Extended TESS Mission · 12/15/2015 Meeting Notes

1 Regarding science goals

Emphasizing habitable-zone planets, particularly those that would be good targets for JWST, Earth-sized planets orbiting M-dwarfs. Not only scientifically interesting but might also increase the chance of getting an Extended Mission approved.

Long-period planets.

Observing open clusters.

2 Regarding observing plans

The default should probably be to repeat the survey; any other plan has to demonstrate special added value

Not in our existing menu: Anti-ecliptic pole: put bottom of bottom camera along ecliptic; you miss the CVZ of years 1-2, but get new planets, K2 targets, and reduce the ephemerides problem.

3 Regarding metrics and other points to consider

Consider implications of each scenario for synergy with HST, JWST, WFIRST, CHEOPS (and possibly PLATO).

Consider implications for each scenario of observing Kepler (see below), K2, CoRoT fields.

Consider implications of each scenario for Guest Investigator program (e.g., breadth of science, ease of implementing)

Consider implications of each scenario for follow-up programs, e.g., How well can future transit times be predicted? Can the photometric variability measured by TESS help to support Doppler or atmospheric follow-up? In particular can we obtain TESS photometry contemporaneous with those programs?

Changing the balance between number or cadence of target stars and FFI cadence

Changing the selection of target stars (for instance, for more open clusters, transients, or asteroseismology targets)

Quantify loss of duty cycle due to Earth/Moon transits, particularly when observing the ecliptic plane

Associate with each TESS planet a metric for 'ease of atmospheric characterization' (e.g., calculate SNR estimates for tranmission spectroscopy measurements, and/or expected SNR for RV measurements; compare with benchmark objects as a function of planet mass, semimajor axis, temperature, etc.)

Pass along simulated planet catalogs to Atm Char WG and Drake Deming, for post-processing

Greater realism in simulation of multiplanet systems

For how many systems do we detect *additional* planets during the Extended Mission?

The Kepler field: Possible science: extending baseline for TTVs searching for frequency shifts in p-modes due to solar cycles How long could we dwell on the Kepler field? Can we center the camera fields on the spot in between the NEP and Kepler field? Can we shift the fields just a smidge to enhance visibility of Kepler field?

Eventual form of recommendations: Rank-order list of different scenarios based on given priorities. Come up with indices (e.g., 'new planet index', 'long period planet index', 'characterizable atmospheres index') that describe how well each observing strategy performs each science goal, then explore the parameter space of indices vs. mission type.

Working timeline: metrics from main overview memo, as well as some of those above, by TESS science team meeting Spring 2016.

4 Regarding observing details

What is loss of duty cycle due to Earth/Moon occultations? Esp. impt. for ecliptic survey. Also relevant for Camera 1 (lowest ecliptic latitude) during primary mission.

Earth/Moon spoil camera data when within 35 degrees of field center

Camera center must be pointed within 30 deg of antisolar, and 15 deg is preferred.

Can we do 'drift scanning' or at least hop fields more frequently than 27 days? How badly would this affect photometry?

Related idea that would likely never work: if the spacecraft rotated about the boresight on a half-hour period (transit duration histogram for detected planets peaks at 1.5 hours for all stars, 1 hour for M dwarfs) would it be possible to detect *any* planets? In this scenario, would it be possible to get enough light on the solar panels, and transmit data at perigee? (These last questions are likely nails in the coffin for this idea; spacecraft needs stable pointing to Earth for high quality telemetry, even if the photometry worked).