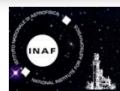


The benefits of MICADO for exploring the population of young giant planets

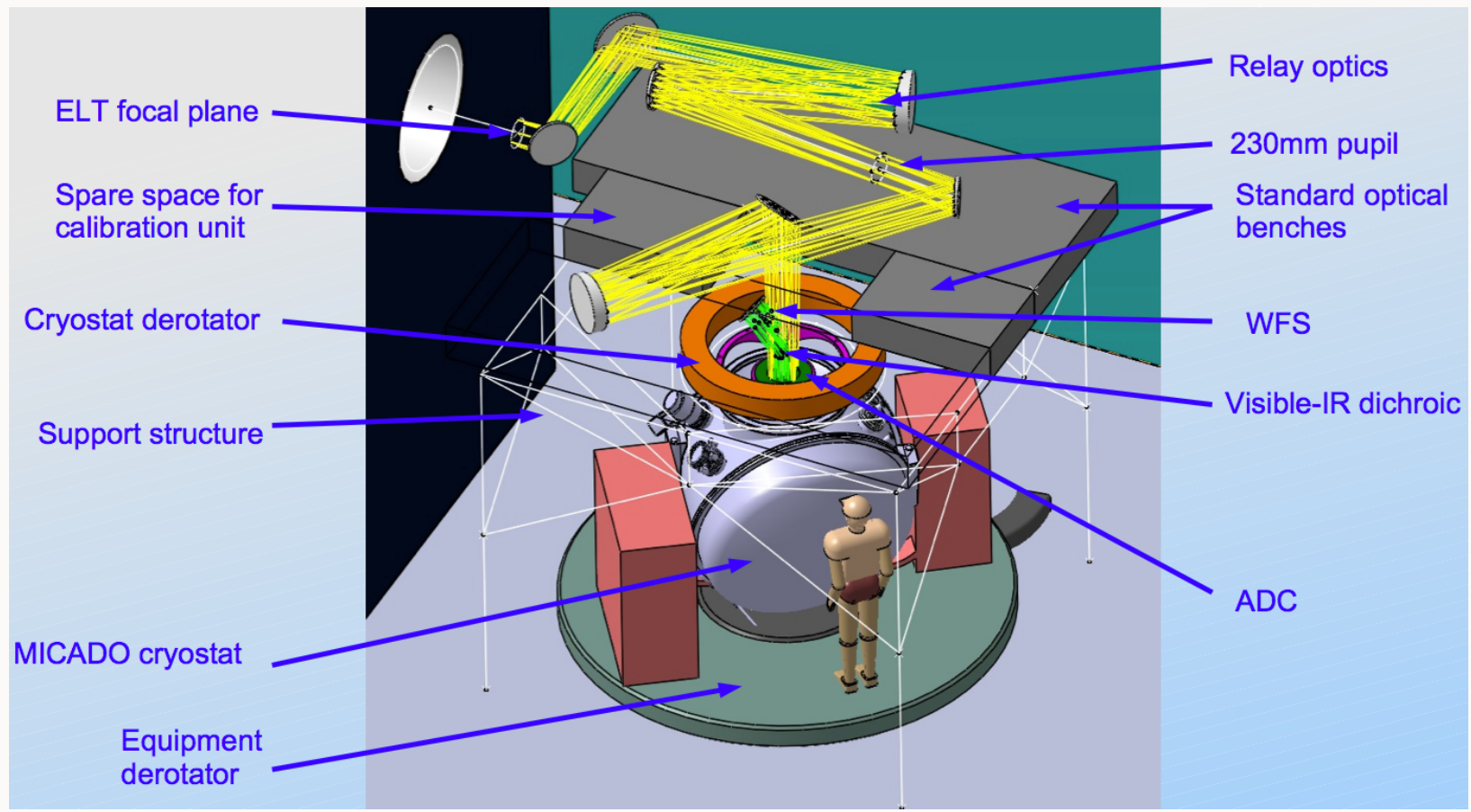
A. Boccaletti, P. Baudoz, R. Galicher, Y. Clénet,
D. Gratadour, (Paris Observatory LESIA)
& R. Davies (MPE)



MICADO OVERVIEW

- NIR camera (0.8-2.5 microns)
- 1 arcmin FOV, Accurate astrometric capability
- Spectroscopic capabilities with R between 4000 and 8000
- Diffraction limited observations
 - internal SCAO mode (SR = 50 - 70%)
 - MCAO mode when coupled to MAORY
- High contrast imaging mode (with SCAO)
 - coronagraphy
 - pupil masking

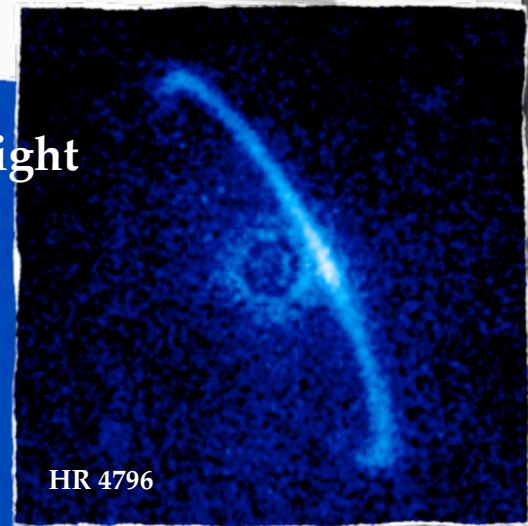
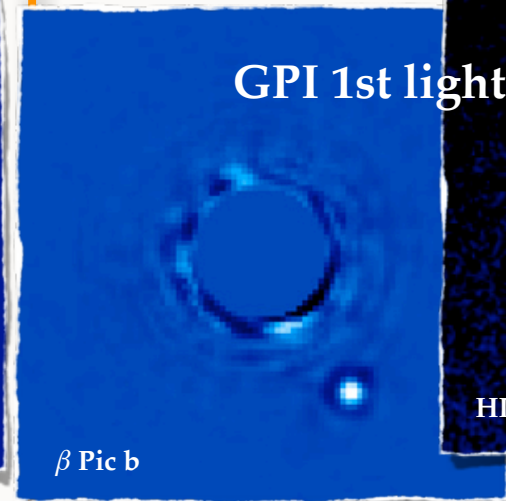
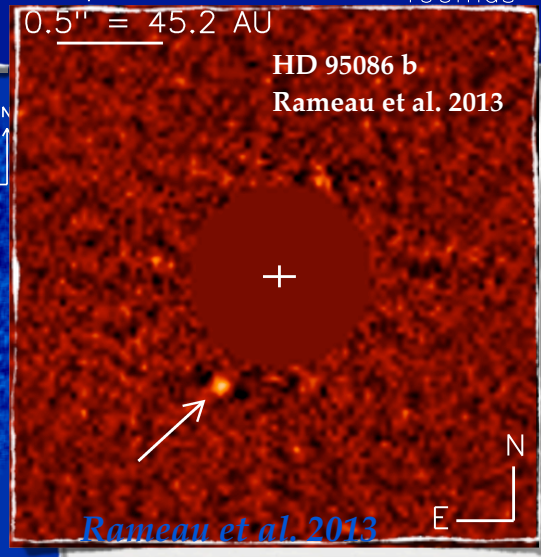
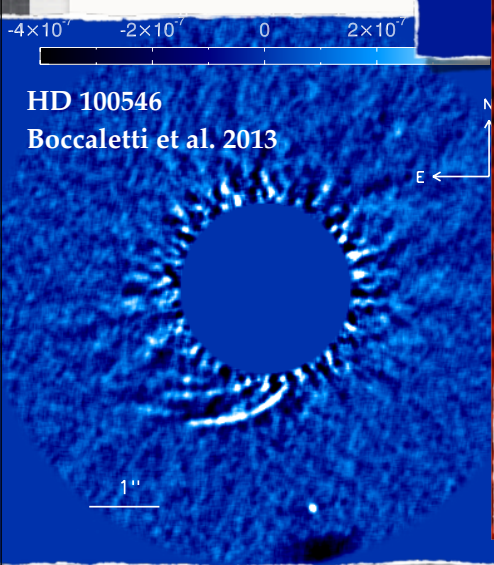
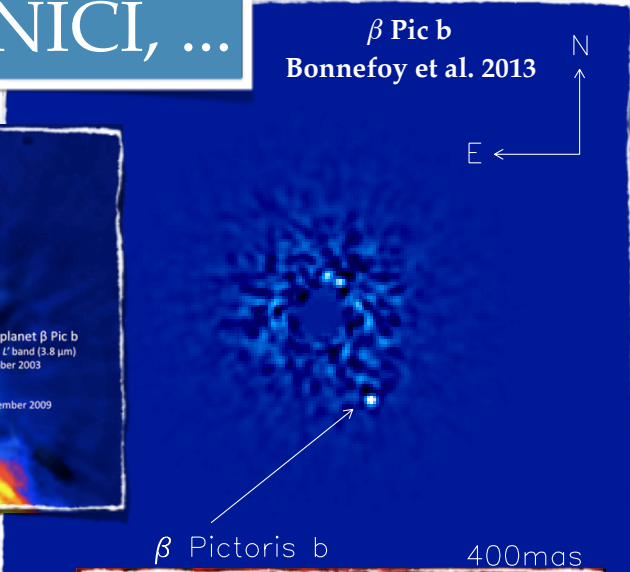
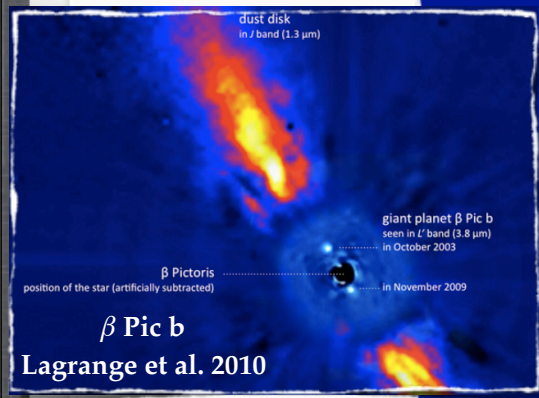
MICADO DESIGN



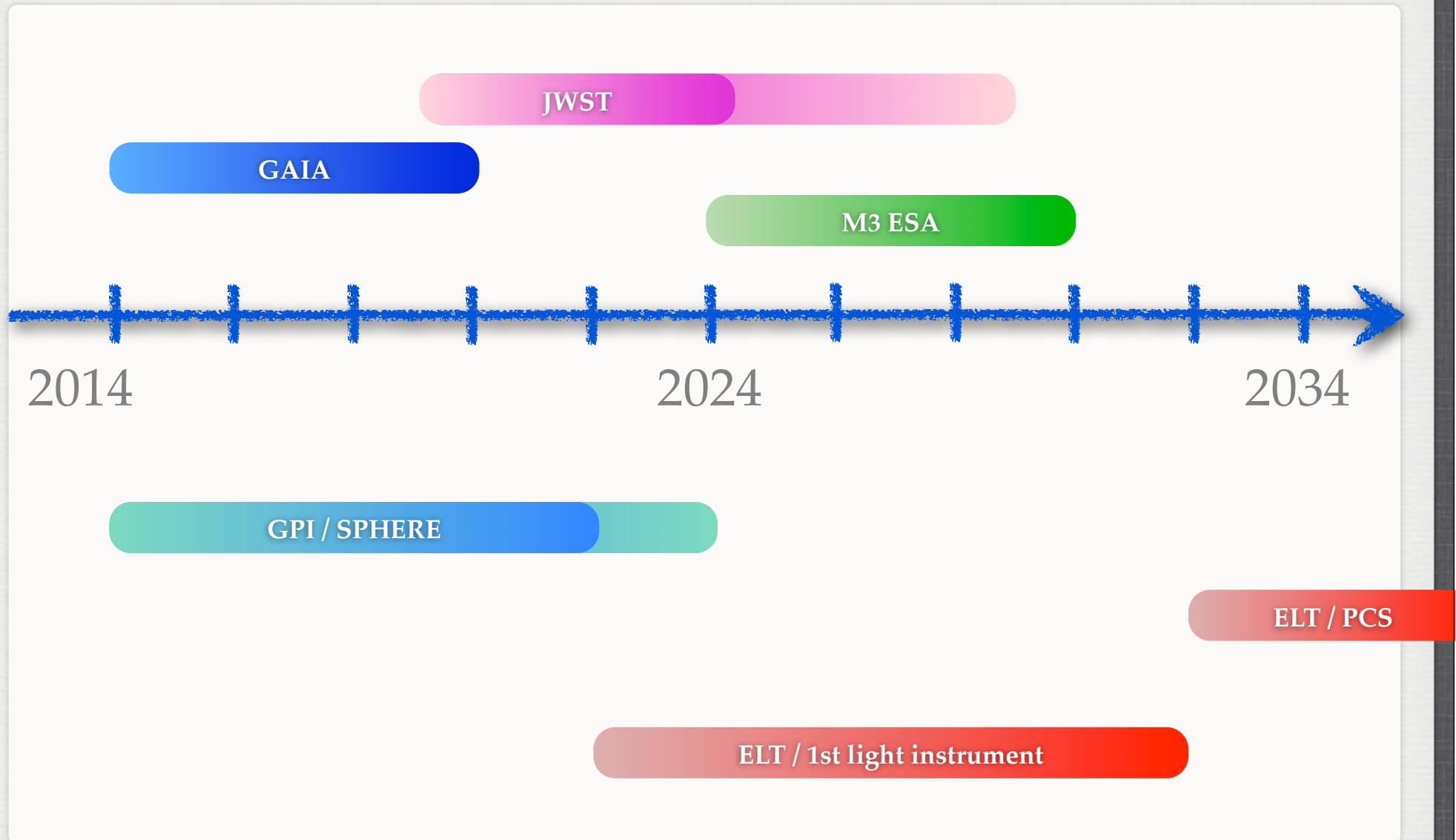
WHAT DO WE HAVE SO FAR?

SCAO
 NaCo, NICI, ...

XAO
 GPI, SPHERE

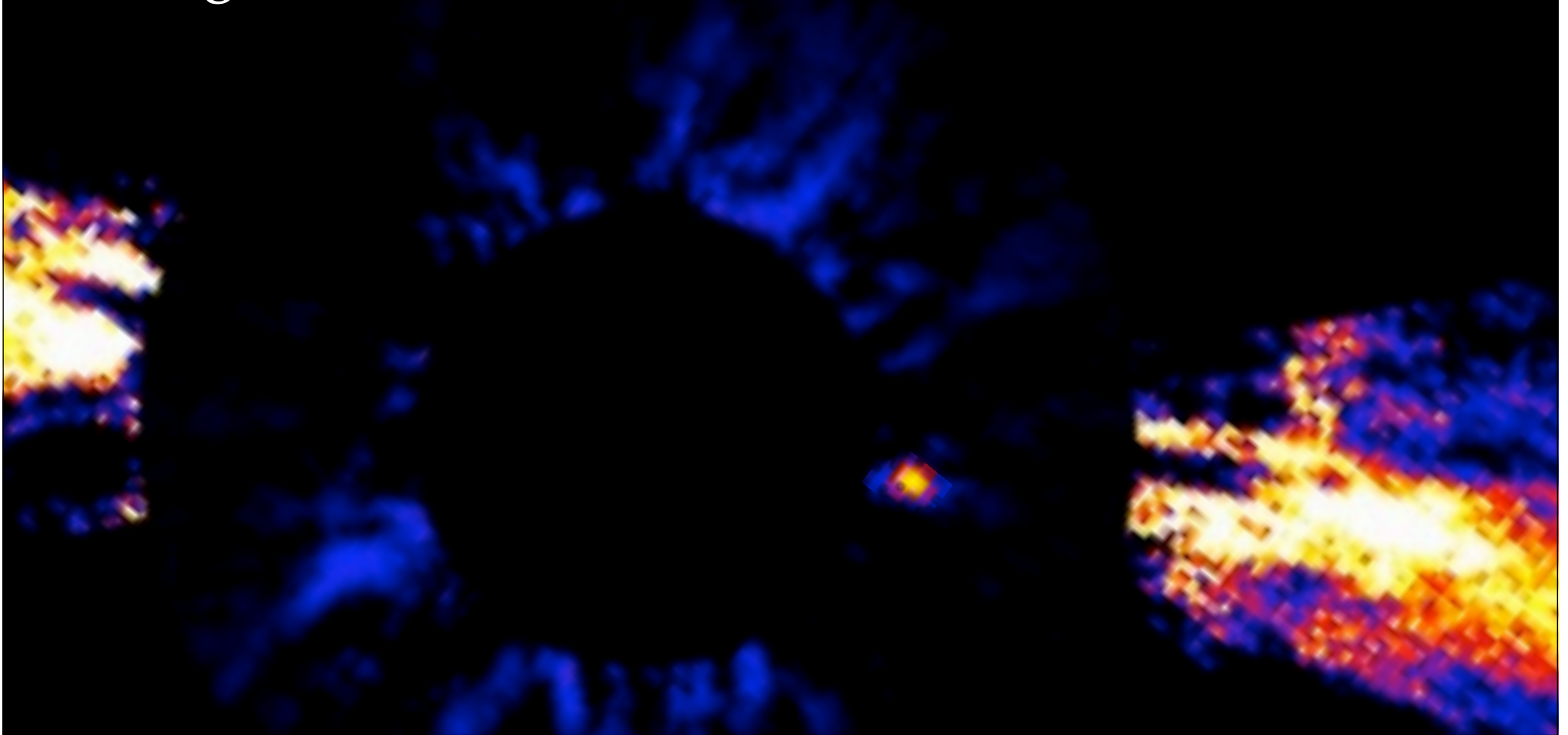


TIMELINE FOR EXOPLANETS



INTEREST OF MICADO

take advantage of the **4-5x gain**
in angular resolution w.r.t VLT



INTEREST OF MICADO

take advantage of the **4-5x gain**
in angular resolution w.r.t VLT

How does it
translate in
contrast ?



2 NICHEs FOR MICADO

ACCESS to **1-2 AU** orbits around **nearby young** stars (β Pic-like)

>> more planets/less massive

=> all SPHERE/GPI targets are of interest

ACCESS to **10-20 AU** orbits around young stars assoc. at **100-150 pc**

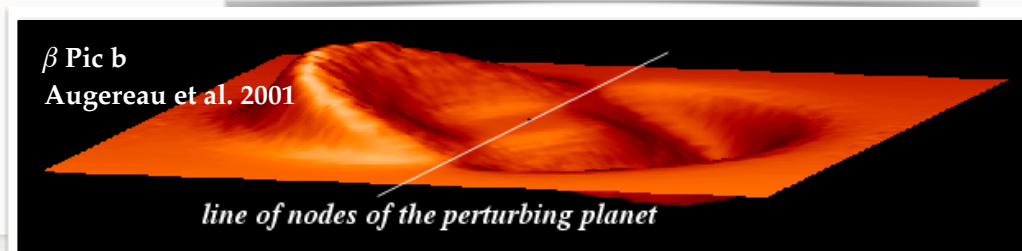
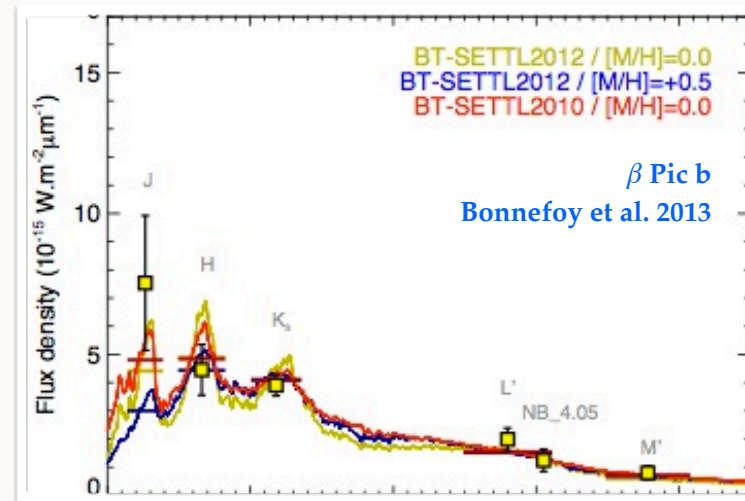
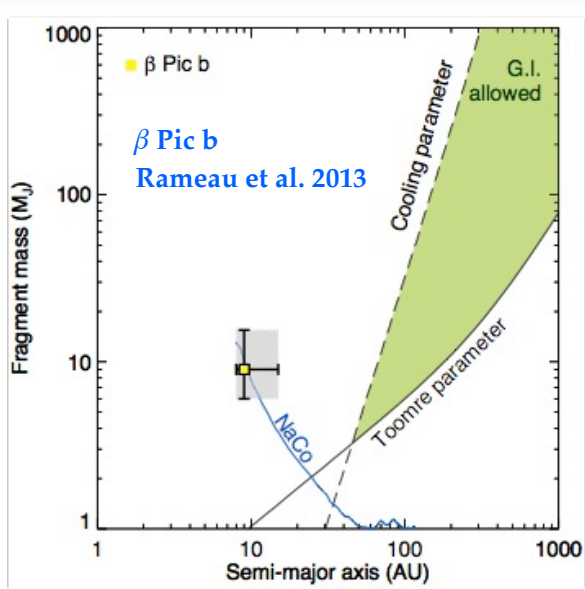
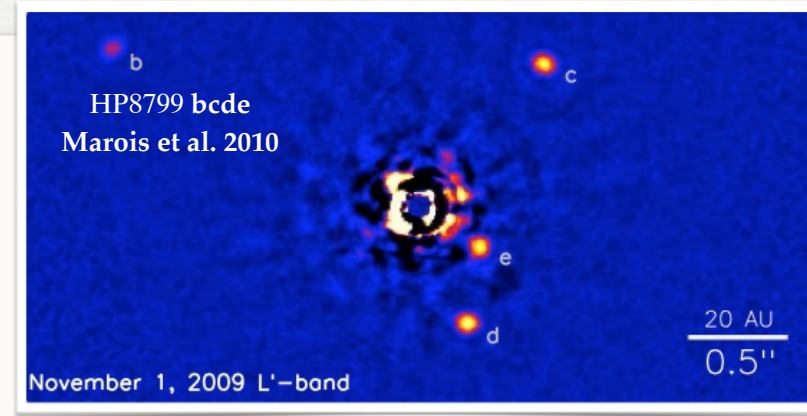
>> more planets

=> not accessible to SPHERE/GPI

=> future targets for ELT/PCS

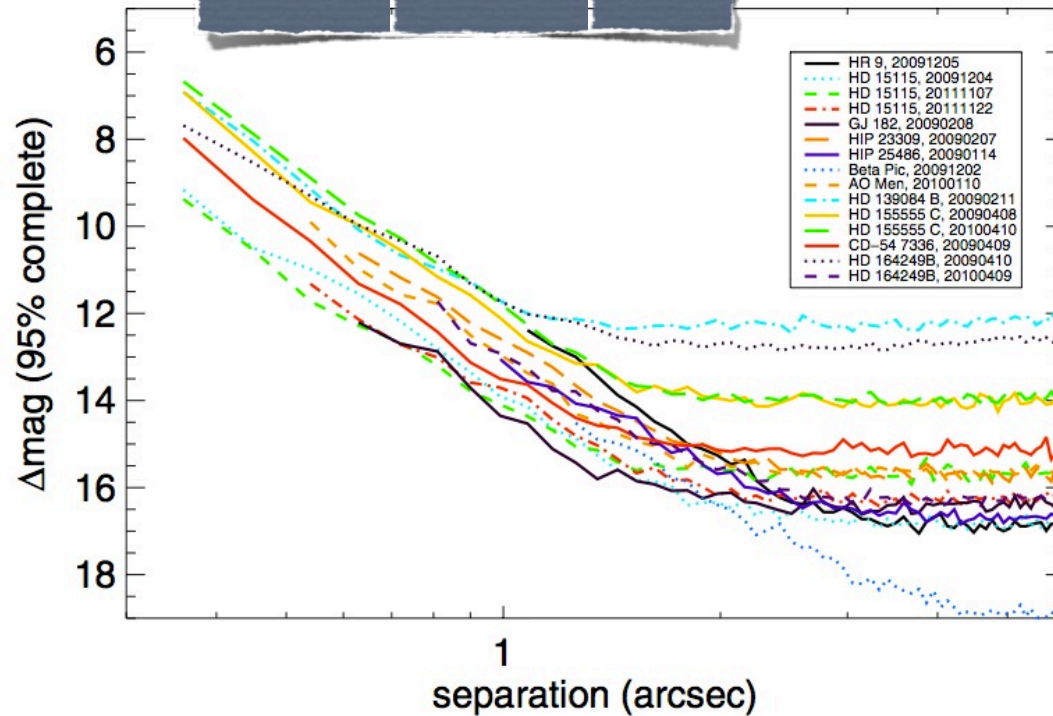
SCIENCE CASES FOR YOUNG GIANTS PLANETS

- detection of young giant planets
- architecture of planetary systems
- physics of atmospheres
- planet-disk interactions
- formation mechanisms



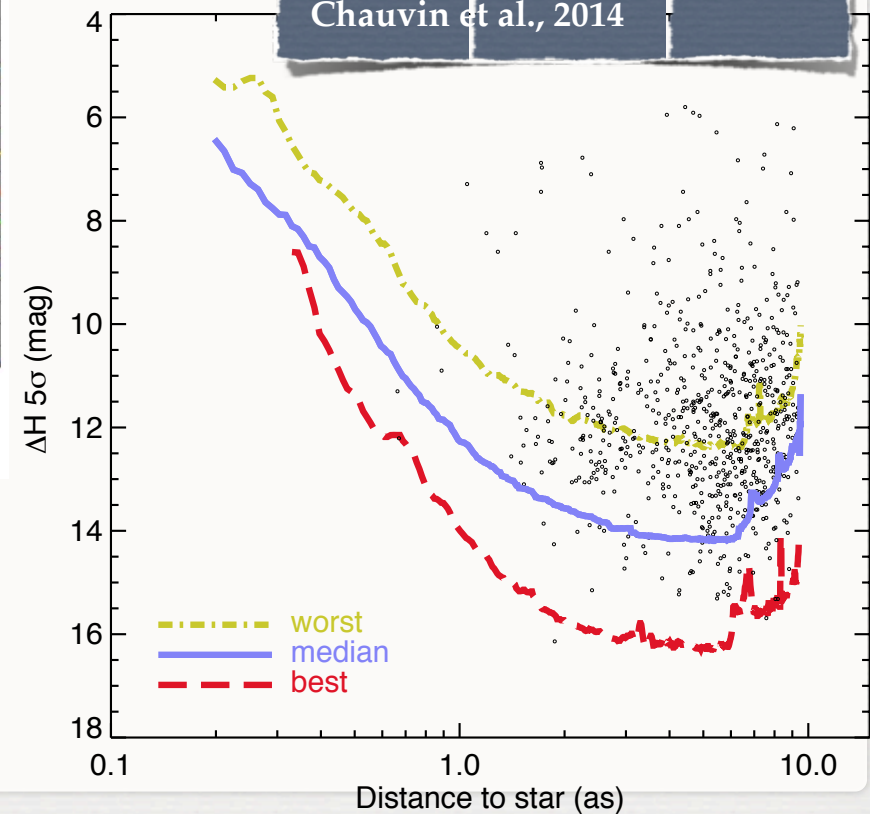
CONTRAST ASSUMPTIONS

NICI contrast - b Pic MG
 Biller et al. 2013

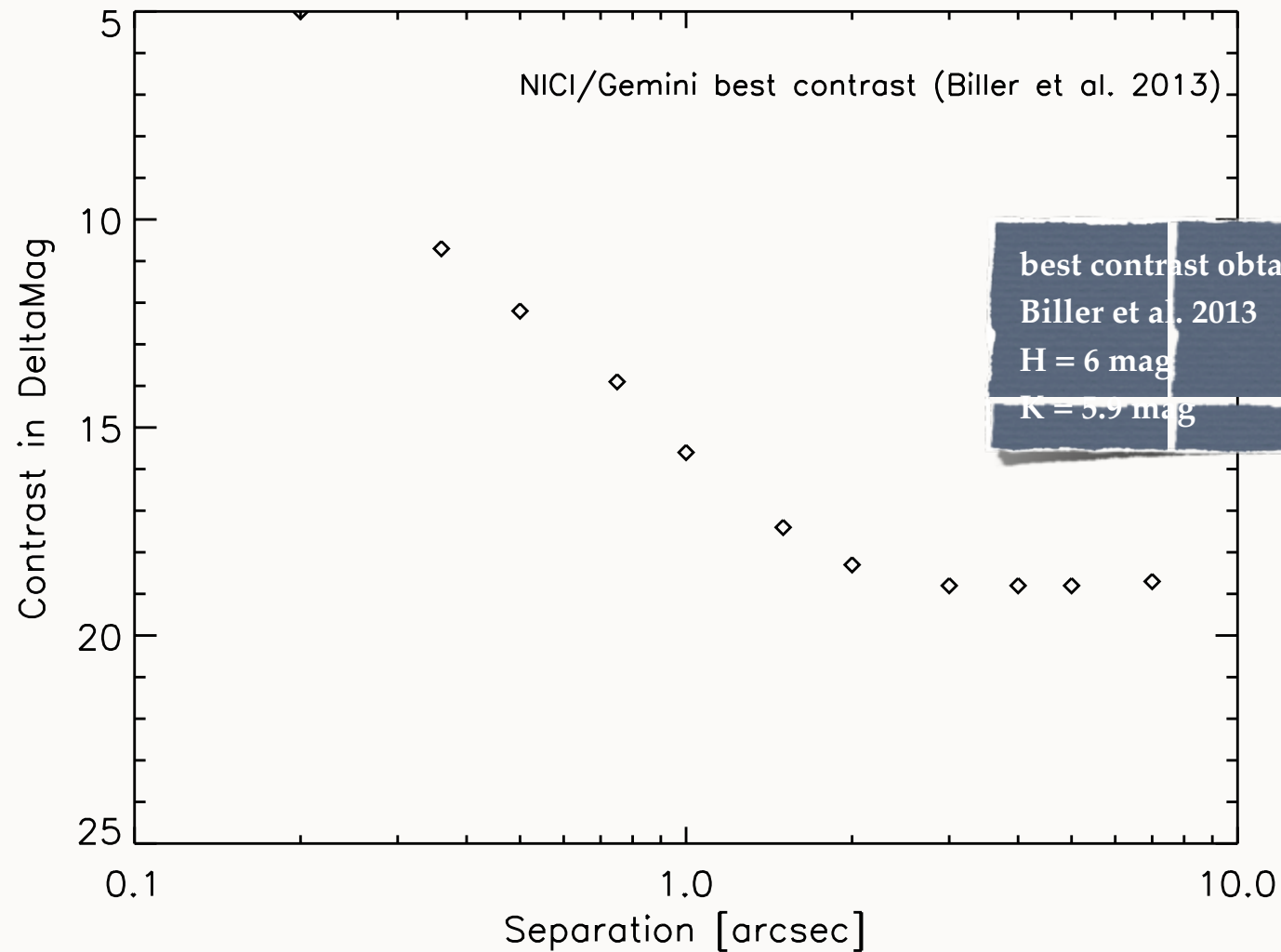


- results are comparable in H band
- the slope of the halo appears reproducible

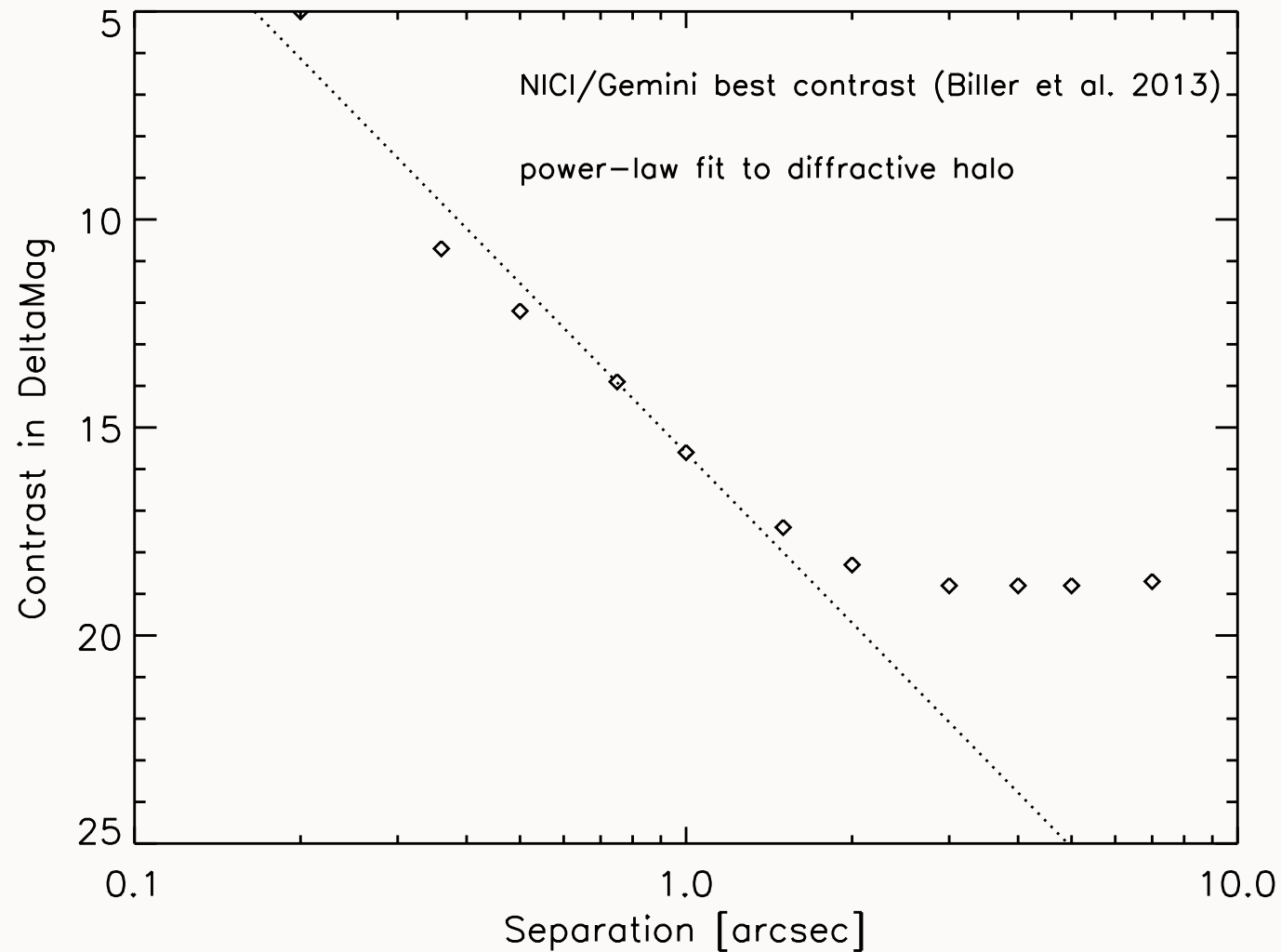
NACO LP contrast - all targets
 Chauvin et al., 2014



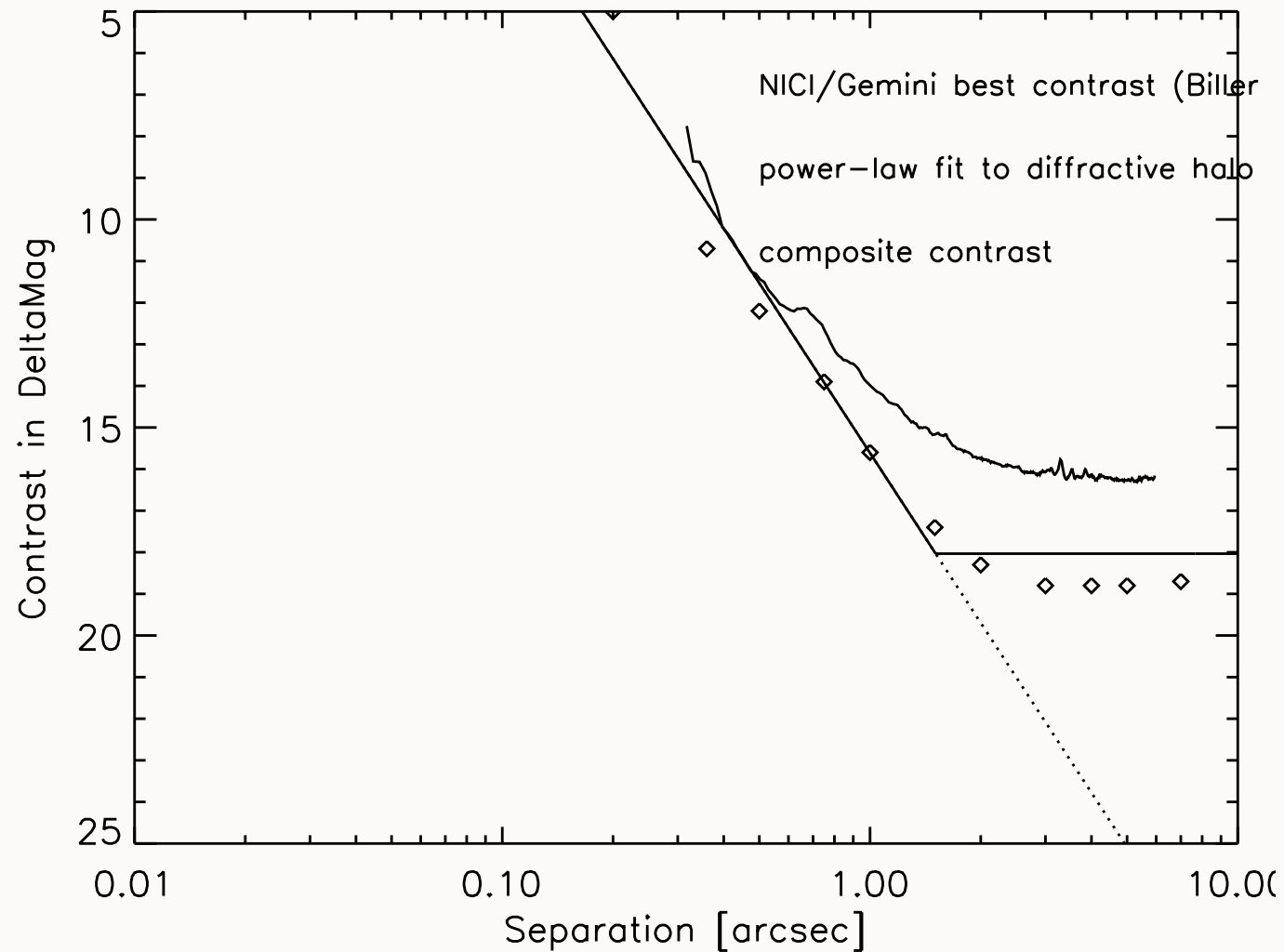
EXTRAPOLATED CONTRAST



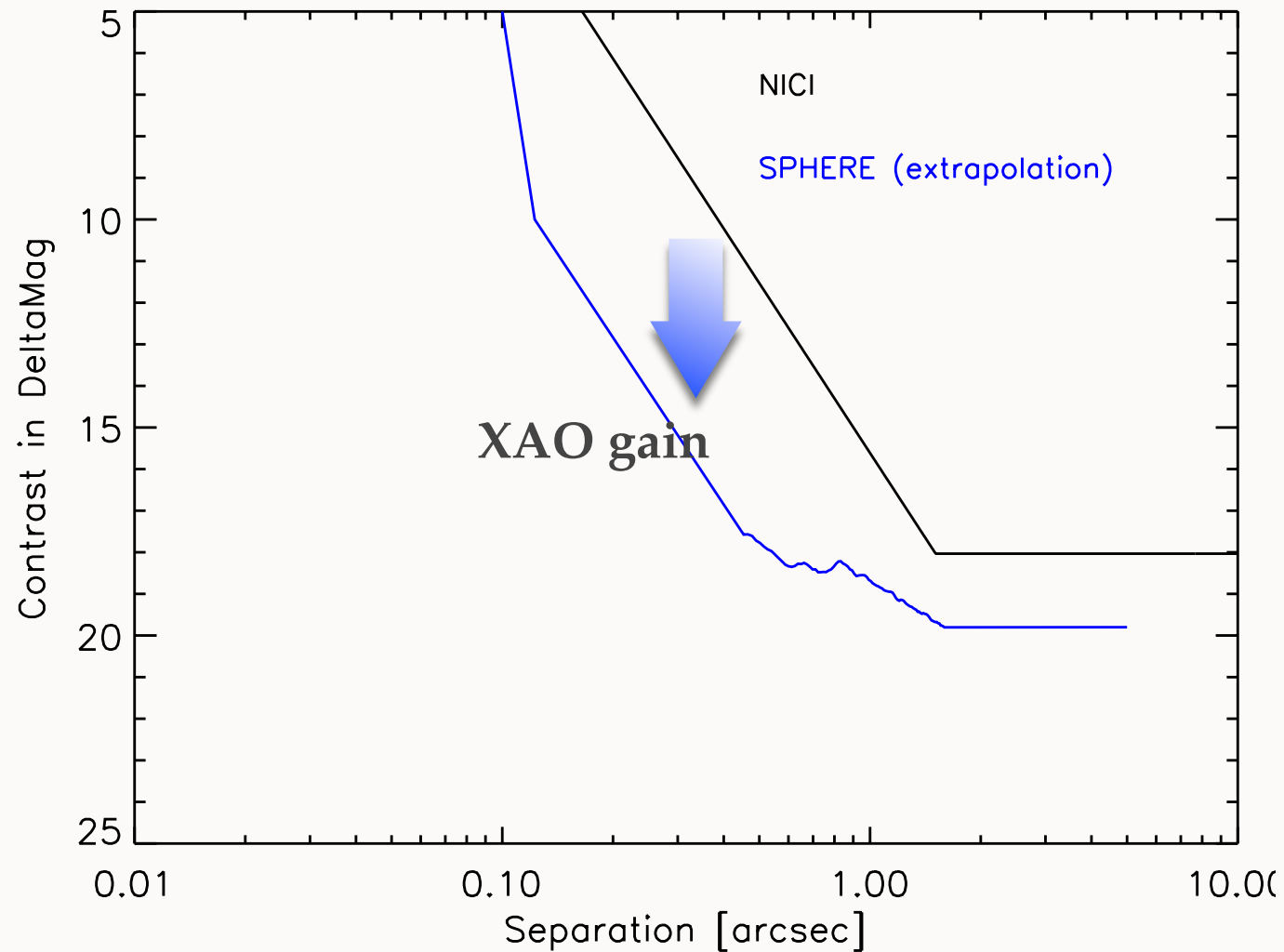
EXTRAPOLATED CONTRAST



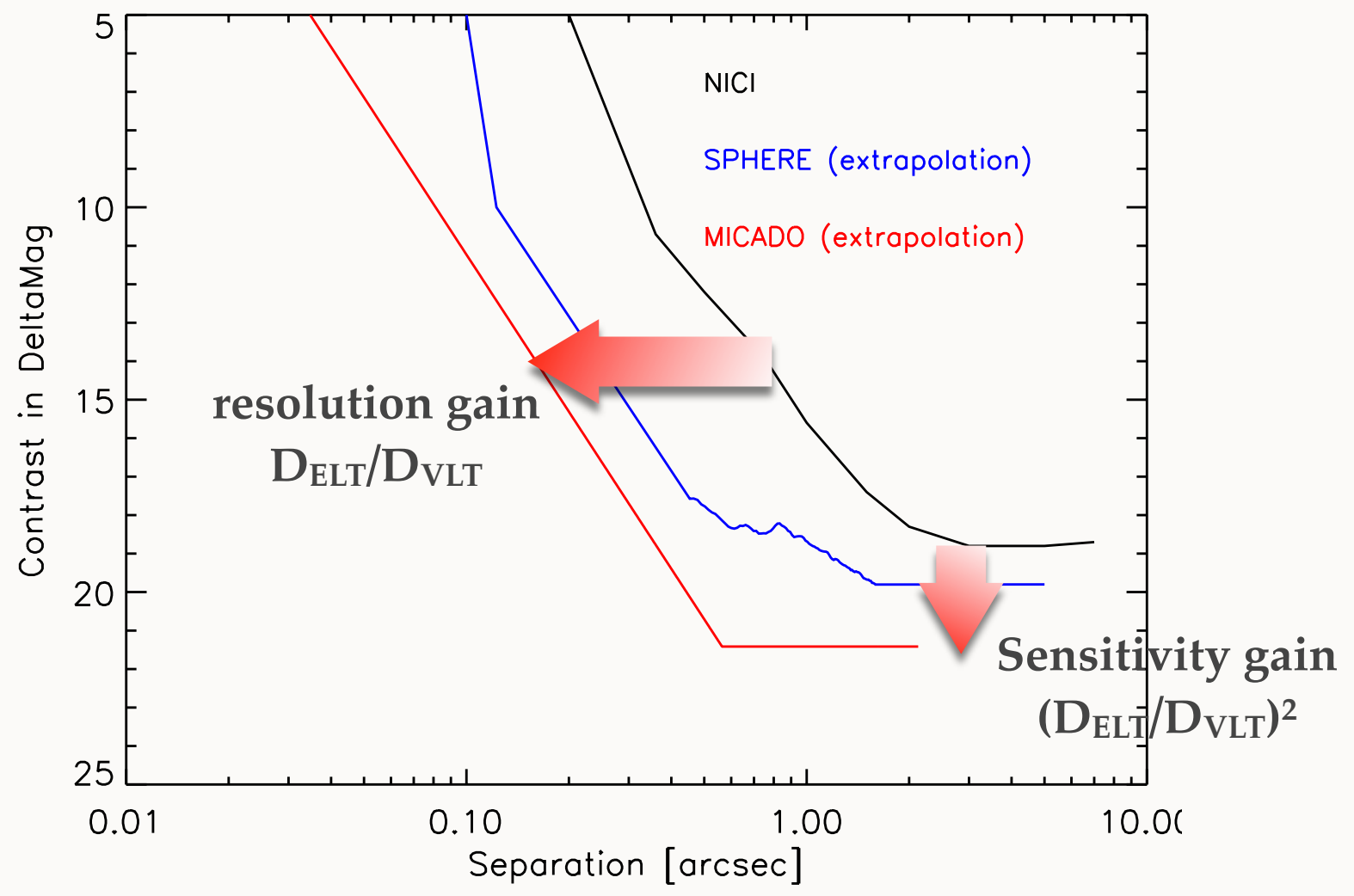
EXTRAPOLATED CONTRAST



EXTRAPOLATED CONTRAST

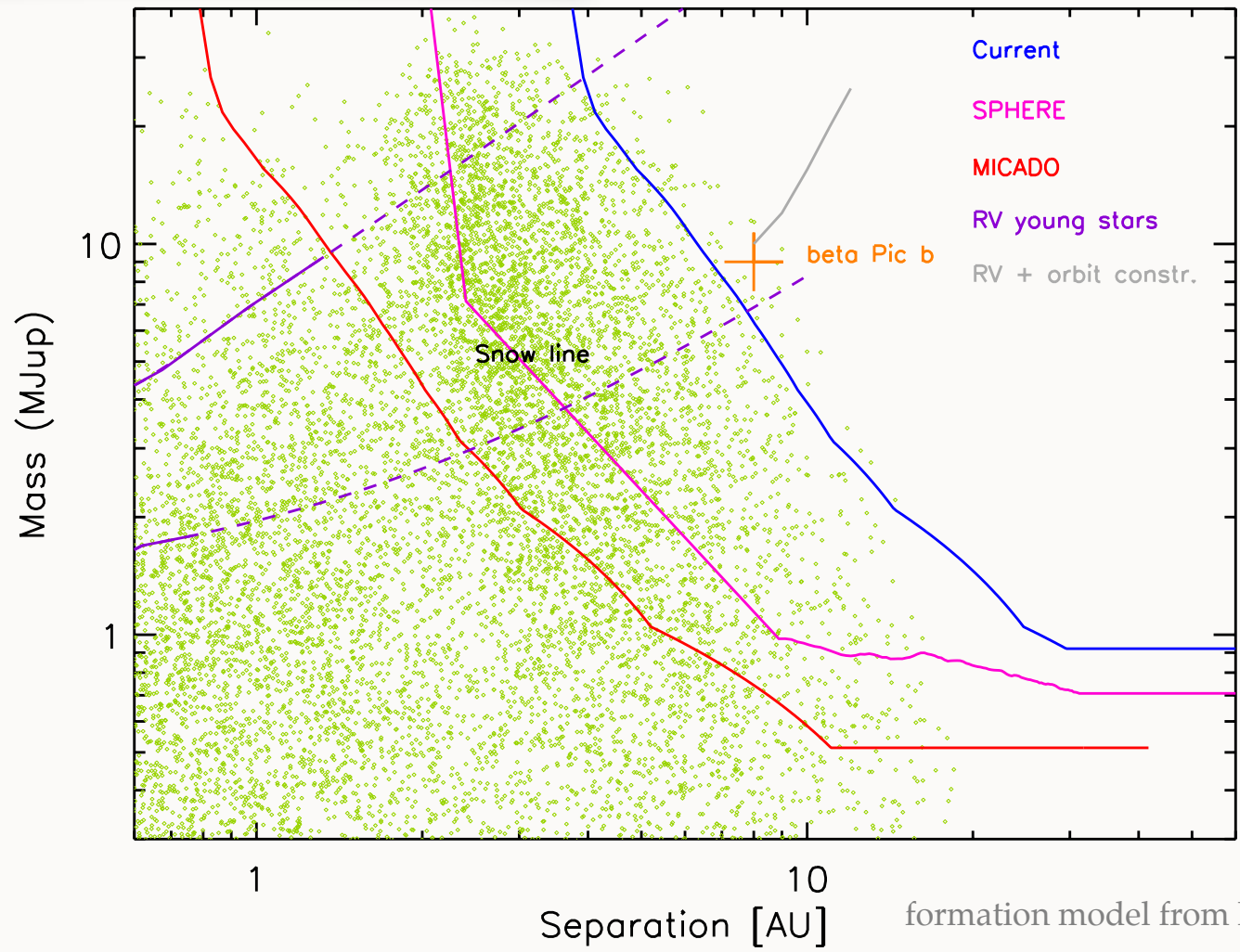


EXTRAPOLATED CONTRAST



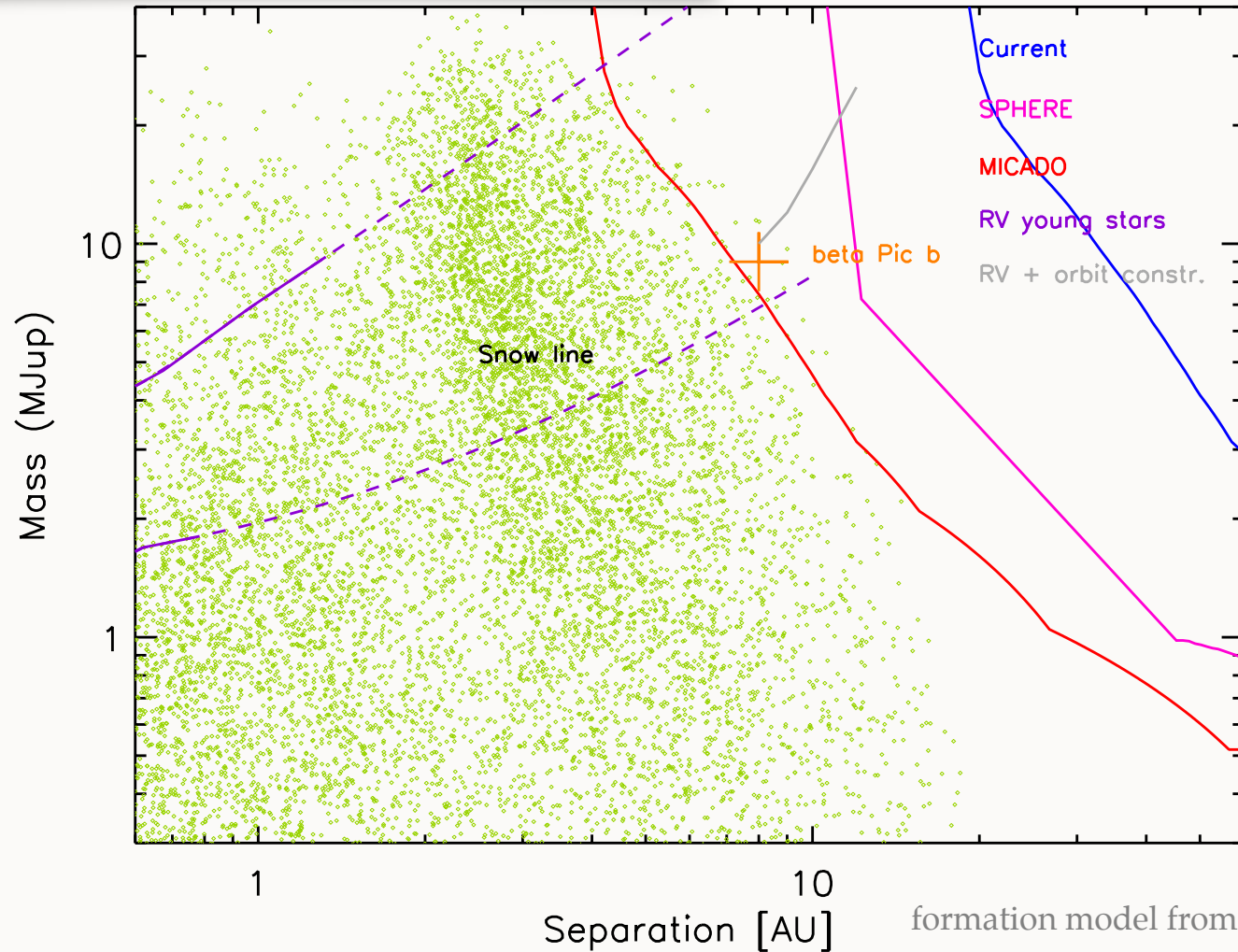
EXTRAPOLATED MASS LIMIT

beta Pic - 10 Myr - 20 pc



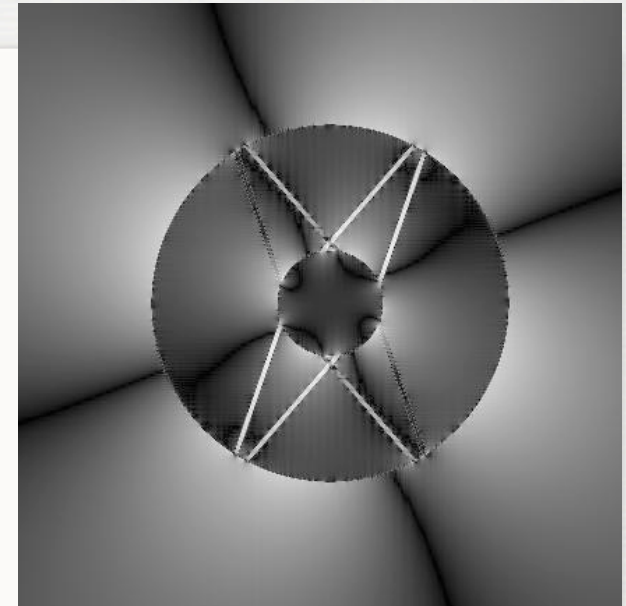
EXTRAPOLATED MASS LIMIT

Young Assoc - 10 Myr - 100 pc



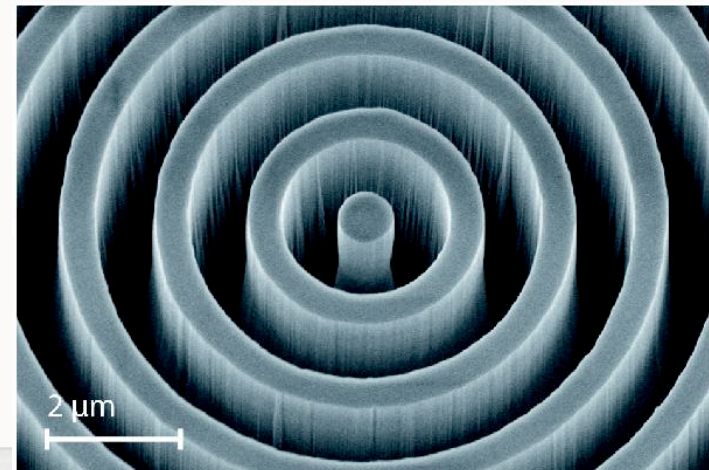
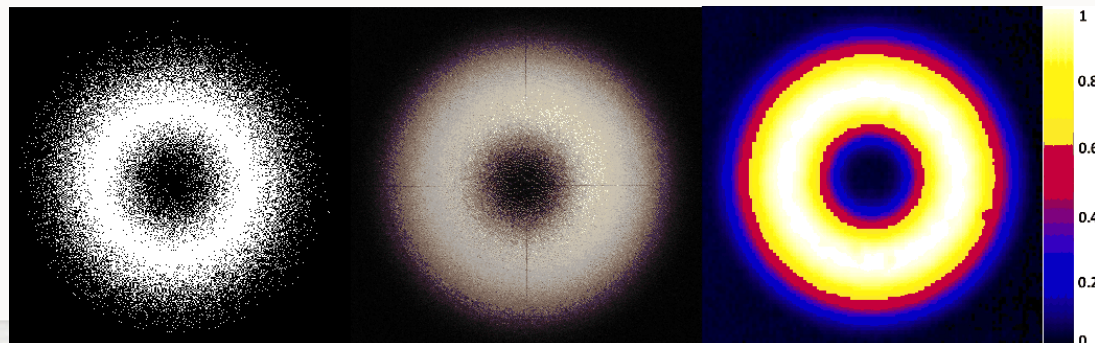
CORONAGRAPH IMPLEMENTATION

- **corono design in a preliminary stage**
- possible choices : apodized Lyot or apodized vortex
- NaCo like operations: one broad band (JHKs) at a time + Pupil Tracking
- some issues to be studied:
 - ADC for achromatic centering
 - pupil stabilization for optimal differential imaging
 - jitter

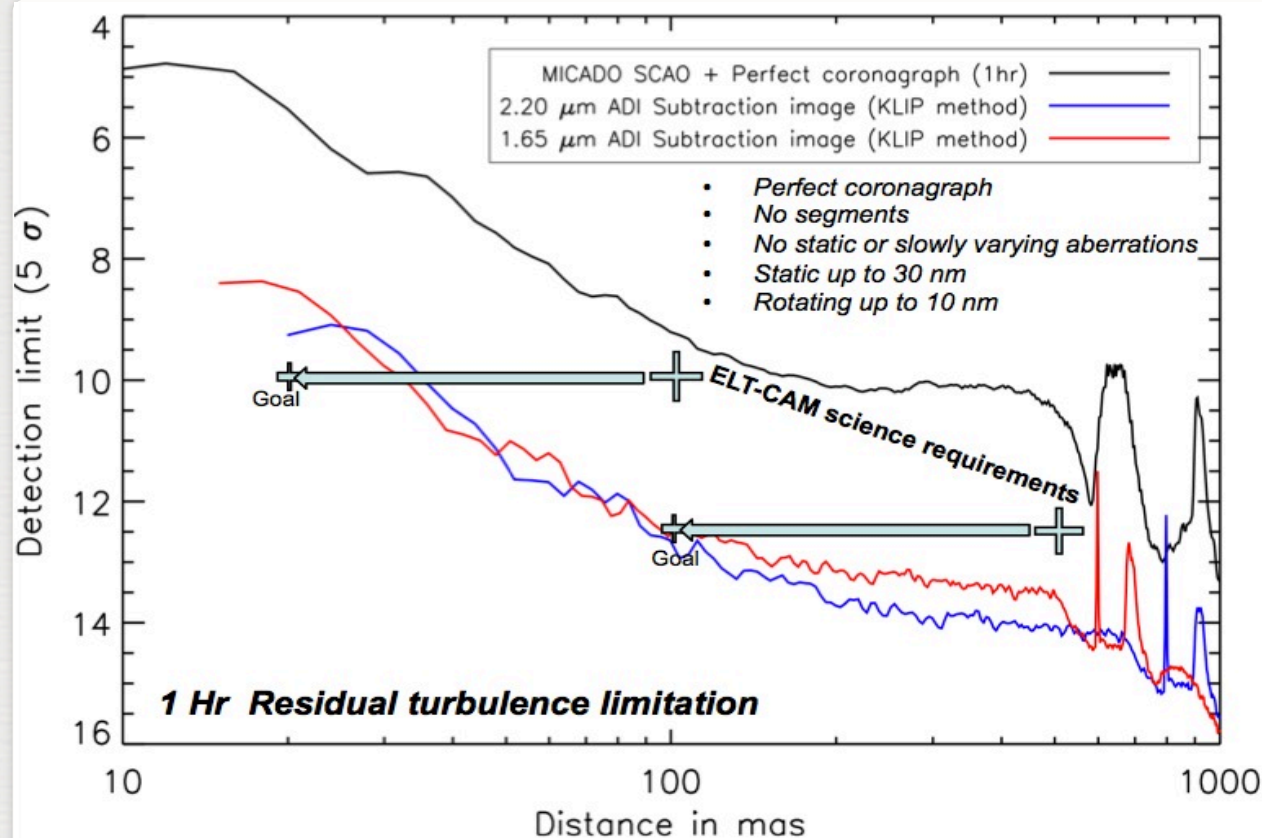


Delacroix et al. 2013

Martinez et al. 2010



PRELIMINARY SIMULATIONS



see Baudoz et al.
 poster for details

5 sig contrast
 in H and K

- GPU SCAO simulation:
 - circular pupil, no spiders, no segments
 - mean Strehl @ 2.2mic = 0.76
 - coronagraph Vortex 4th order, + Lyot 80%

SUMMARY

- SCAO => Exoplanets can be done at small cost in MICADO !!!

- Preliminary analysis confirms the MICADO interest for Exoplanets:
 - nearby stars (same SPHERE targets):
 - ▶ get closer-in than SPHERE: β Pic b detectable at 2 AU vs. 8 AU
 - ▶ true mass from RV (current facilities i.e. HARPS)
 - distant stars (not attainable by SPHERE):
 - ▶ found more β Pic b-like objects