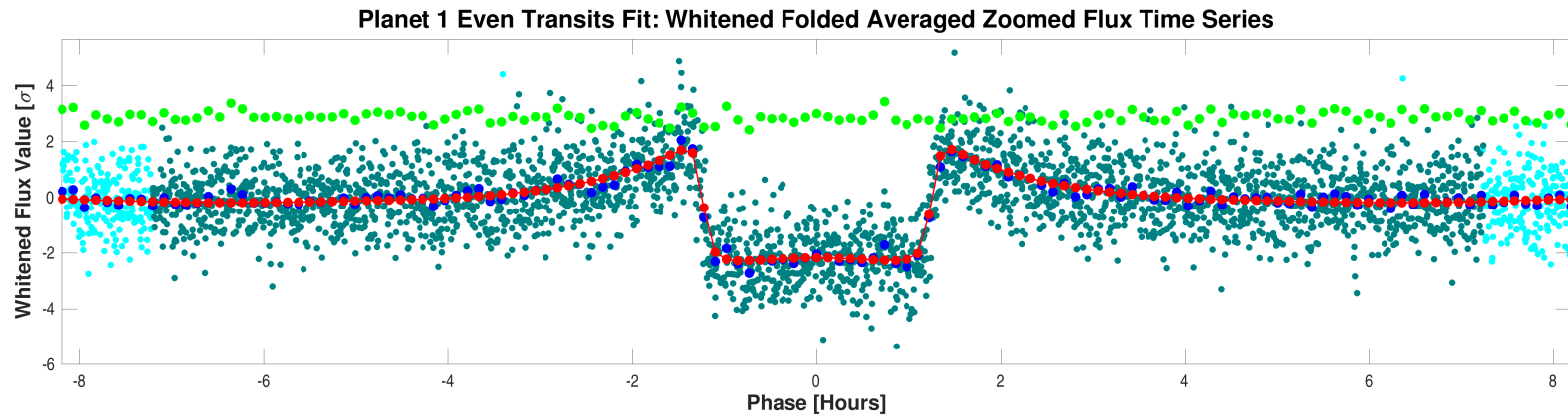
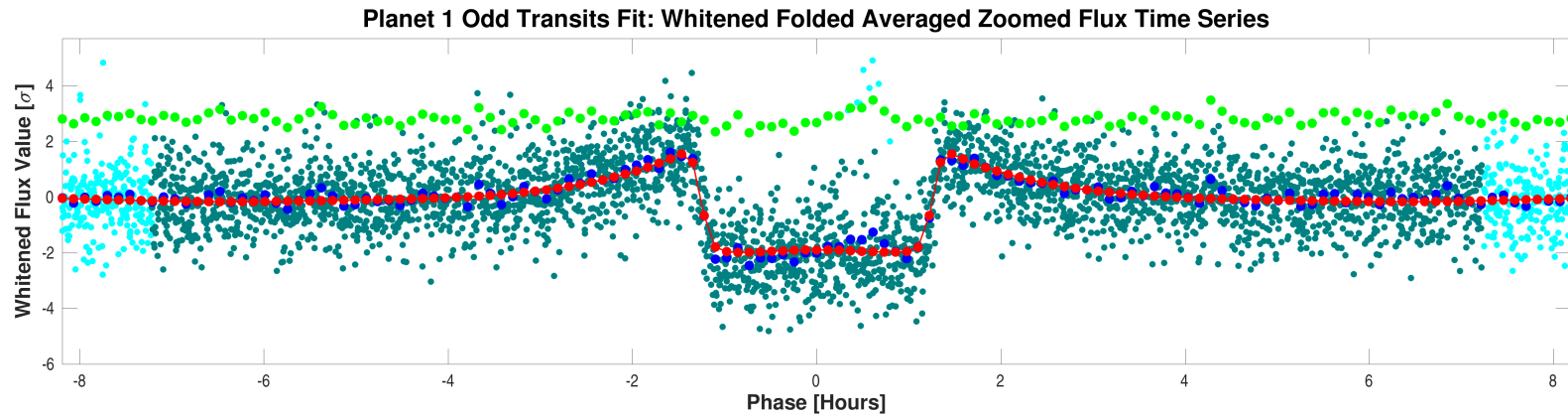
Parameter	Odd Transits Value	Odd Transits Uncertainty	Even Transits Value	Even Transits Uncertainty	Units	$\frac{\text{Difference}}{\ \text{Uncertainty}\ }$
SNR	49.7		53.9			
Orbital Period	1.2174576	4.2093e-05	1.2175741	4.2955e-05	days	1.9370e+00
Transit Epoch	1765.5341306	4.6730e-04	1766.7509146	4.2530e-04	BTJD	1.1591e+00
Impact Parameter	0.0340	3.3343e+00	0.0100	9.7369e+00		2.3329e-03
Planet Radius to Star Radius Ratio	0.0718894	1.5013e-03	0.0767215	1.4156e-03		2.3417e+00
Semi-major Axis to Star Radius Ratio	3.7035	3.8938e-01	3.7515	3.3902e-01		9.2975e-02
Planet Radius	11.4752	6.1958e-01	12.2466	6.5029e-01	Earth radii	8.5876e-01
Semi-major Axis	0.0248	1.9322e-03	0.0248	1.9323e-03	AU	5.7967e-04
Effective Stellar Flux	5879.8948	1.0172e+03	5879.1447	1.0171e+03	Goldilocks	5.2143e-04
Equilibrium Temperature	2233	9.6594e+01	2233	9.6591e+01	Kelvin	5.2143e-04
Stellar Density	0.4604	1.4522e-01	0.4785	1.2971e-01	Solar density	9.2671e-02
Transit Depth	5888	1.1648e+02	6706	1.2468e+02	ppm	4.7987e+00
Transit Duration	2.7296	4.6432e-02	2.7076	4.2058e-02	hours	3.5136e-01
Transit Ingress Duration	0.1876	4.6180e-02	0.1974	4.1725e-02	hours	1.5694e-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)	4732.1 (5816.3)		4732.1 (5816.3)			

DoF: Degrees of Freedom



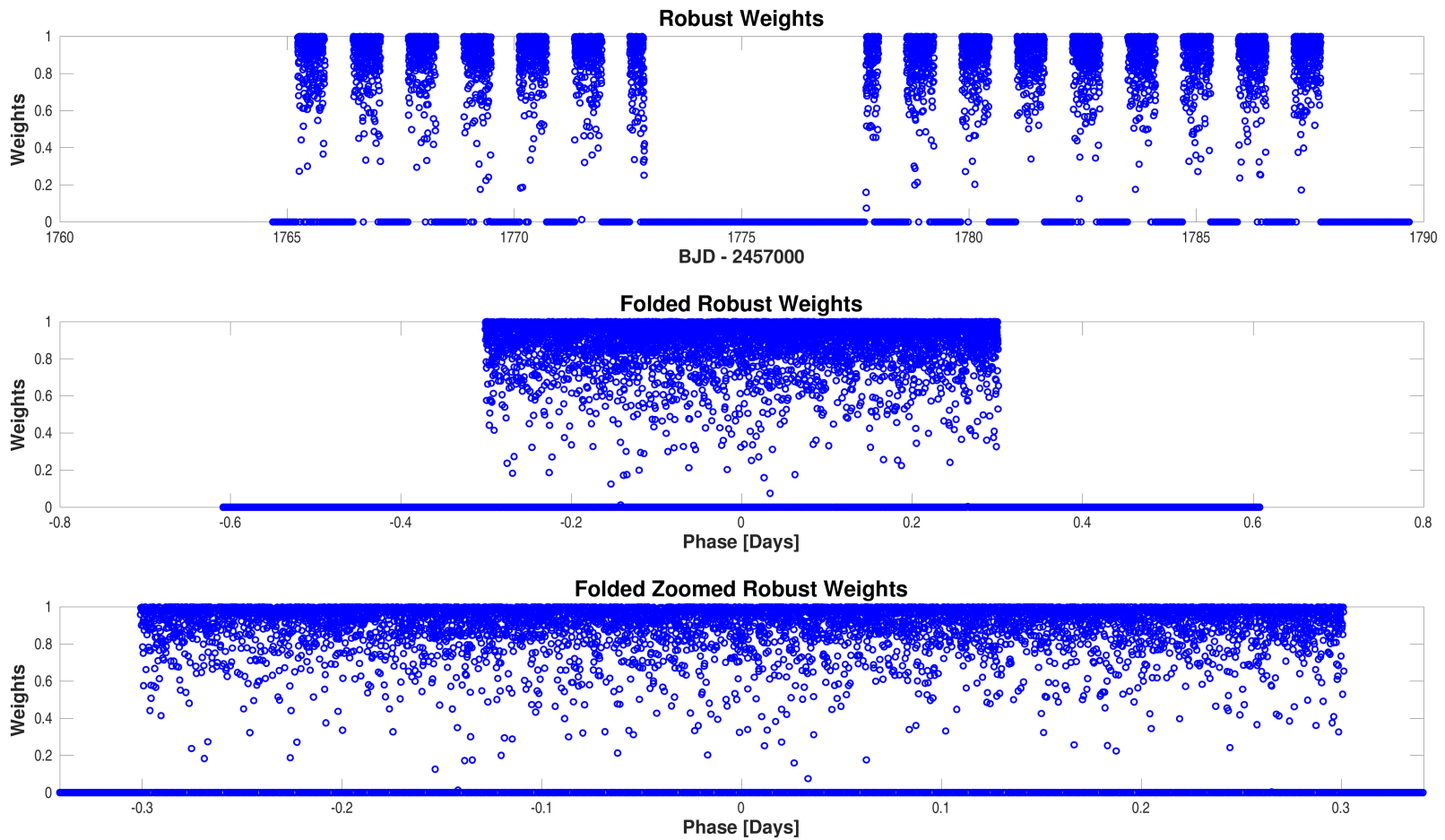
Folded flux time series for CatId 432549364, Planet candidate 1 in the whitened domain is plotted in black dots. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged values of the folded flux time series; the red dots represent the averaged values of the folded model light 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/000000432549364-01-odd-even-whitened.fig`



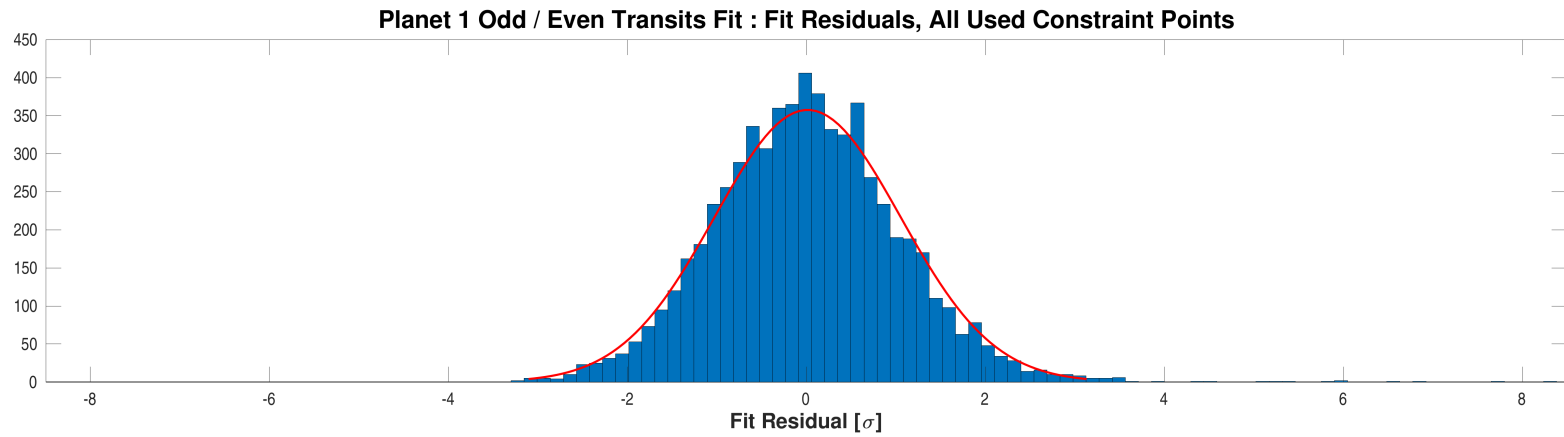
Folded flux time series for CatId 432549364, Planet candidate 1 in the whitened domain, zoomed on the transit. The flux data whose robust weights are larger/smaller than 0.1 are plotted in dark green/cyan dots, respectively. Values are averaged into 1 cadence wide bins. The blue dots represent the averaged 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/0000000432549364-01-odd-even-whitened-zoomed.fig`



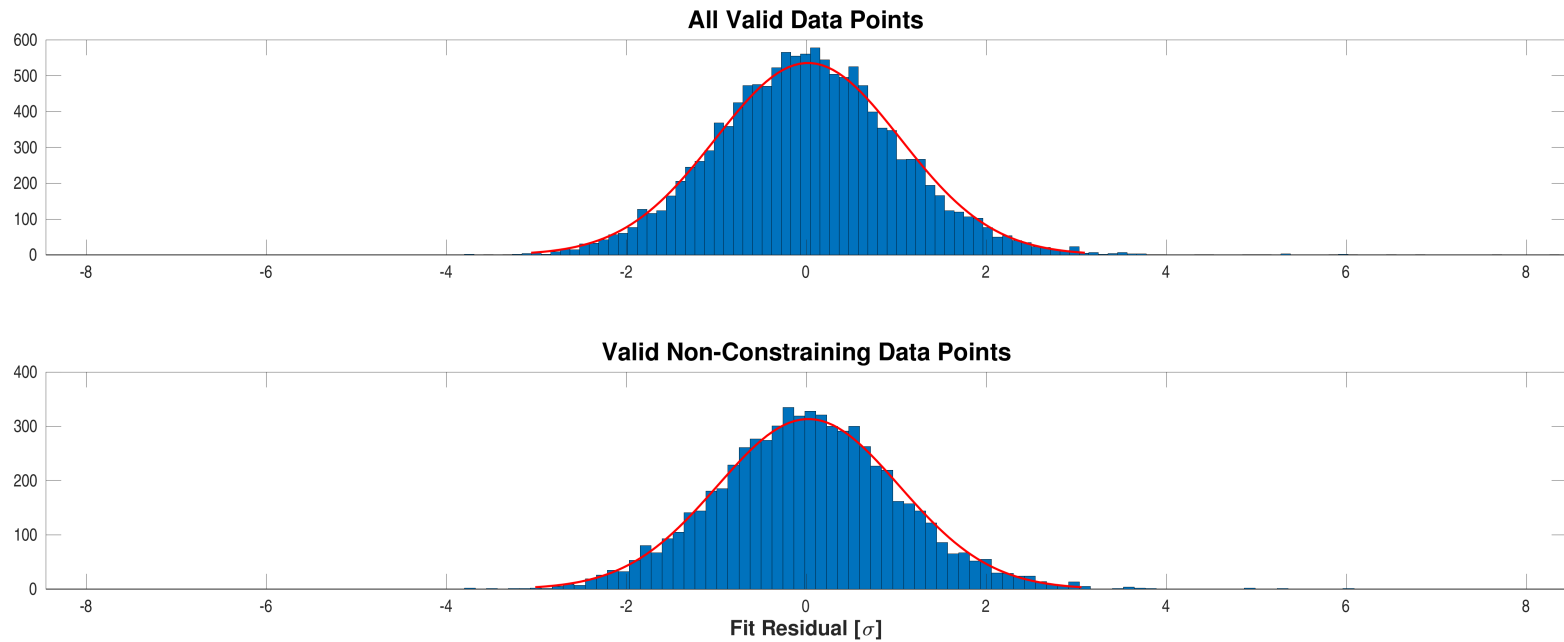
Robust weights distribution for CatId 432549364, Planet candidate 1. Top plot: all data points. Middle plot: all data points, folded per the fitted period and epoch. Bottom plot: all data points, folded and zoomed.

Open `./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000432549364-01-odd-even-robust-weights.fig`



Fit residuals distribution for CatId 432549364, 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.

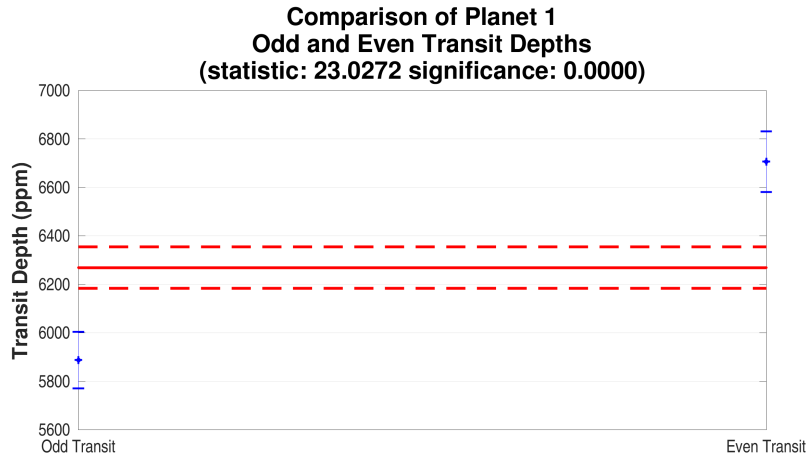
Open `./planet-01/planet-search-and-model-fitting-results/odd-even-transits-fit/0000000432549364-01-odd-even-histo-used.fig`



Fit residuals distribution for CatId 432549364, 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/0000000432549364-01-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 432549364, planet 1. A significance level close to 1/0 favors a transiting planet/an eclipsing binary. Open `./planet-01/binary-discrimination-test-results/0000000432549364-01-eclipsing-binary-discrimination-tests.fig`

Appendix B Alerts

This target did not trigger any alerts.