Name: Steve Bryson
Email: steve.bryson@nasa.gov
Institution: NASA Ames
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Abstract:

The Kepler Sky Model Metric
Stephen T. Bryson, NASA Ames

The Kepler data analysis pipeline uses various models to extract planetary transit parameters from Kepler data. Some of these models inform the pipeline about the local stellar neighborhood and how starlight is distributed on the Kepler pixels. In particular the Kepler Input Catalog (KIC) the the Pixel Response Function (PRF) models are used to determine the photometrically optimal pixels for aperture photometry and estimate dilution due to crowding. Errors in these models may lead to less than optimal photometry, or errors in the estimate of dilution that can lead to incorrect estimates of transit depths and therefore planet sizes.

When individual planet candidates are followed up in detail, flaws in these models can be detected and corrected. But it will be some time before such detailed followup is performed for the majority of planet candidates. It is therefore useful to have a metric which indicates when the KIC and PRF models are problematic for individual Kepler targets.

We present the Kepler sky model metric, which uses the catalog and PRF models to create a synthetic pixel image for a target star This synthetic image can be compared to the corresponding observed pixel image, and the Kepler sky model metric measures the magnitude of the difference. When the sky model metric is large, the results of the Kepler data analysis pipeline should be treated with caution. We show the statistics of the sky model metric for Kepler Objects of Interest (KOIs), giving a sense of "nominal" metric values, compared with large outliers that indicate problems. We describe a table that provides sky model metric values for all Kepler target stars.

We suggest that statistical analyses of the Kepler planet candidate catalog should take the Kepler sky model metric into account, for example de-weighting planet candidates where the sky model metric is large.