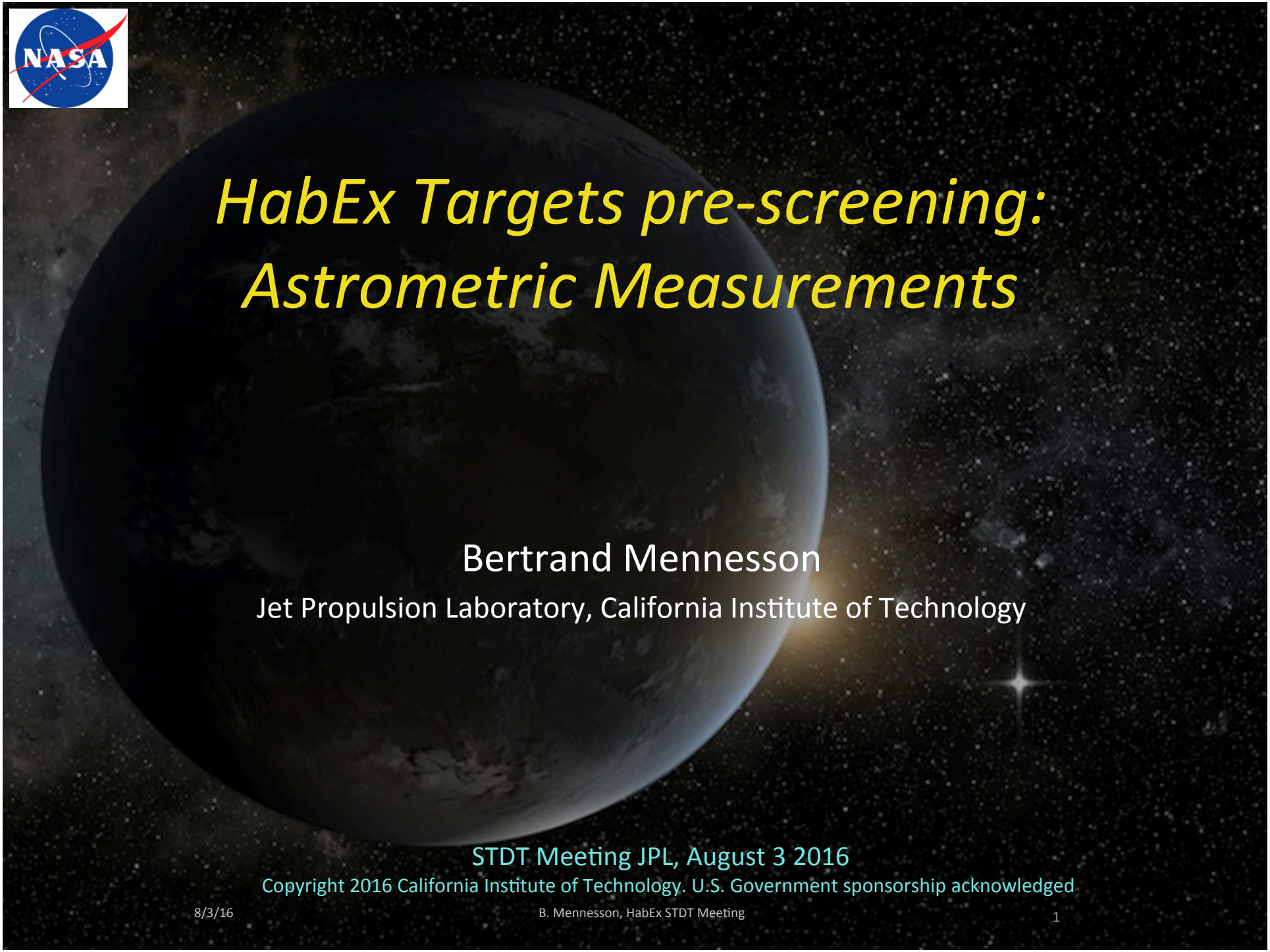

HabEx Targets pre-screening: Astrometric Measurements

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STDT Meeting JPL, August 3 2016

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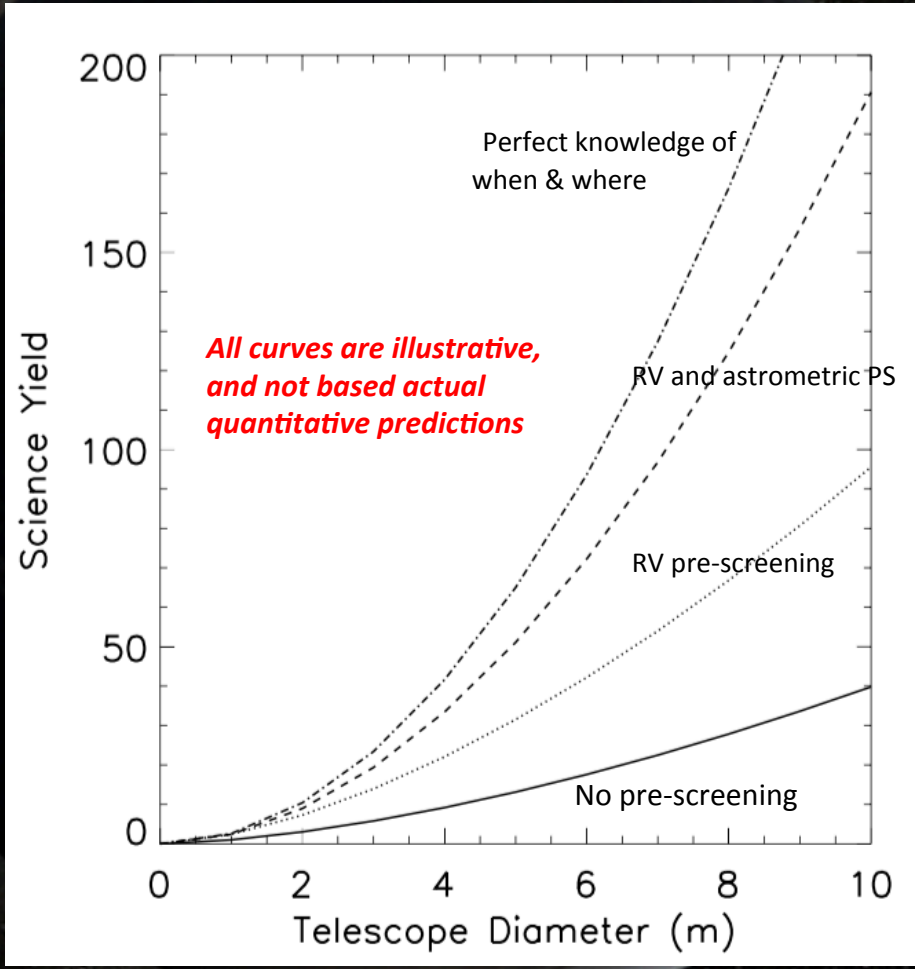
The interest of pre-screening



- Other options for SY increase:
  - pre-screening of exozodi levels (LBTI, WFIRST, others?)
  - coping with binaries (Belikov MSWC etc)

- Worth noting that RV and astrometric measurements complement and reinforce each other → use both if possible

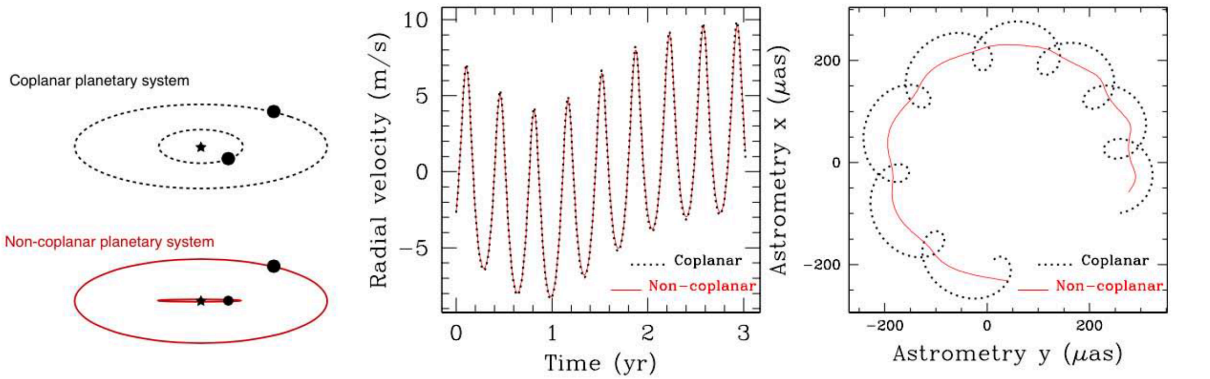
The pros of Astrometry

- Stand-alone mass determination
- Works on broader target sample (F stars OK, all inclinations OK)
- Less sensitive to stellar jitter than RV or TSI

Period	rms(ΔX)	rms(ΔY)	rms(RV) without conv.	rms(RV) with conv.	rms(TSI)
all	0.07	0.05	0.33	2.4	3.6×10^{-4}
high1	0.09	0.06	0.42	1.42	4.5×10^{-4}
high2	0.08	0.05	0.37	1.62	3.9×10^{-4}
low	0.02	0.01	0.08	0.44	1.2×10^{-4}

"Using the Sun to estimate Earth-like planets detection capabilities" (Lagrange et al. 2011)

- Breaks mass vs non coplanarity degeneracies in multiple systems



The cons of μas Astrometry

- Micro arcsec astrometry of solar type stars has to be done in space
- Expensive ($ 500M)
- Proved difficult in the past

Mission Opportunities: US

- Explorers (MIDEX) call: Draft AO released on July 21, 2016
  - Cost cap likely too low (250M + ELV + any contributions < 100M)

- Probe Class mission concept studies as part of the Decadal survey preparations
  - Upcoming AO release this August
  - NOIs due mid-Sept 2016
  - Full proposals due to NASA mid-Nov
  - Cost range = 400 M to 1B

Mission Opportunities: ESA THEIA (M5)

- THEIA is a μas astrometric observatory
  - Based on a super-stable TMA telescope (0.8m primary and 0.6 deg FoV)
- THEIA addresses 3 main science topics:
  - Dark Matter (small scale structure- Observations of 25 MW dwarf satellites galaxies)
  - Compact Objects (quark stars)
  - Nearby Earths (10% of a 3-year mission):
    - census of ~50 nearby Sun-like stars with 95% completeness for Earth mass planets in HZ
    - Assumes 50 1h visits per star at 0.85 μas accuracy per visit per hour of exposure
- Submitted to 2014 ESA Cosmic Vision call for M4 (cost cap = 440M€)
  - Not selected but positive overall feedback
- Will be re-proposed in October 2016 as M5 candidate (cost cap = 550M€)
- PI: Celine Boehm, Durham University