

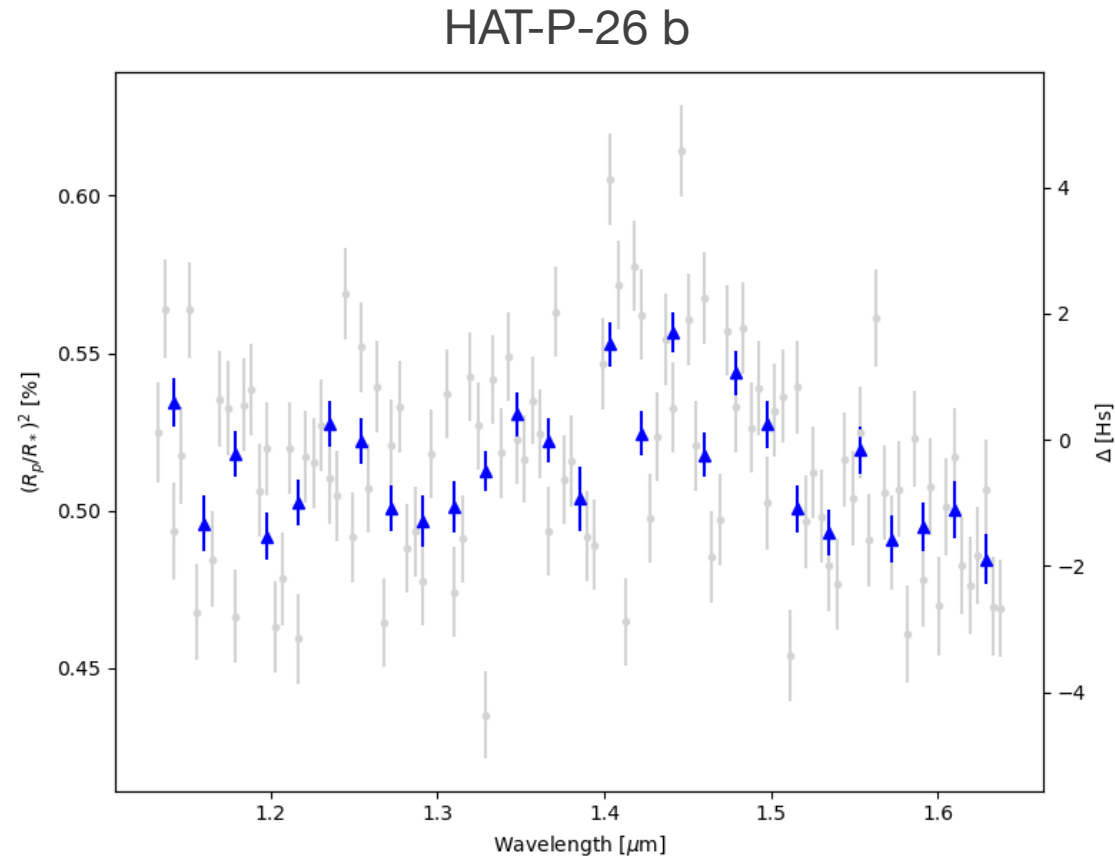
Validating the Transit Spectra: An Automated Flagging System

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Validating Transit Spectra

Traditionally, we determine whether a spectrum is of “good” or “bad” quality by looking at it manually:



The Need for Automated Validation

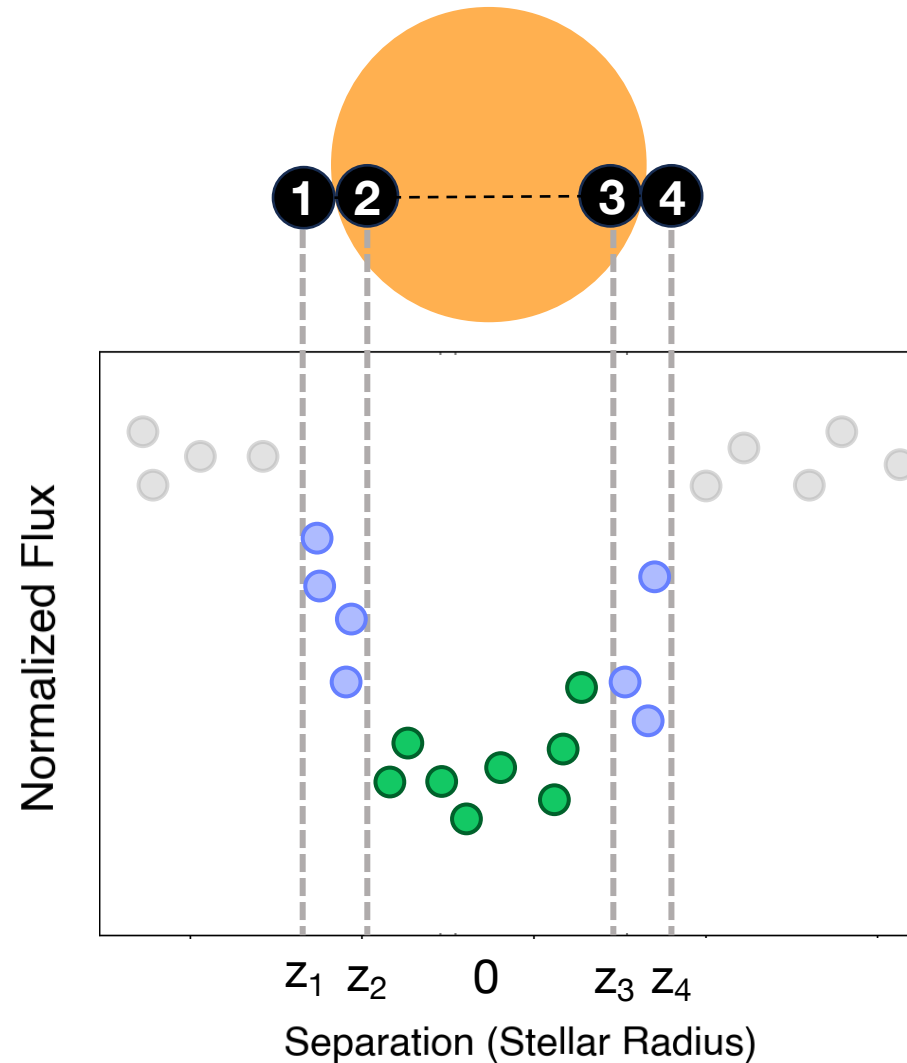
- EXCALIBUR is expanding with more targets and instruments
- It is not feasible to manually validate data products for 1,000+ targets
- How can we automate transit spectra validation?

Data Quality Flags

green	yellow	red
<p>Passed Classifier tests (perfection not guaranteed)</p>	<p>Proceed with caution</p>	<p>Use at your own risk</p>

Example: Points in Transit

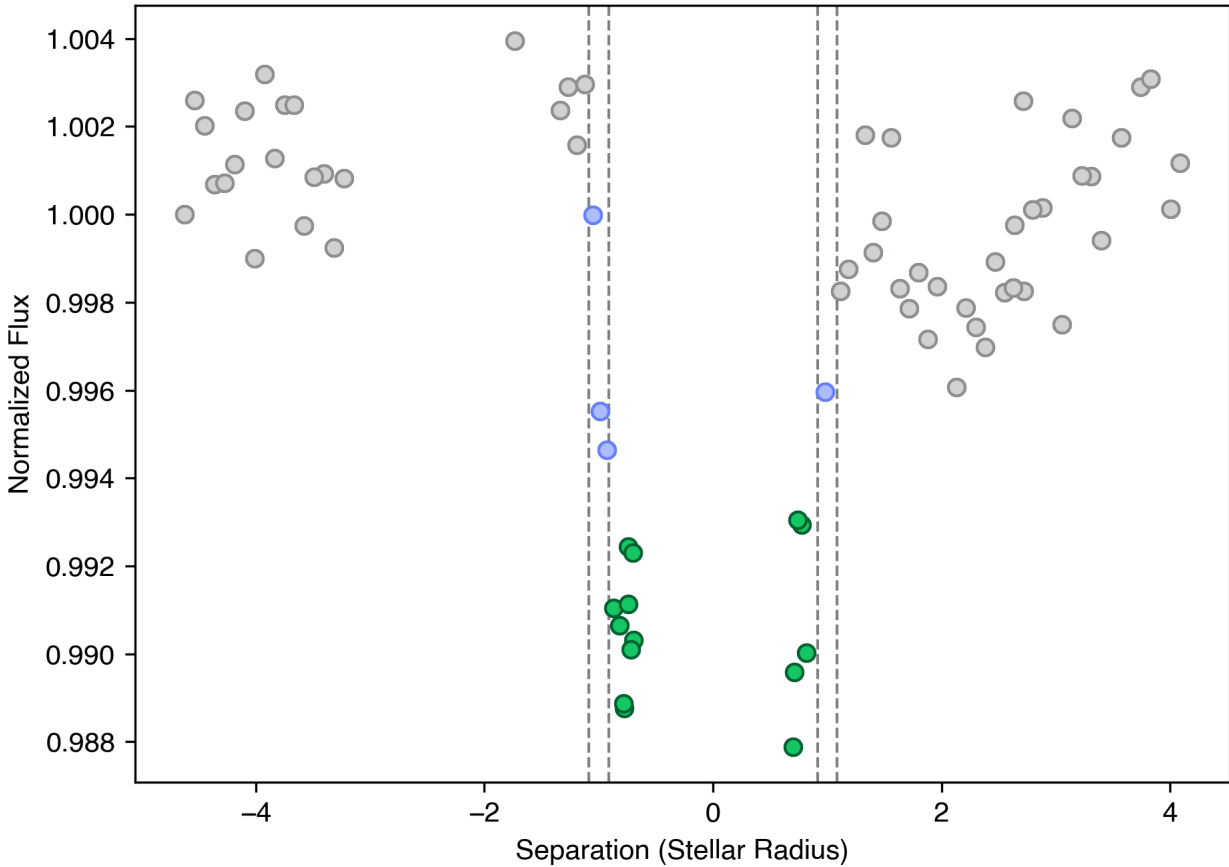
The number of points in the full and total transit.



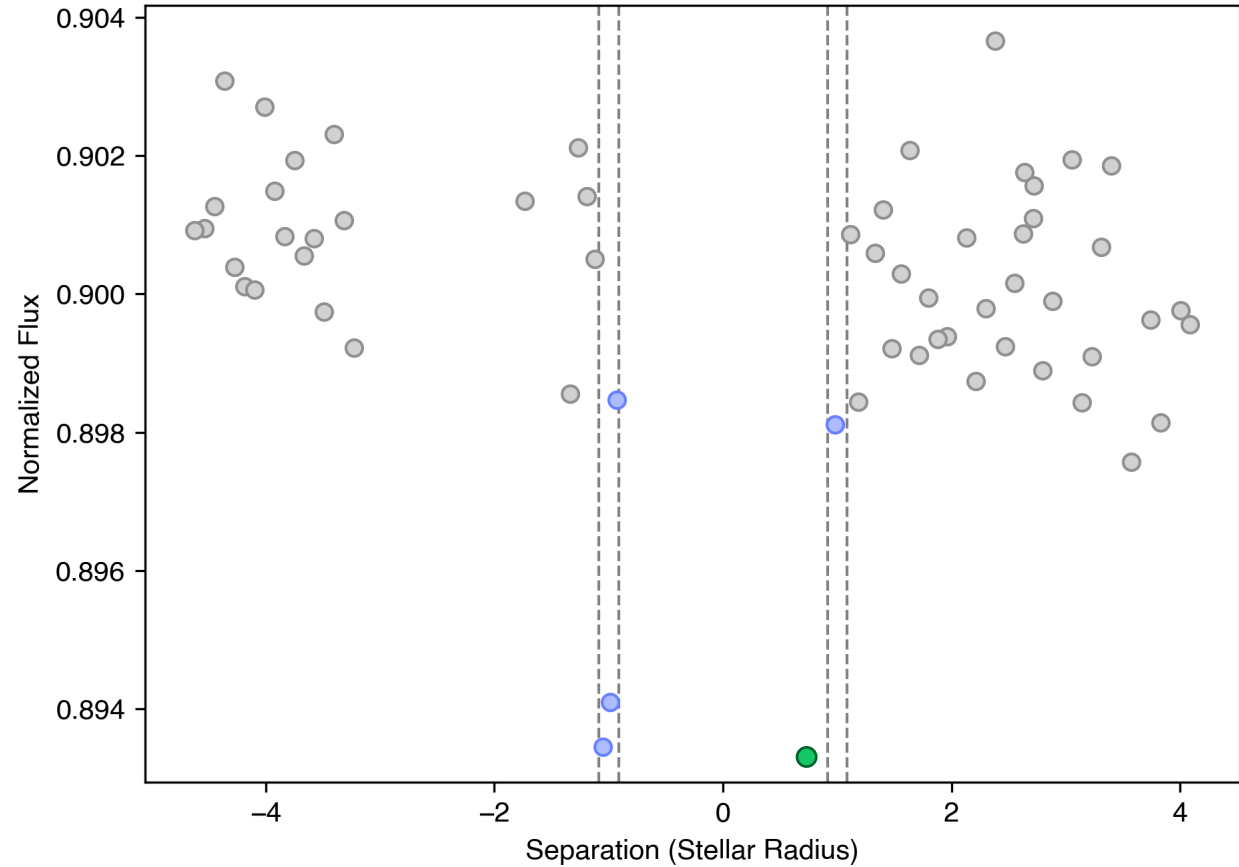
Example: Points in Transit

- Ingress/Egress
- Full transit

TRAPPIST-1 g White Light Curve (G141)

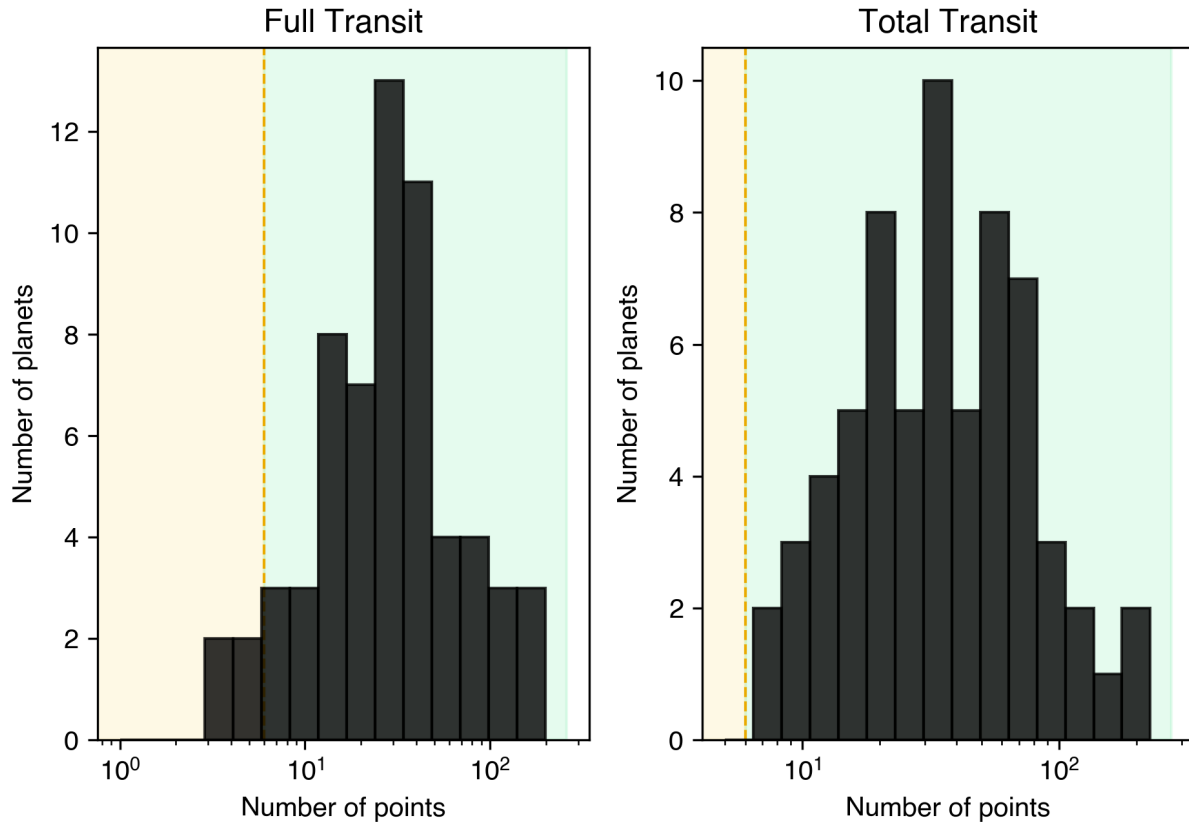


Simulated White Light Curve

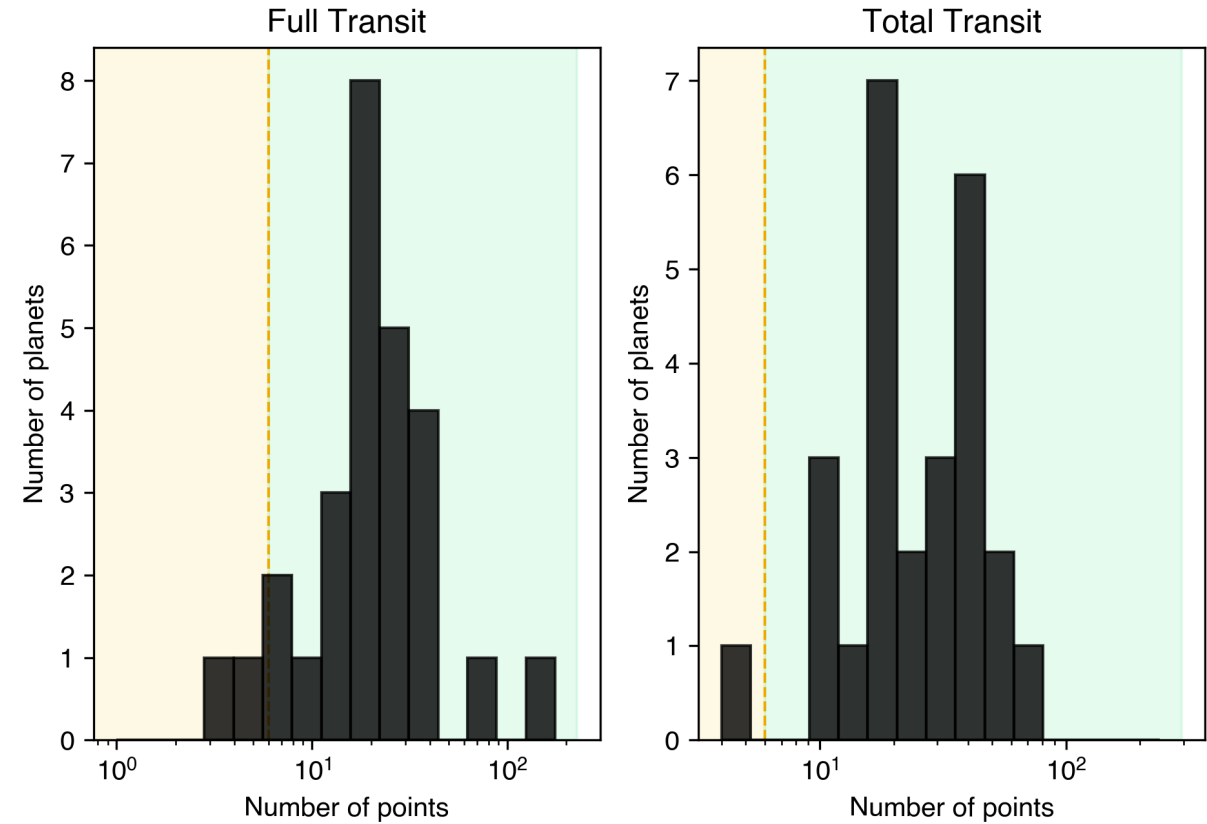


Example: Points in Transit

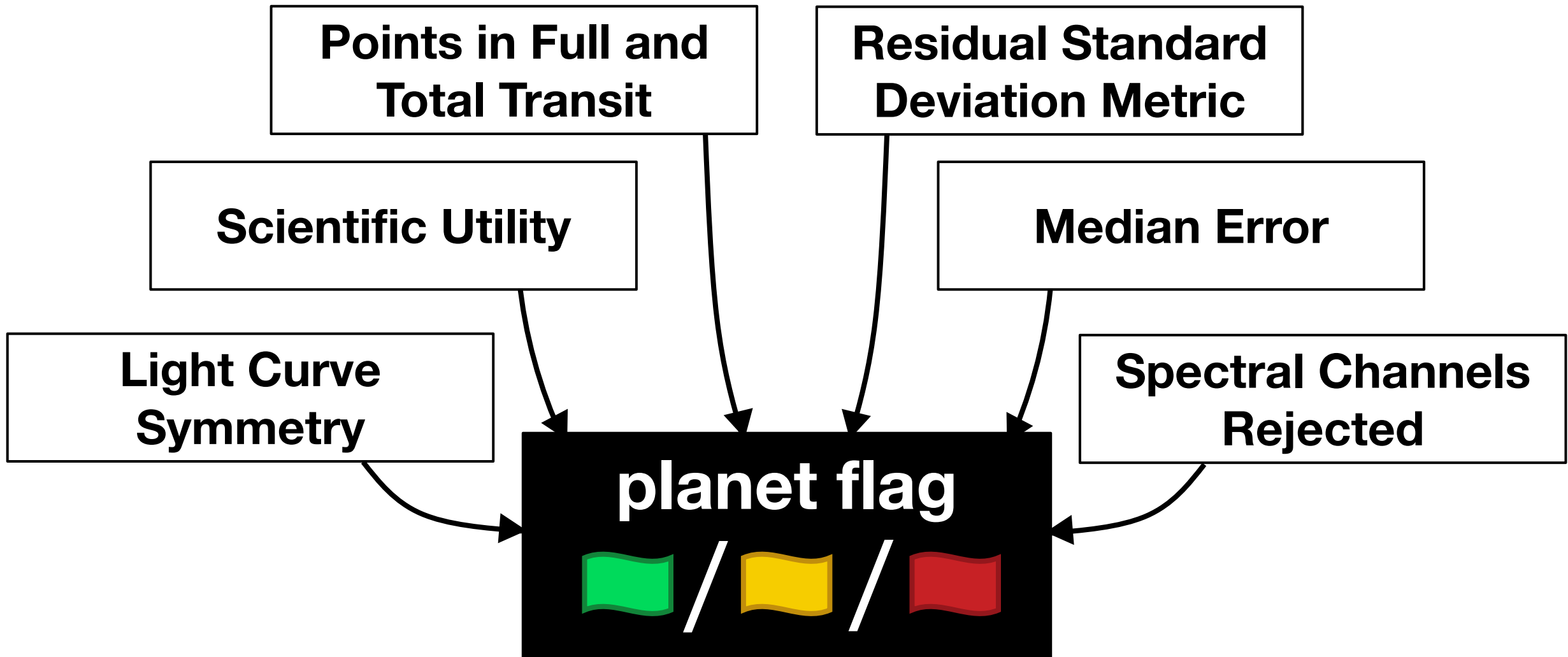
Points in Transit Across Targets (G141)



Points in Transit Across Targets (G430L)



Classifier: A Suite of Algorithms



Planet-Specific Flags

“classifier.flags” state vector

classifier.flags.eclipse-HST-STIS-CCD-G430L-STARE	1
classifier.flags.eclipse-HST-STIS-CCD-G750L-STARE	1
classifier.flags.eclipse-HST-WFC3-IR-G102-SCAN	1
classifier.flags.eclipse-HST-WFC3-IR-G141-SCAN	1
classifier.flags.transit-HST-STIS-CCD-G430L-STARE	1
classifier.flags.transit-HST-STIS-CCD-G750L-STARE	1
classifier.flags.transit-HST-WFC3-IR-G102-SCAN	1
▶ classifier.flags.transit-HST-WFC3-IR-G141-SCAN	1

Viewing State Vector:

Run ID: 1

Target: 55 Cnc

Task: classifier

Algorithm: flags

State Vec: transit-HST-WFC3-IR-G141-SCAN

PLANET: e

Overall Flag: green

POINTS IN FULL AND TOTAL TRANSIT

Flag: green

Flag Description: Sufficient points between 1st and 4th contact points. Sufficient points between 2nd and 3rd contact points.

Number of points in total transit: 10

Number of points in full transit: 10

LIGHT CURVE SYMMETRY

PLANET: e

Overall Flag: green

Pipeline-Wide Flag Summaries

“classifier.summarize_flags” state vector

Search Database

User Dev Admin None

State Vector* summarize_flags

Target Name* Search

classifier.summarize_flags.HST-STIS-CCD-G430L-STARE	
Target Name	Run ID
all	1

classifier.summarize_flags.HST-STIS-CCD-G750L-STARE	
Target Name	Run ID
all	1

classifier.summarize_flags.HST-WFC3-IR-G102-SCAN	
Target Name	Run ID
all	1

classifier.summarize_flags.HST-WFC3-IR-G141-SCAN	
Target Name	Run ID
all	1

Viewing State Vector:

Run ID: 1

Target: _all_

Task: classifier

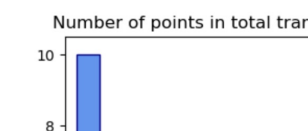
Algorithm: summarize_flags

State Vec: HST-WFC3-IR-G141-SCAN

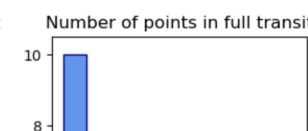
Data Quality Metric	Green	Yellow	Red
count_points_wl	14	2	0
symmetry_wl	14	3	0
rsdm	15	1	0
perc_rejected	15	1	0
overall_flag	11	6	0

Points in Transit Across Targets

Number of points in total transit

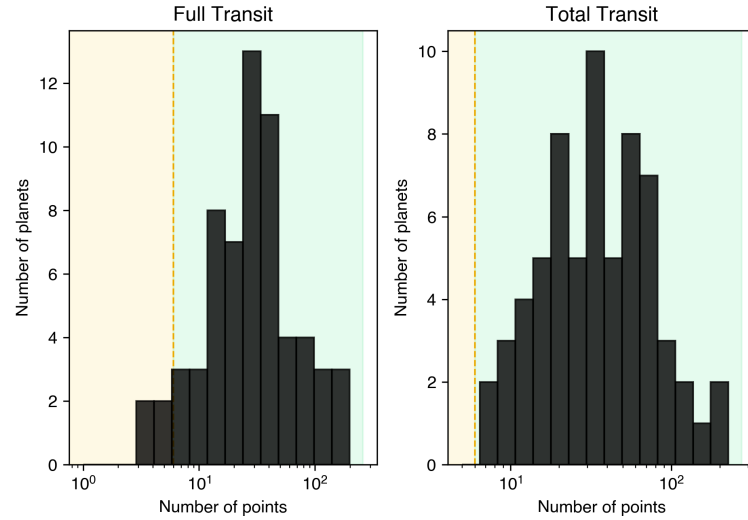


Number of points in full transit

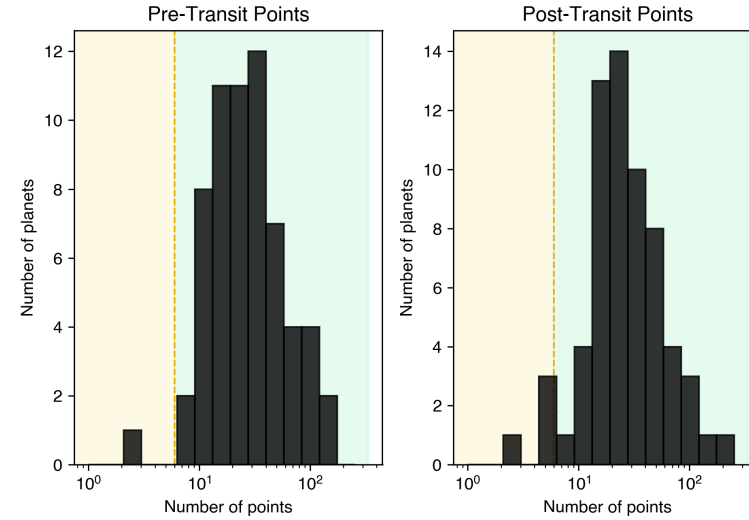


Pipeline-Wide Flag Summaries

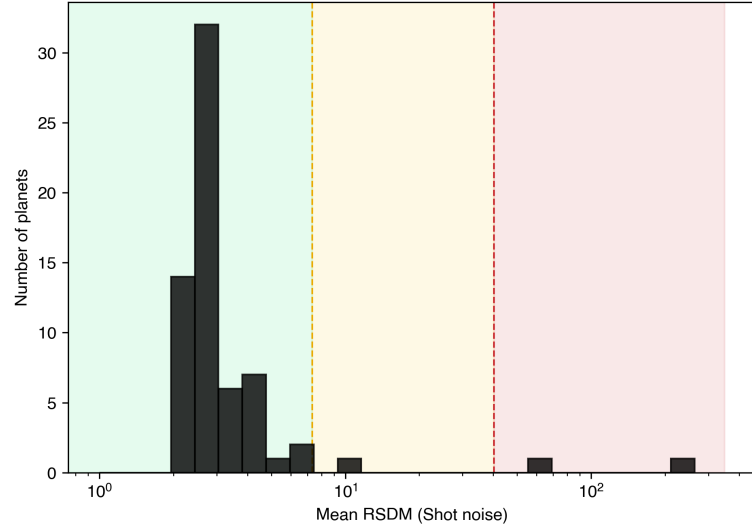
Points in Transit Across Targets (G141)



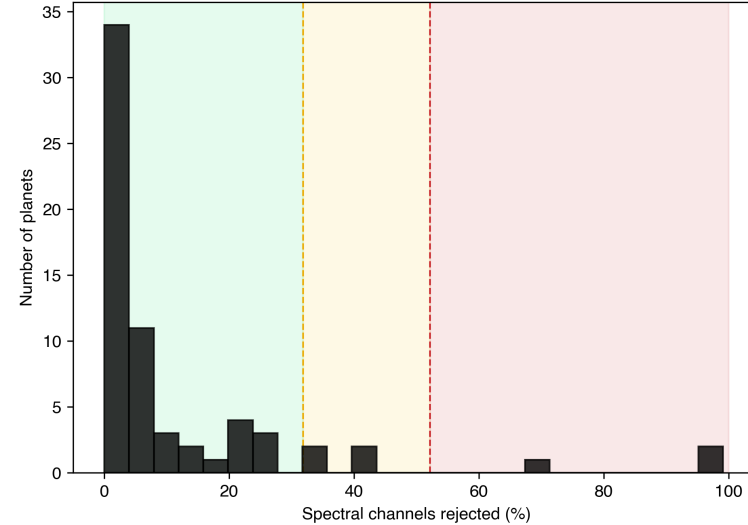
Light Curve Symmetry Across Targets (G141)



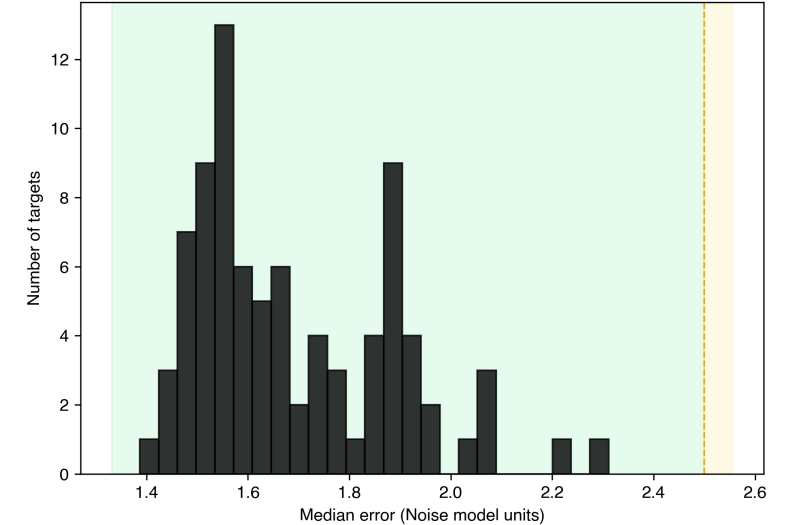
Residual Standard Deviation Metric (RSDM) (G141)



Spectral Channels Rejected Across Targets (G141)



Median Error Across Targets (G141)



Conclusions

- Classifier is a system of algorithms to flag data quality for each target
- Automates the initial spectra judgment process
- Can alert you of when to proceed with caution
- Offers insight into EXCALIBUR's overall performance at each stage
- Provides validation infrastructure to support EXCALIBUR's expansion