TESS from 2019-2021

Dec 15 2015

Simulations Working Group

Luke Bouma

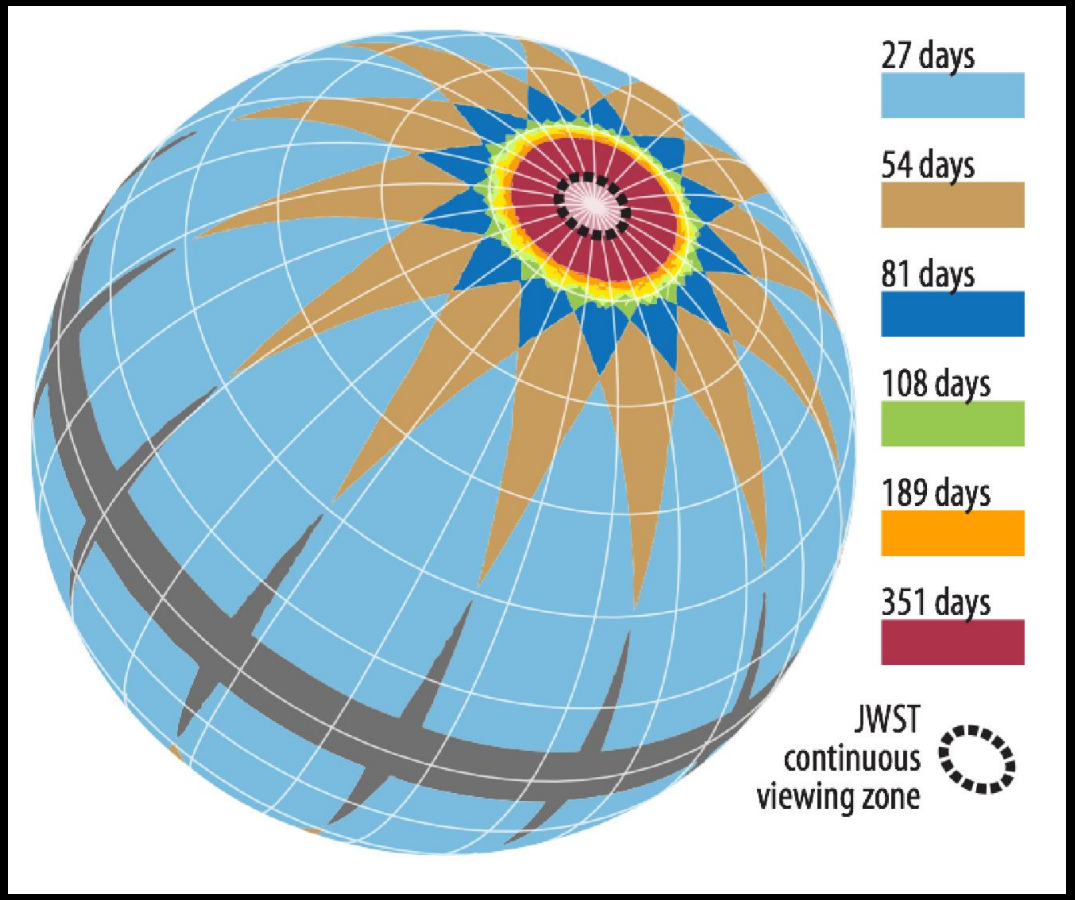
A) Which criteria should we use to compare observing plans after *TESS*'s first two years?

B) What specific observing plans should we evaluate?

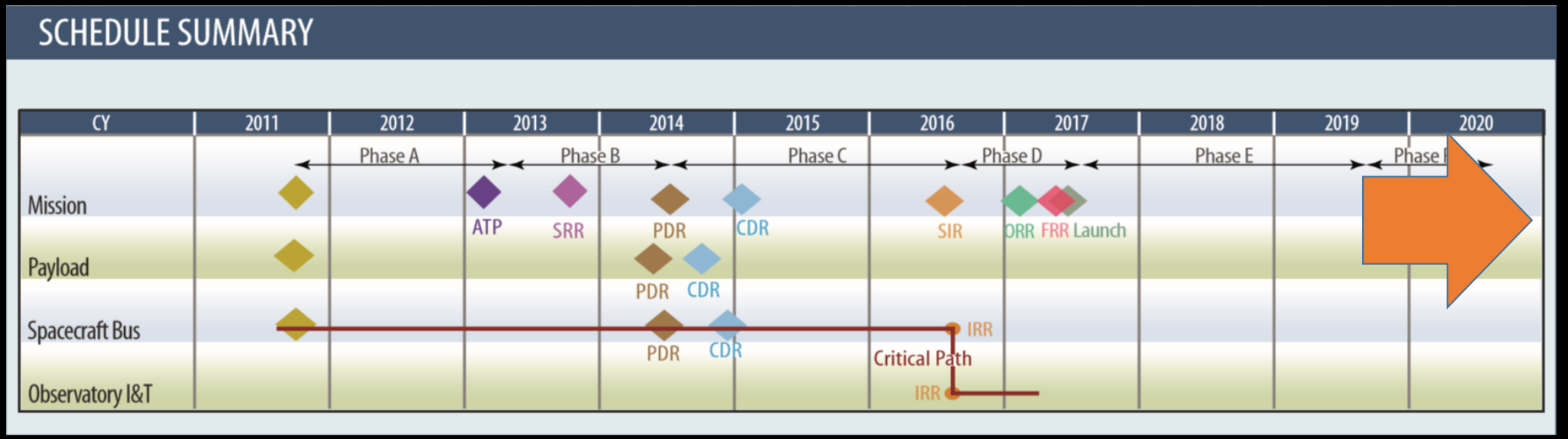
Outline

- Context within *TESS* mission timeline
- Yield calculation for planets and false positives
- Preliminary thoughts on:
  - Metrics for evaluation
  - Possible observing plans
- Discussion

Primary mission runs from late 2017-19; target planets $R<4R_E$ around bright stars



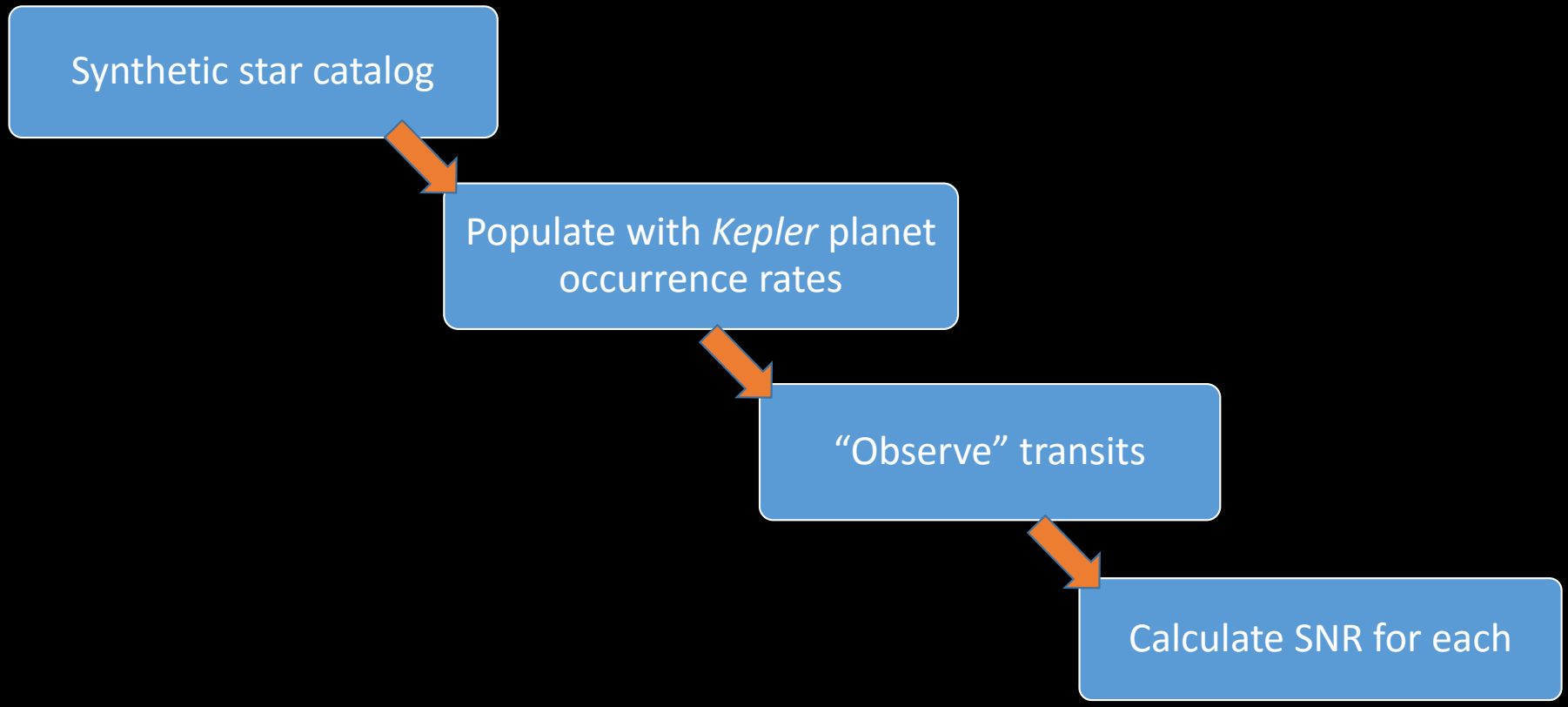
- There are no fundamental obstacles for 5-10 yrs
- Different observing strategies benefit different goals

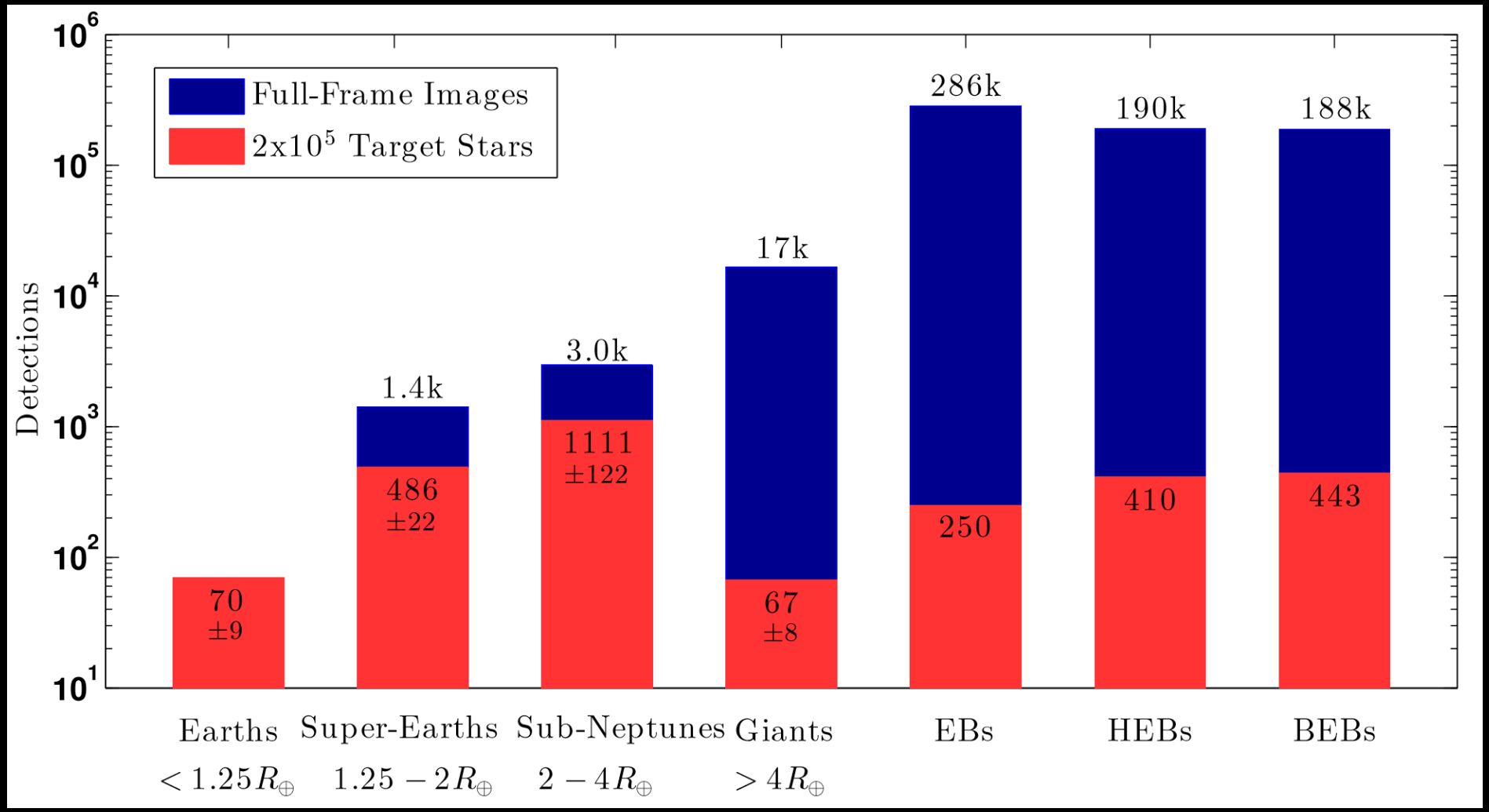


- There are no fundamental obstacles for 5-10 yrs
- Different observing strategies benefit different goals

Assume: primary mission succeeds. What will our 1 and 2-year priorities be?

Yield calculation overview

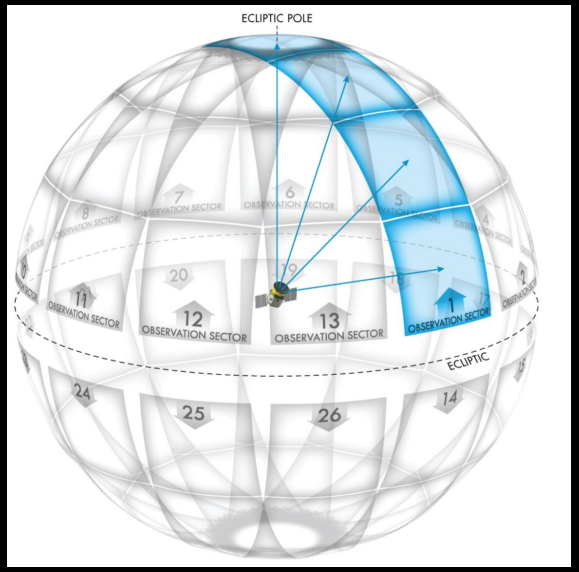


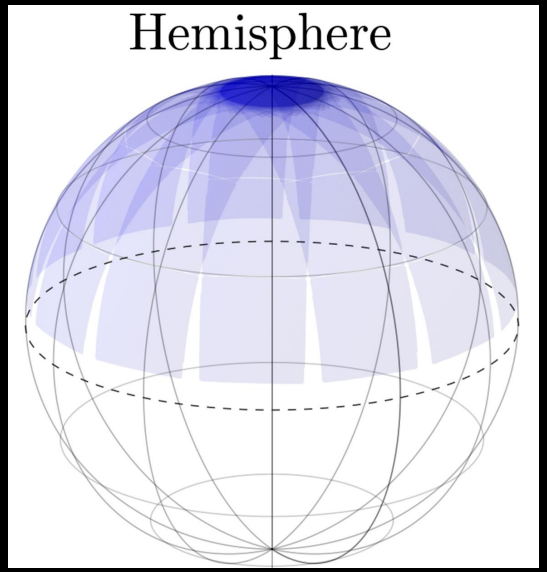

Full-Frame Images
2x10^5 Target Stars
Detections
10^6
10^5
10^4
10^3
10^2
10^1
70
±9
1.4k
486
±22
3.0k
1111
±122
17k
67
±8
286k
250
190k
410
188k
443
Earths
< 1.25R⊕
Super-Earths
1.25 − 2R⊕
Sub-Neptunes
2 − 4R⊕
Giants
> 4R⊕
EBs
HEBs
BEBs

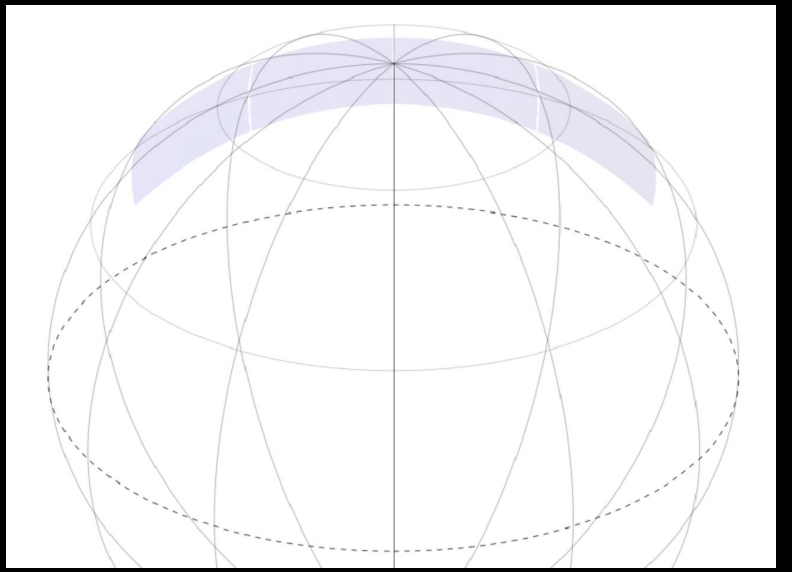
To ensure science goals are met, we monitor:

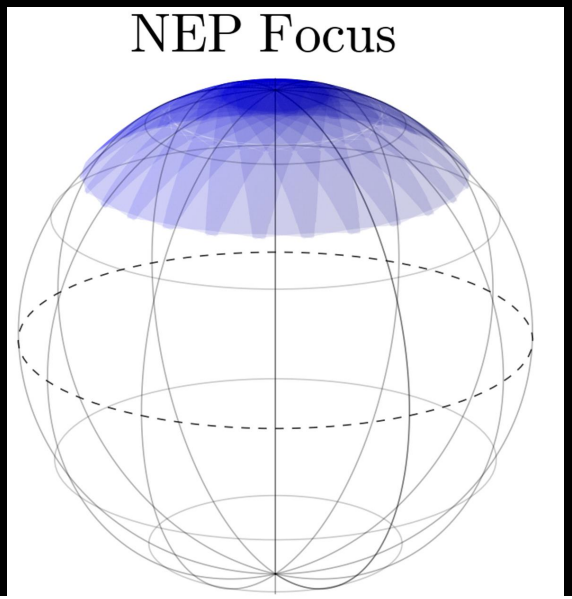
1. Detected planets
2. Host stars
3. Transits
4. Astrophysical false positives
5. “Marginal” detections

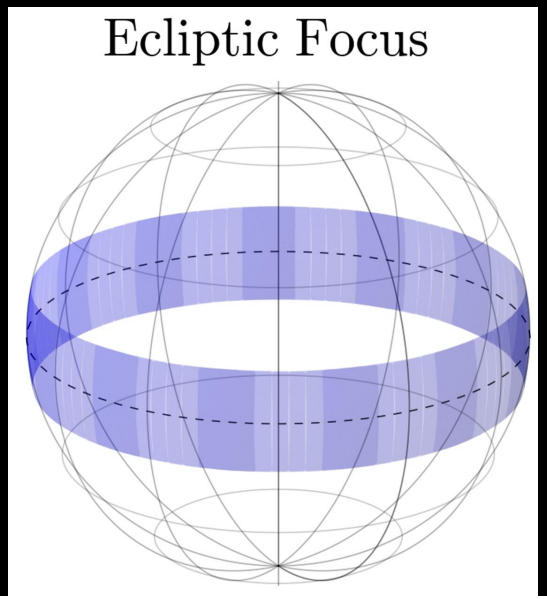
2019-21 figures of merit could focus towards new planets, new parameter spaces, or more details about known planets.









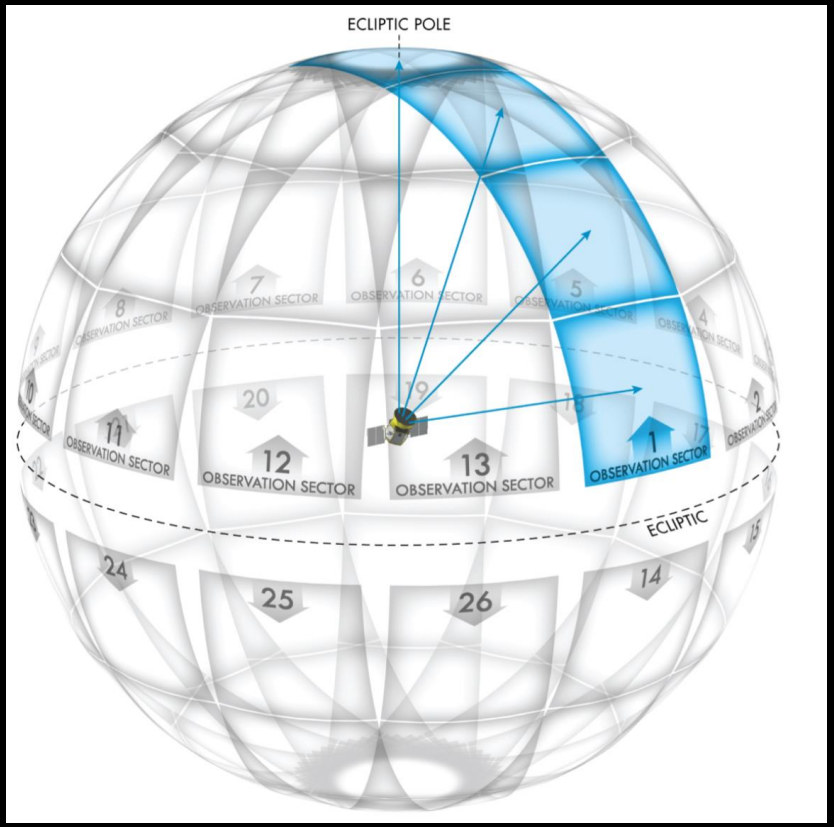


Microlensing:
single camera pointed at galactic bulge; rest perform photometry

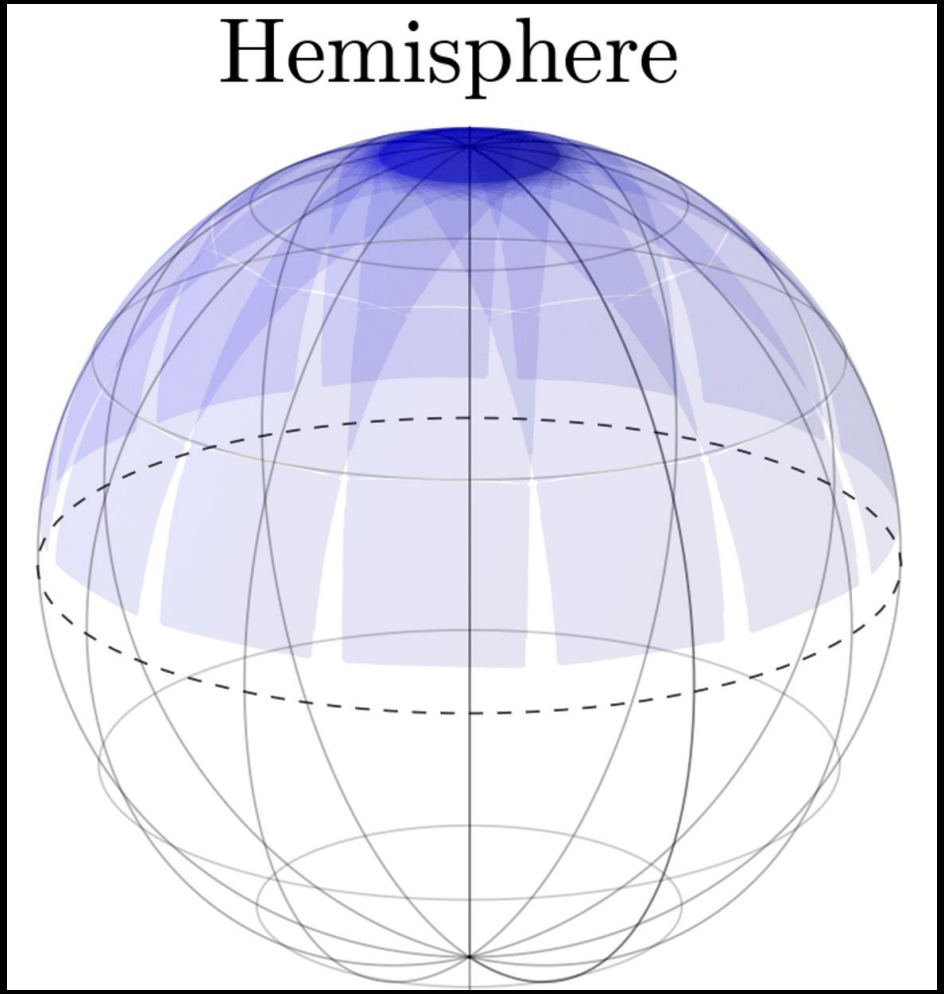
Specific Scenarios

Primary survey repeat

- Advance phase to observe “gaps” (rocky planets about brightest stars)
- Enhance SNR and period sensitivity on known transiting planets
- Address ephemeris problem (*e.g.*, CoRoT)
- Experience from first run
- Short periods; ephemeris problem addressed by followup

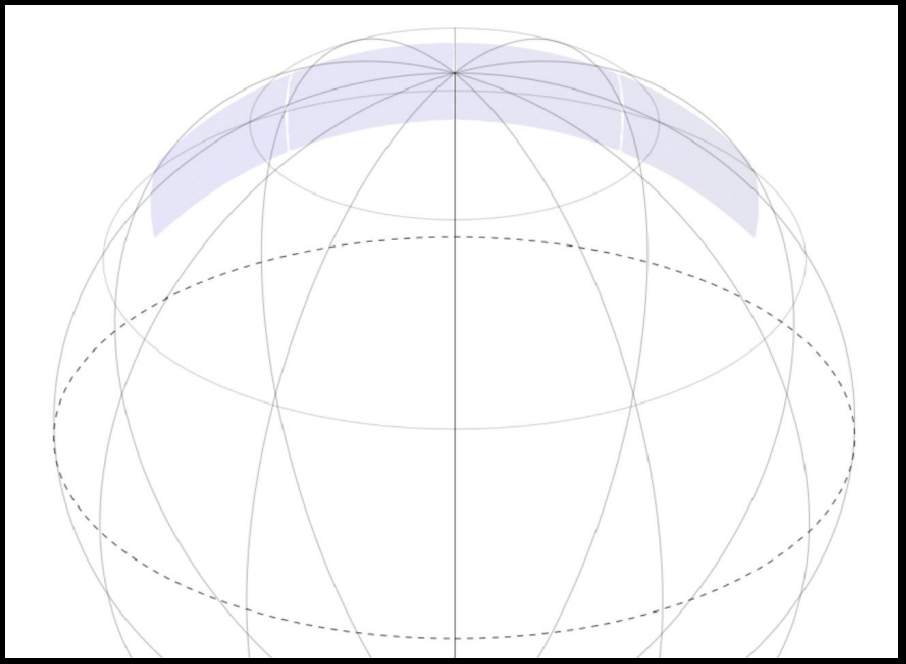


- Advance phase to observe “gaps” (rocky planets about brightest stars)
- Enhance SNR and period sensitivity on known transiting planets
- Helps address “when does it transit” problem? (*e.g.*, CoRoT)
- Experience from first run
- (Can mitigate short period with longer dwell time)

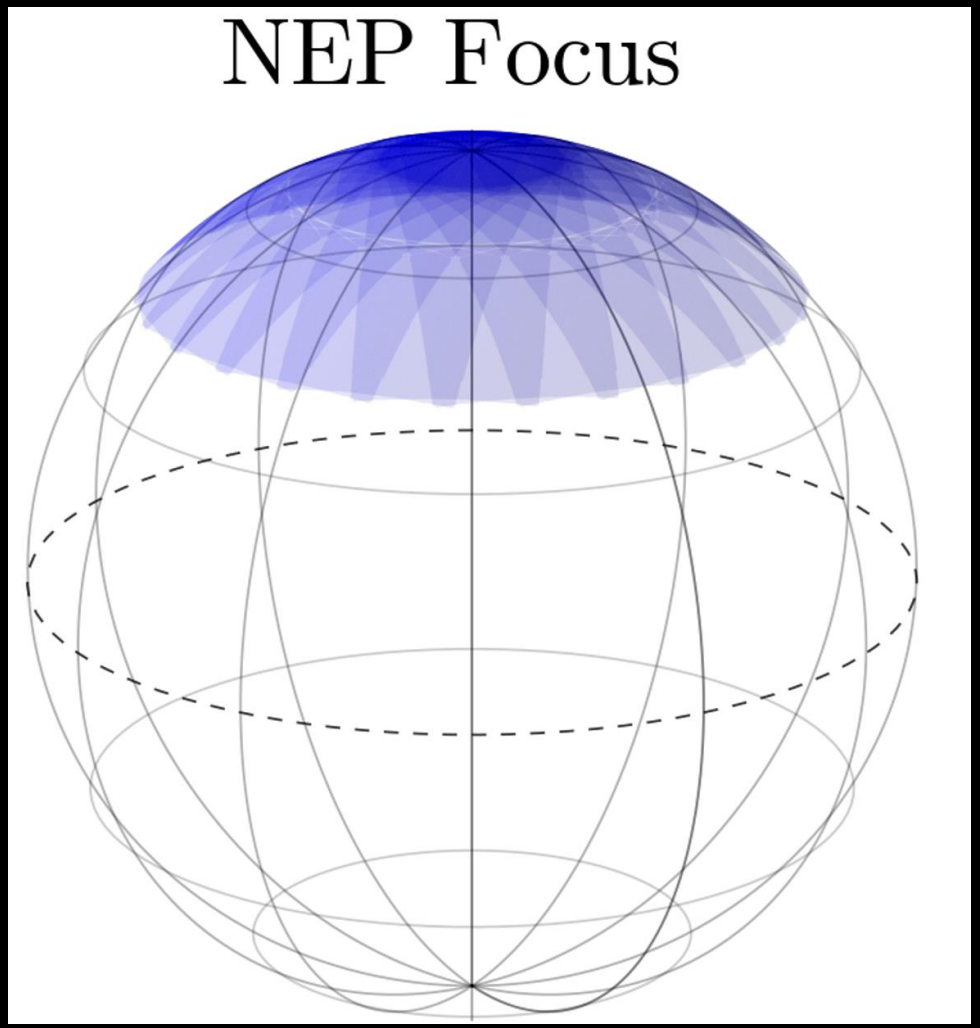


Single Field

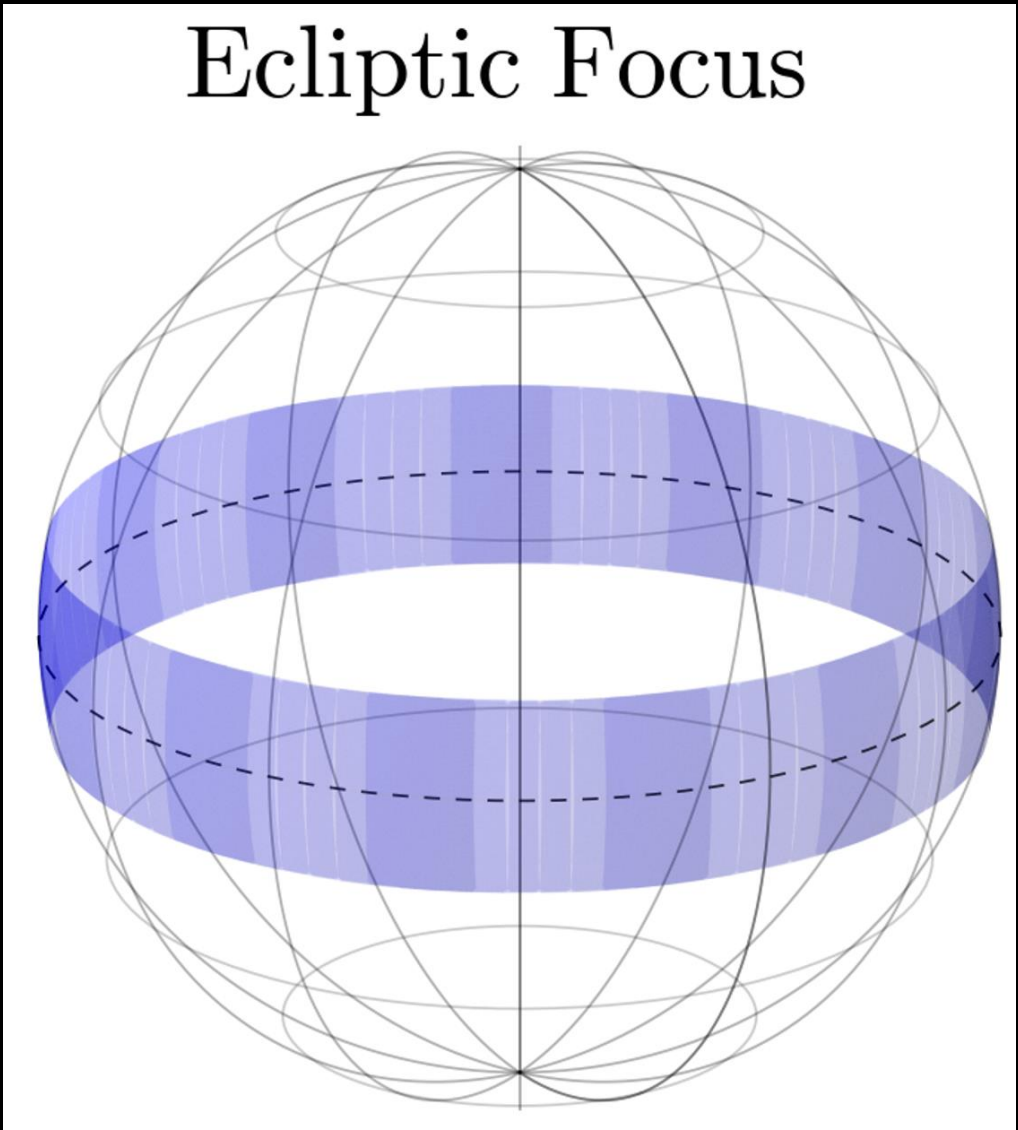
- At an ecliptic pole, or at Kepler field, or at PLATO long-stare field
- Longest possible period coverage, of least # of targets
- Engineering constrained - need to keep solar panels towards sun



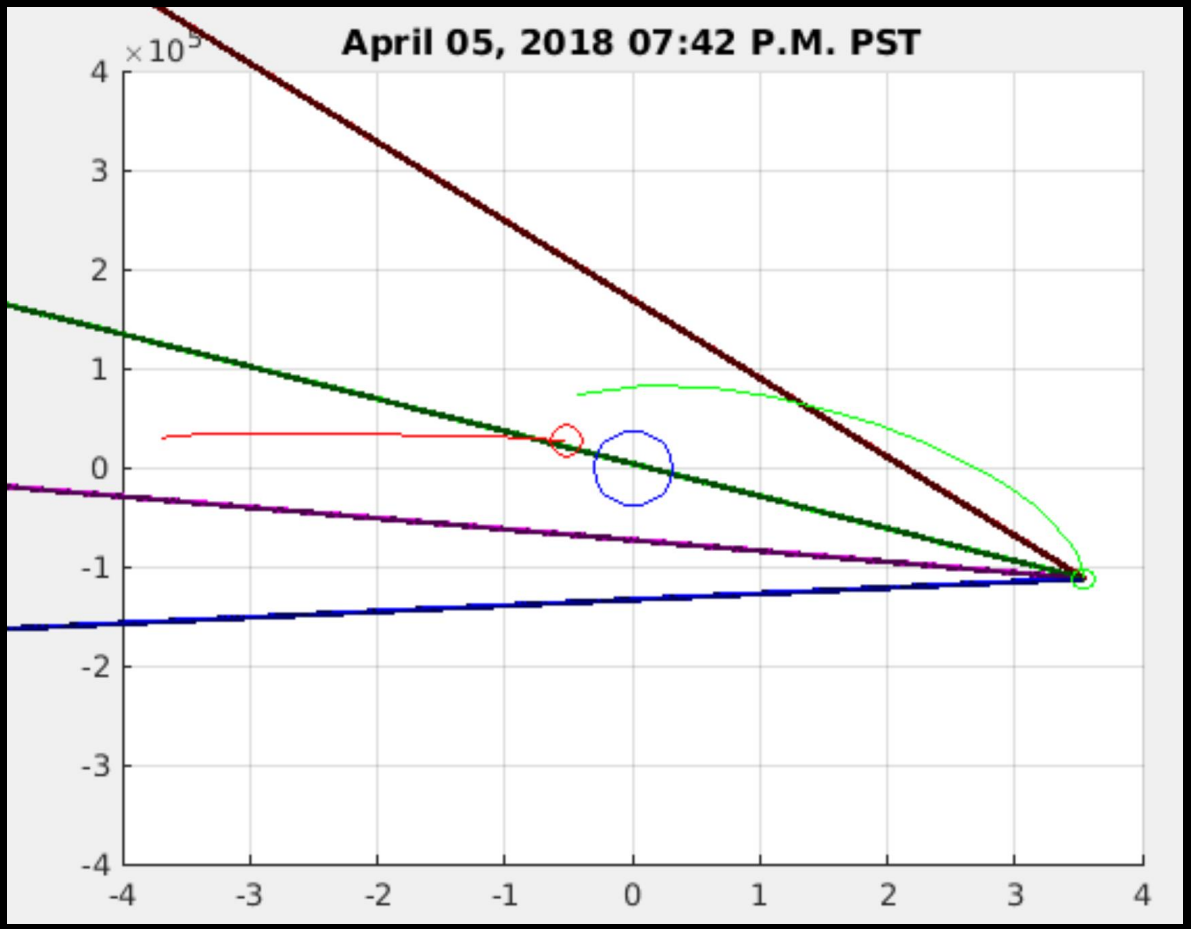
- Longer observing duration over medium number of targets.
  - Longer *P*, still cover ~1/4 of sky.
- Low # astrophysical false positives



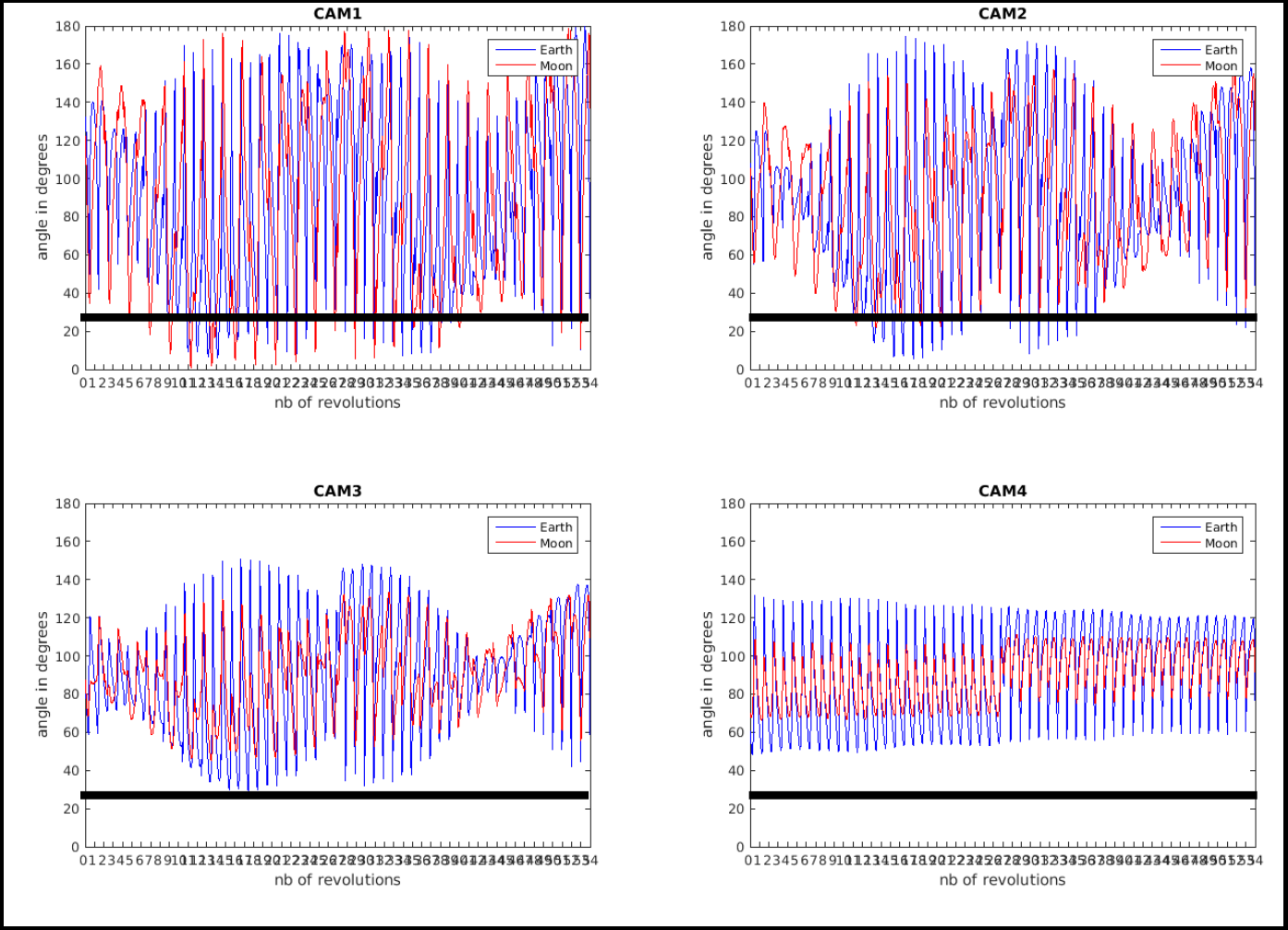
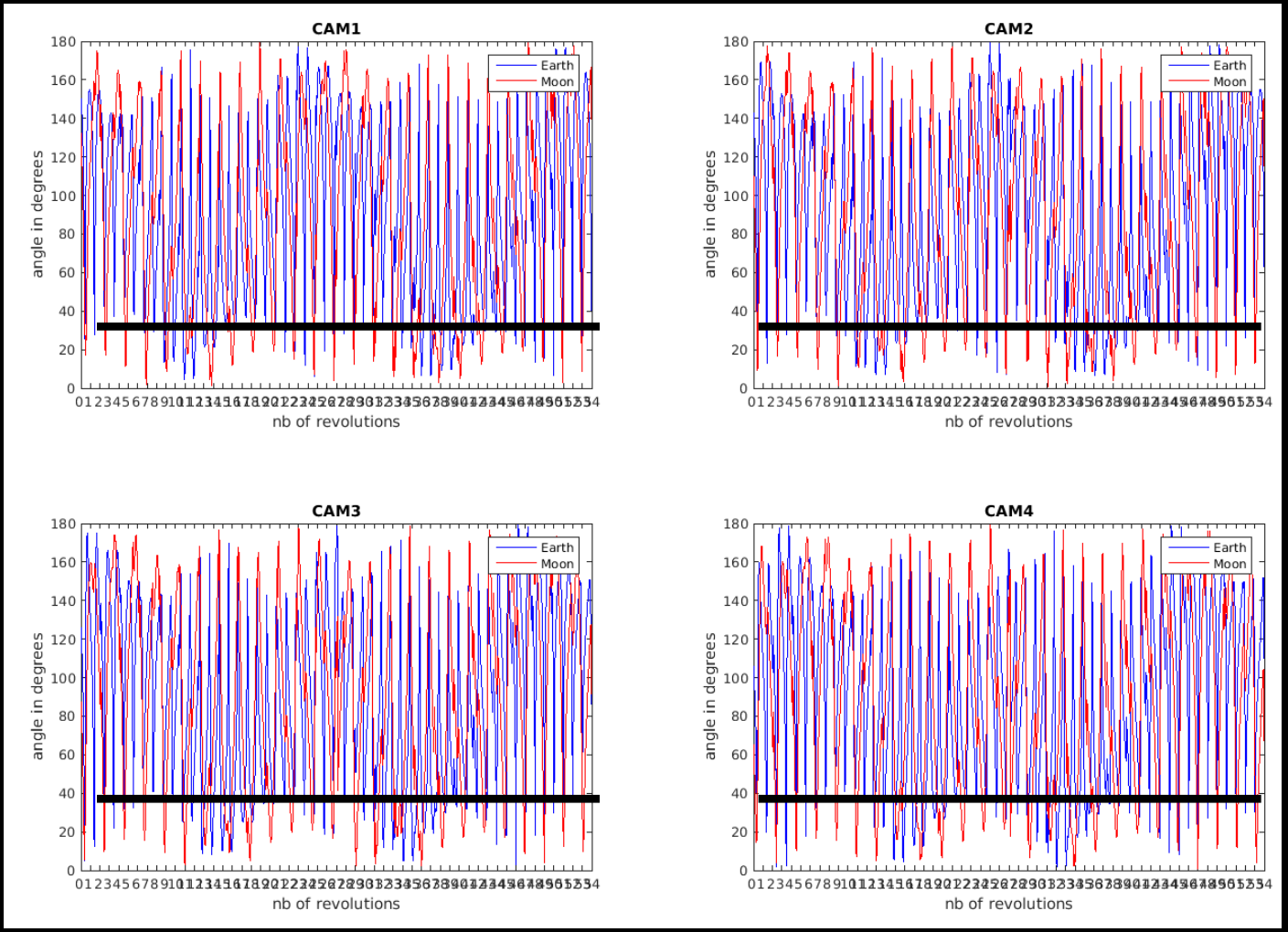
- Confirm *K2* targets (all campaigns, + uncovered fraction of sky from *K2* & *TESS* primary)
- Issues of zodiacal light as well as Earth and Moon transits



Issue with ecliptic: Earth and Moon transits



Primary mission already has a camera suffering from this



Ecliptic plane only: it gets worse