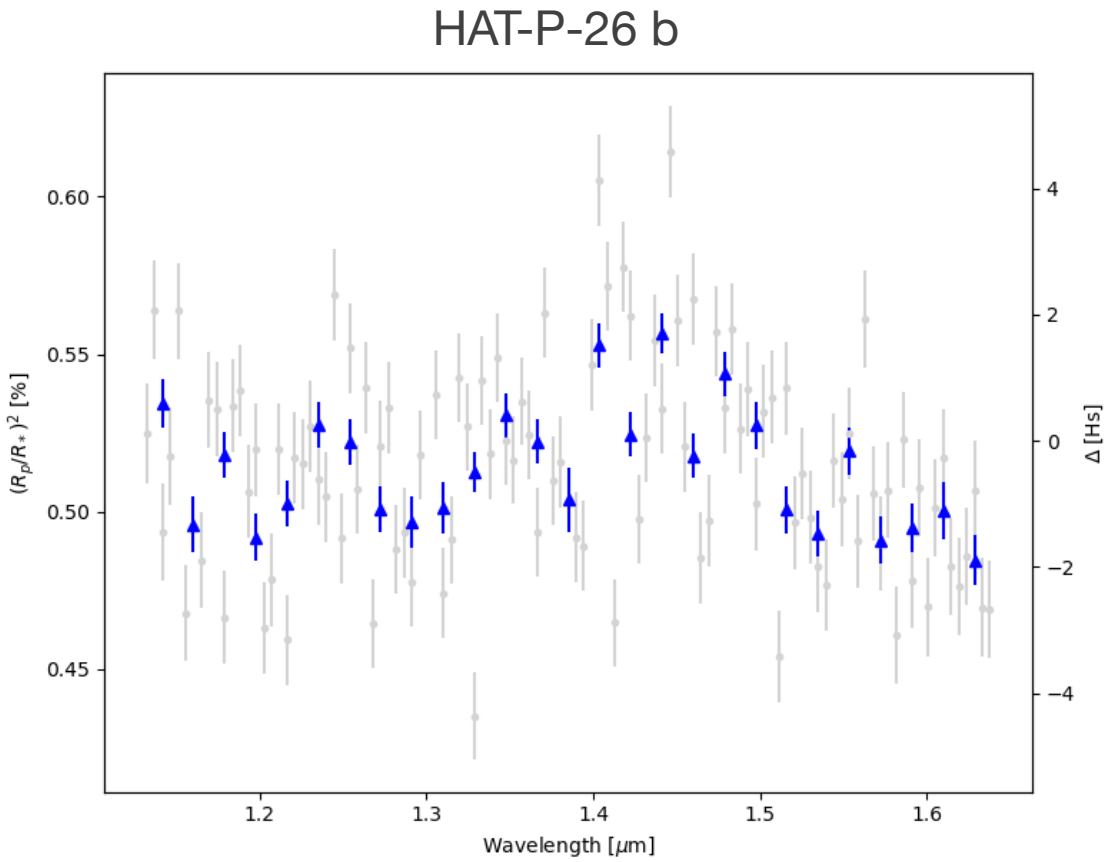
Validating the Transit Spectra: An Automated Flagging System

Kate McCarthy

Jet Propulsion Laboratory, California Institute of Technology

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

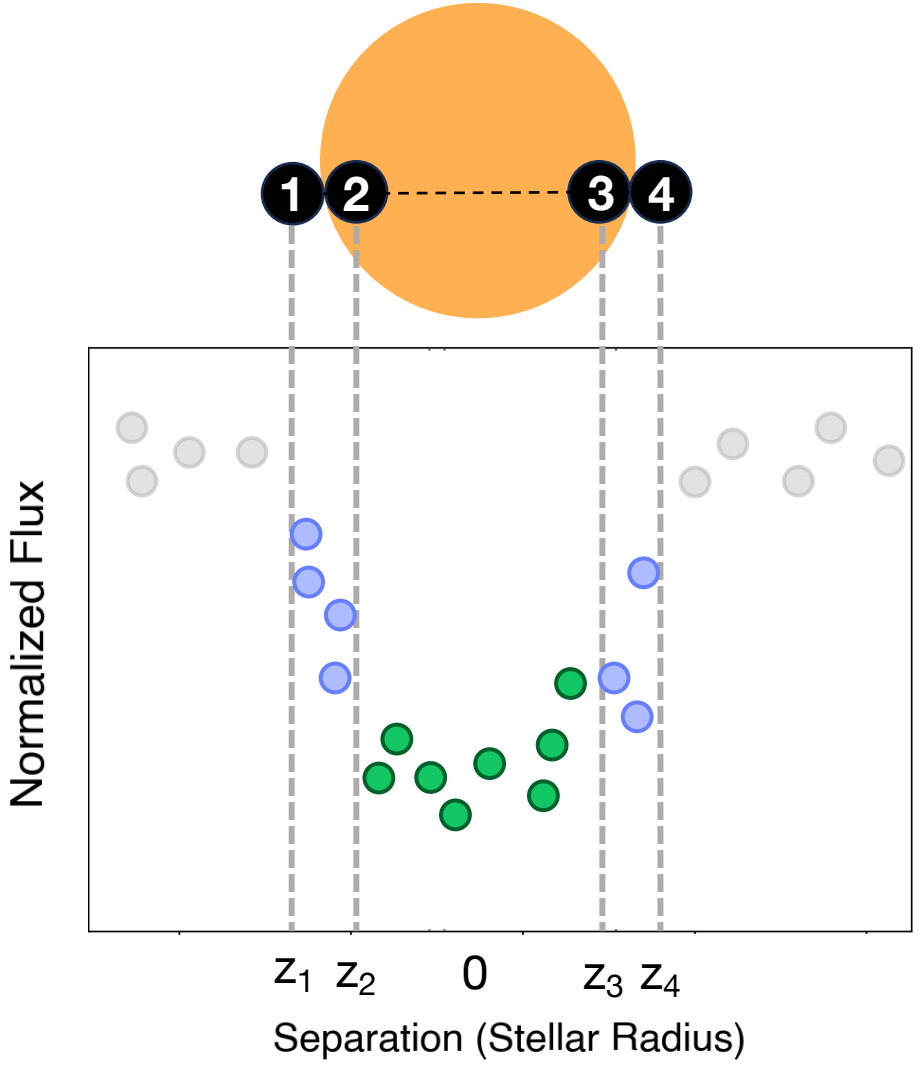
- EXCALIBUR is expanding with more targets and instruments
- It is not feasible to manually validate data products for 1,000+ targets
- How can we automate transit spectra validation?

Data Quality Flags

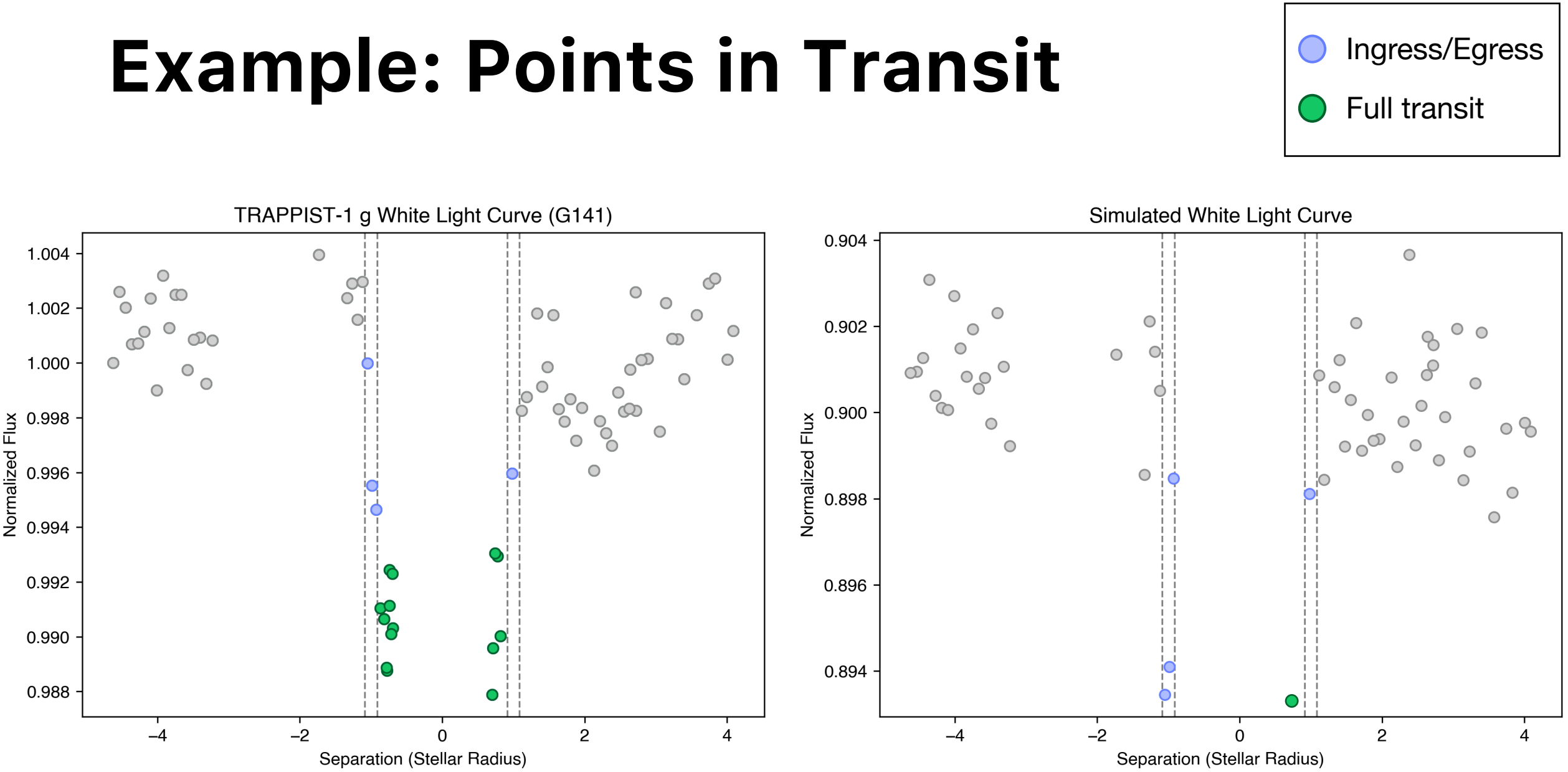
green	yellow	red
Passed Classifier tests (perfection not guaranteed)	Proceed with caution	Use at your own risk

Example: Points in Transit

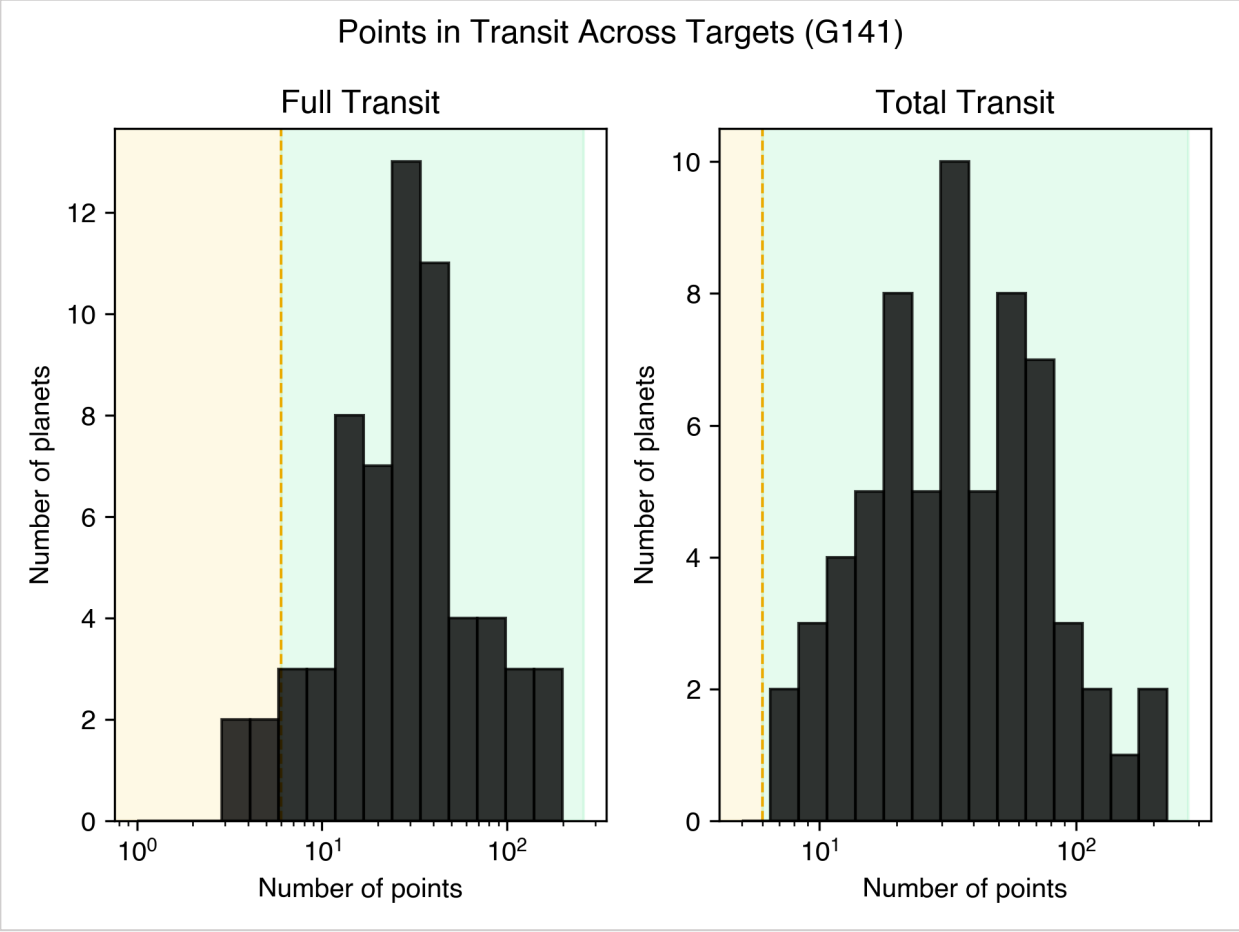
The number of points in the full and total transit.

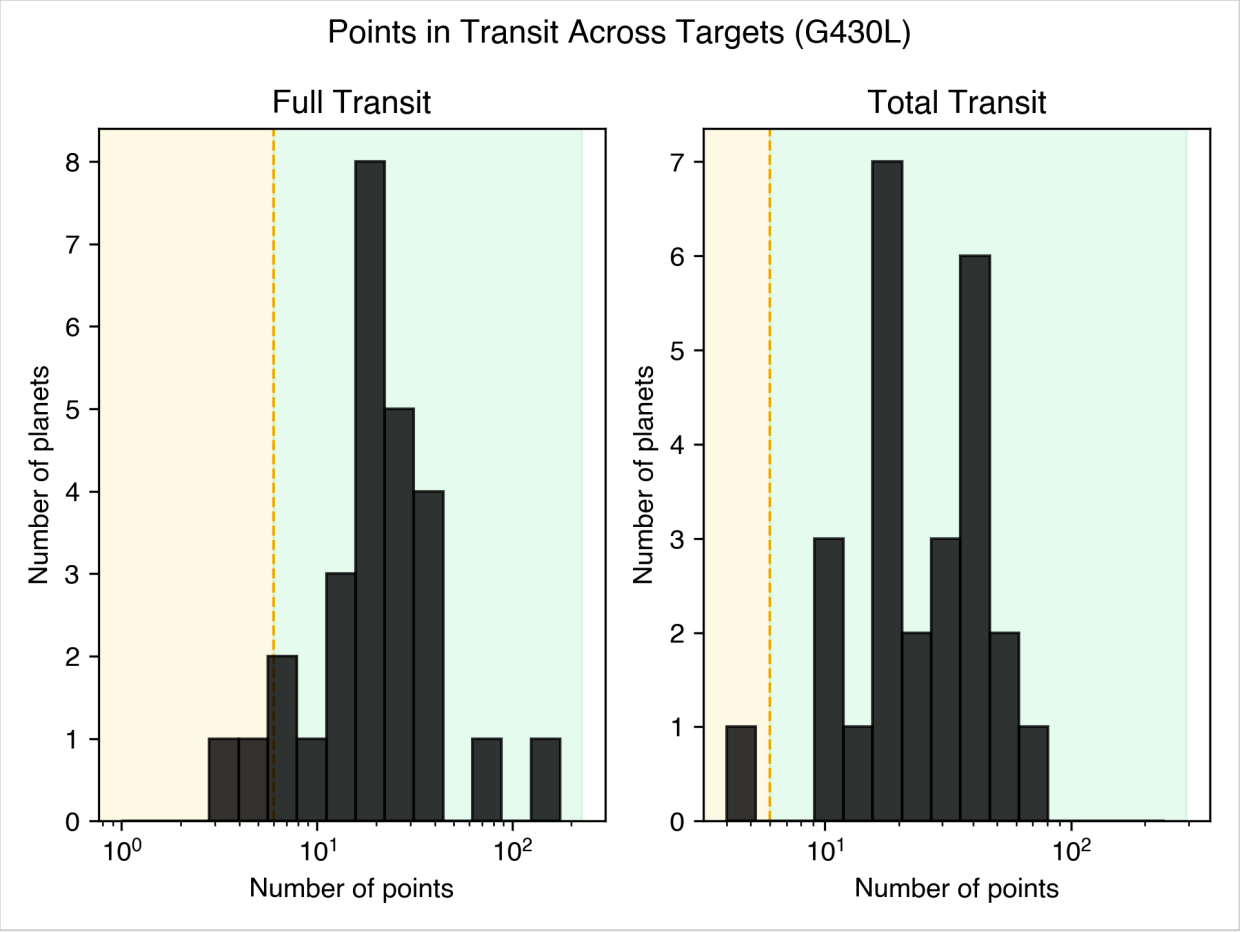


Example: Points in Transit

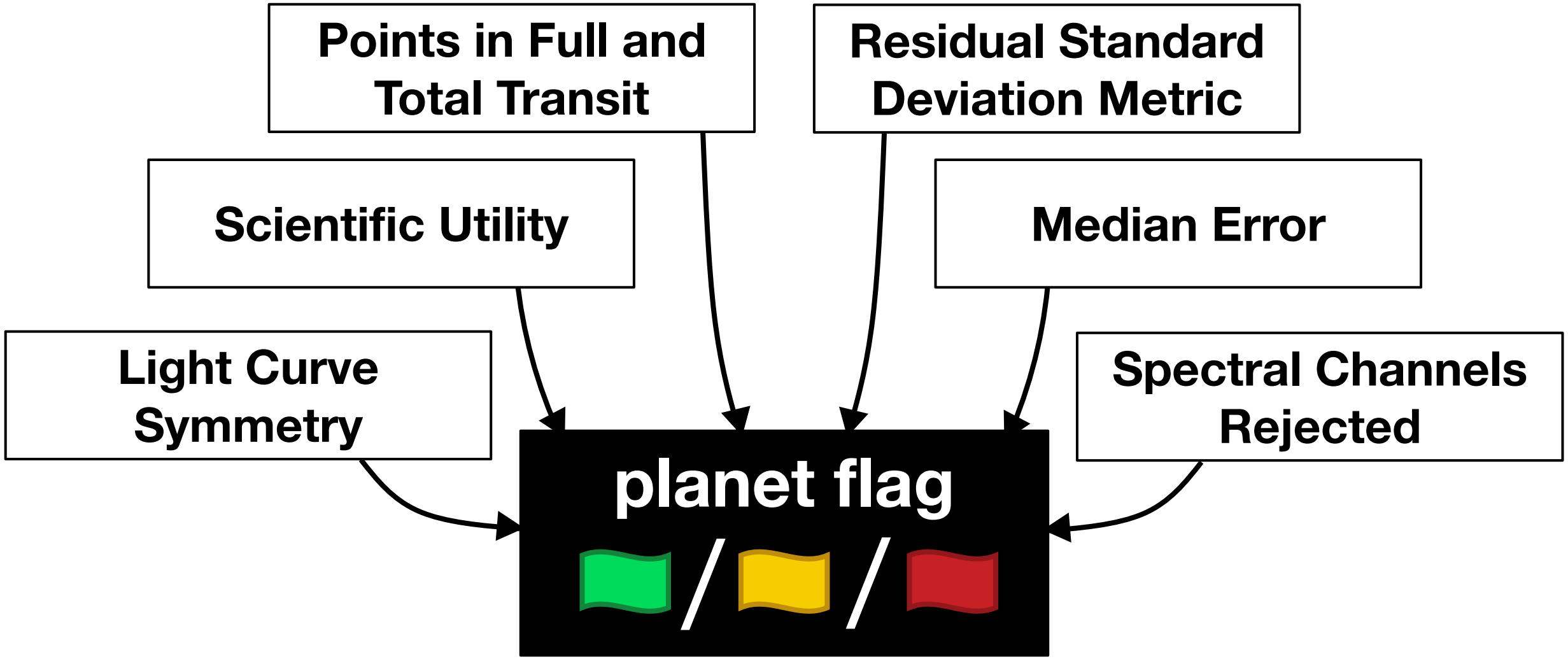


Example: Points in Transit





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

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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

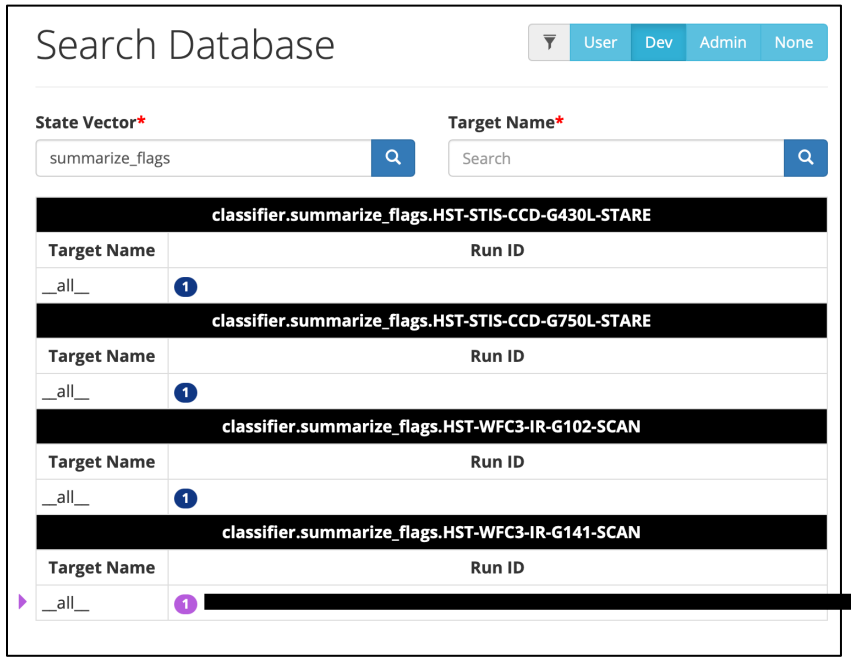
LIGHT CURVE SYMMETRY

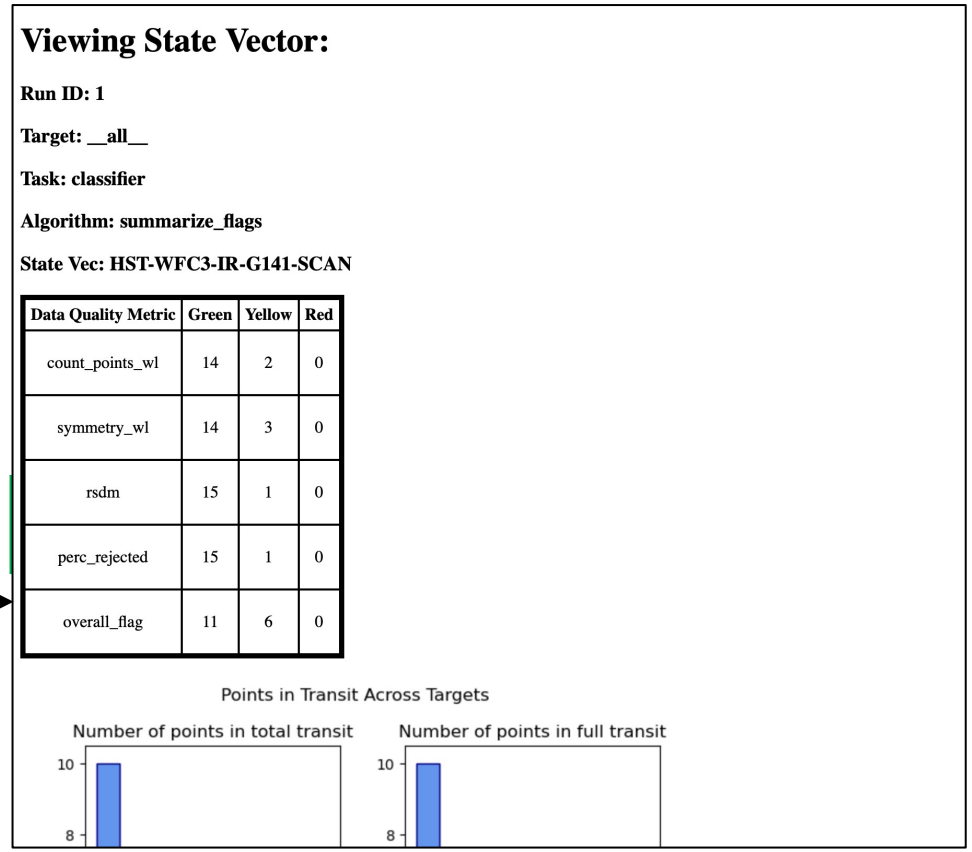
PLANET: e

Overall Flag: green

Pipeline-Wide Flag Summaries

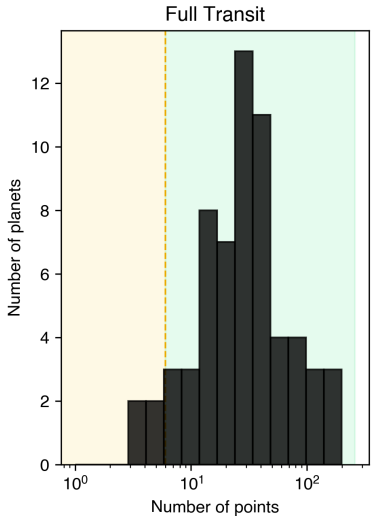
"classifier.summarize_flags" state vector

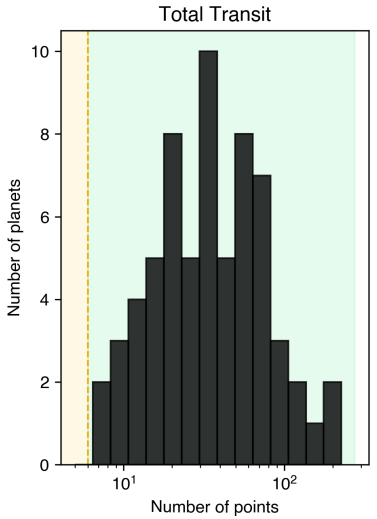




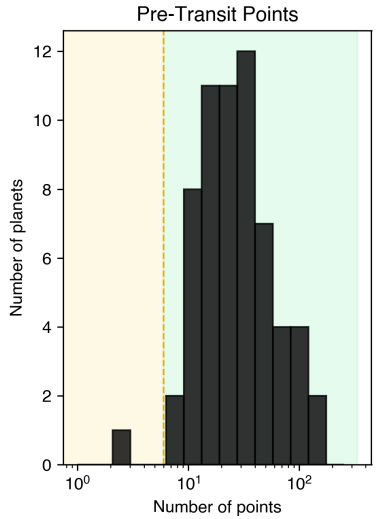
Pipeline-Wide Flag Summaries

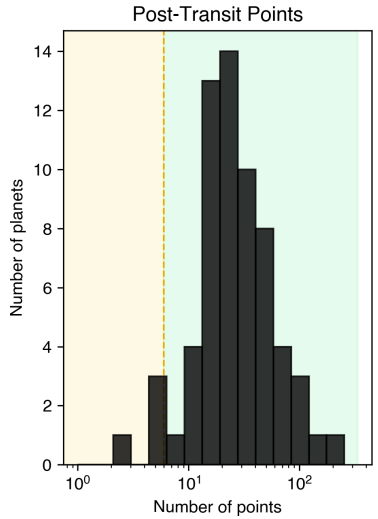
Points in Transit Across Targets (G141)

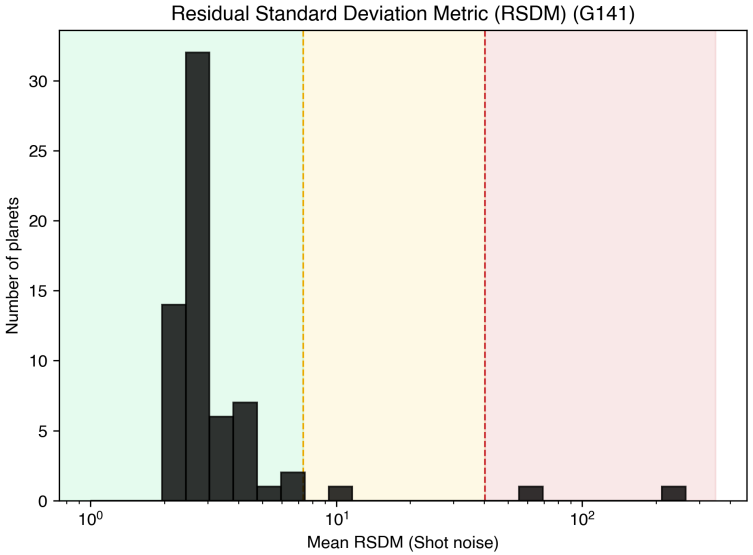


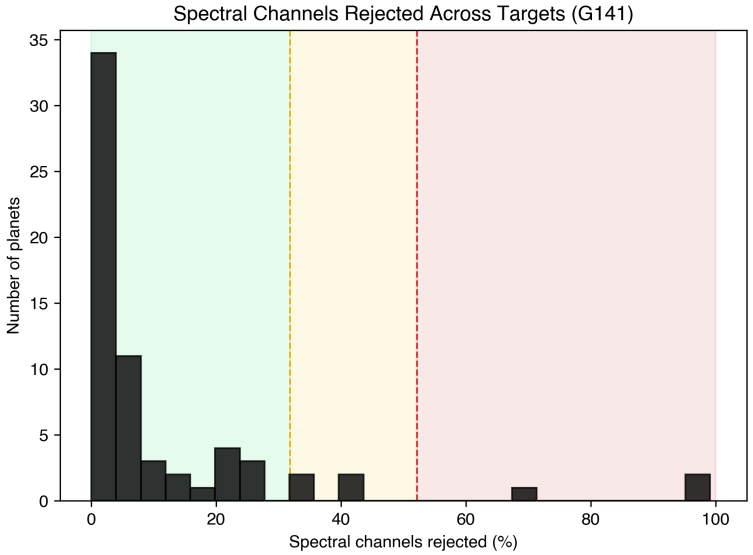


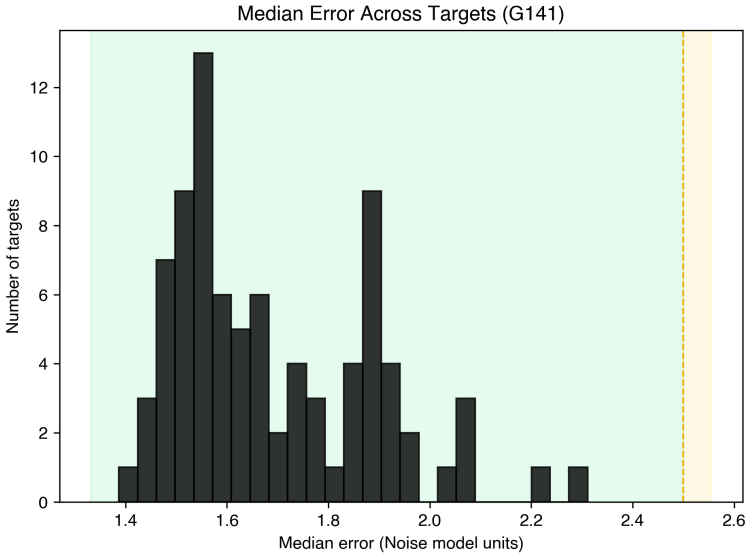
Light Curve Symmetry Across Targets (G141)











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