

# NGS SENSING STRATEGY FOR MAVIS

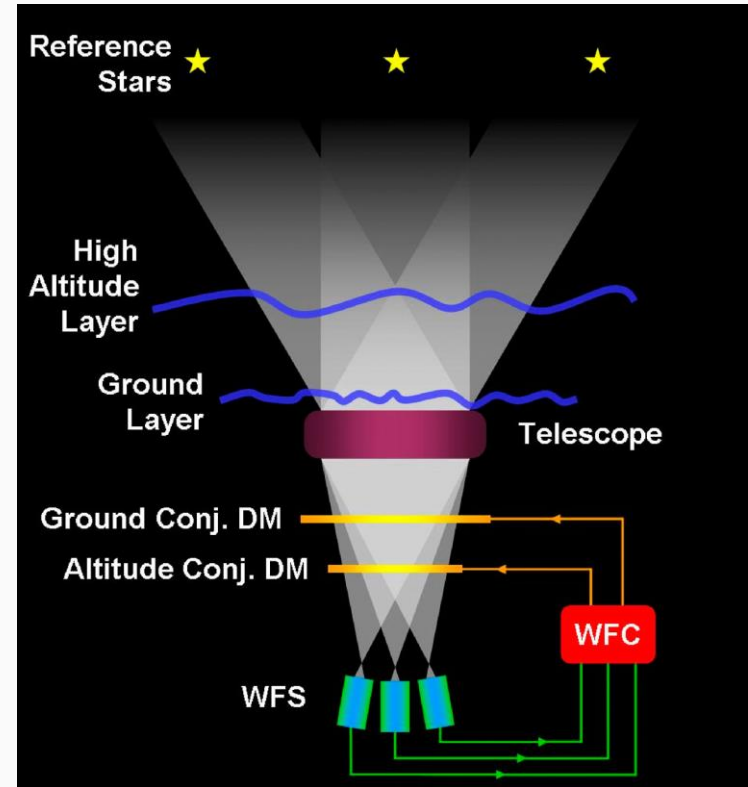
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C. Plantet\*, G. Agapito, E. Pinna, B. Neichel, D. Vassallo, F. Rigaut, M. Bonaglia, V. Viotto

\*cedric.plantet@inaf.it

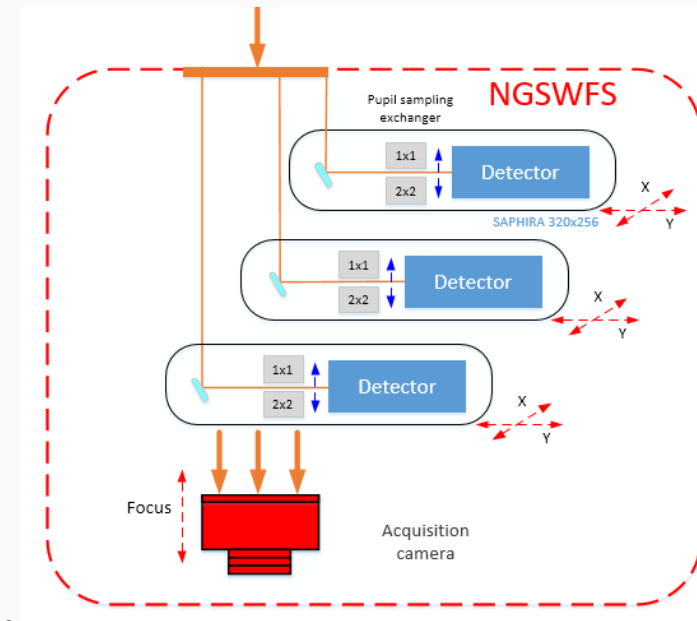
# MAVIS: SPEED-OF-LIGHT SUMMARY

- Multi-conjugate AO system
- Science in visible @ VLT
- Split tomography:
  - 8 LGSs → high orders
  - 3 NGSs → Tip/tilt, plate scale, truth



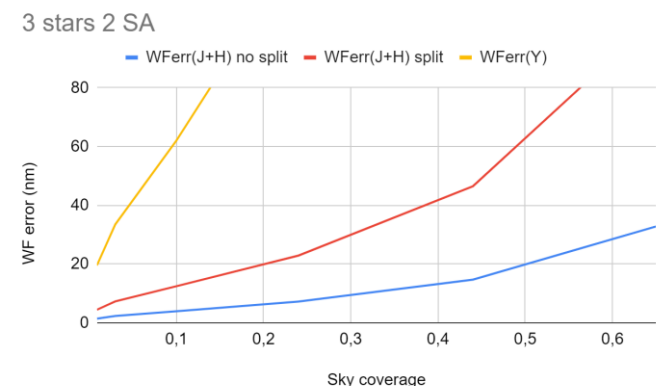
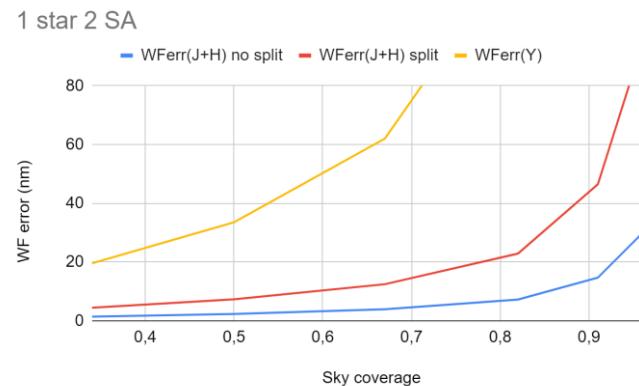
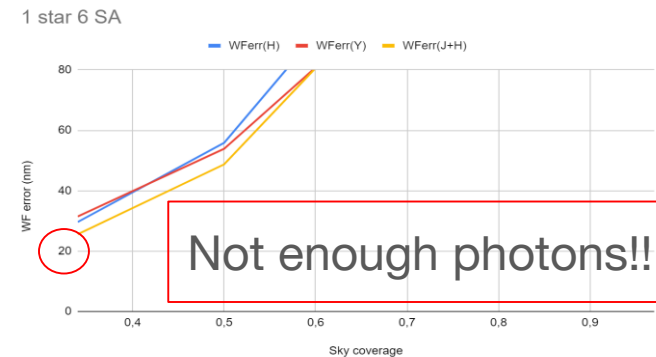
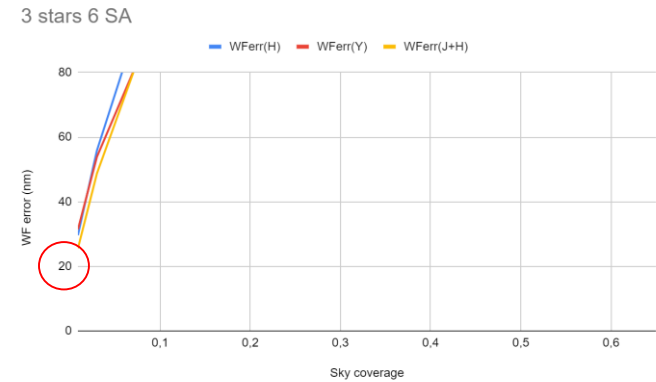
# OVERVIEW OF THE NGS PATH

- Sky coverage requirement: EE(50 mas) = 15% in V for 50% of pointings at the South Galactic Pole → very tight budget
- Maximization of the sky coverage through:
  - Sensitivity of the tip/tilt sensors:
    - Avalanche photodiode arrays (SAPHIRA) → low detector noise
    - J+H band
    - Full aperture sensor
  - Minimal constraints on the NGS asterism:
    - Large technical FoV: 120" diameter (scientific FoV included)
    - Small pick-off mirror (6" footprint)
    - Each sensor can go anywhere in the tech. FoV.
- Acquisition camera:
  - C-RED2, sensing in J+H, Jmag = 20 in 2s
- Truth sensing:
  - Switch 1x1 to 2x2 (more details in next slides)



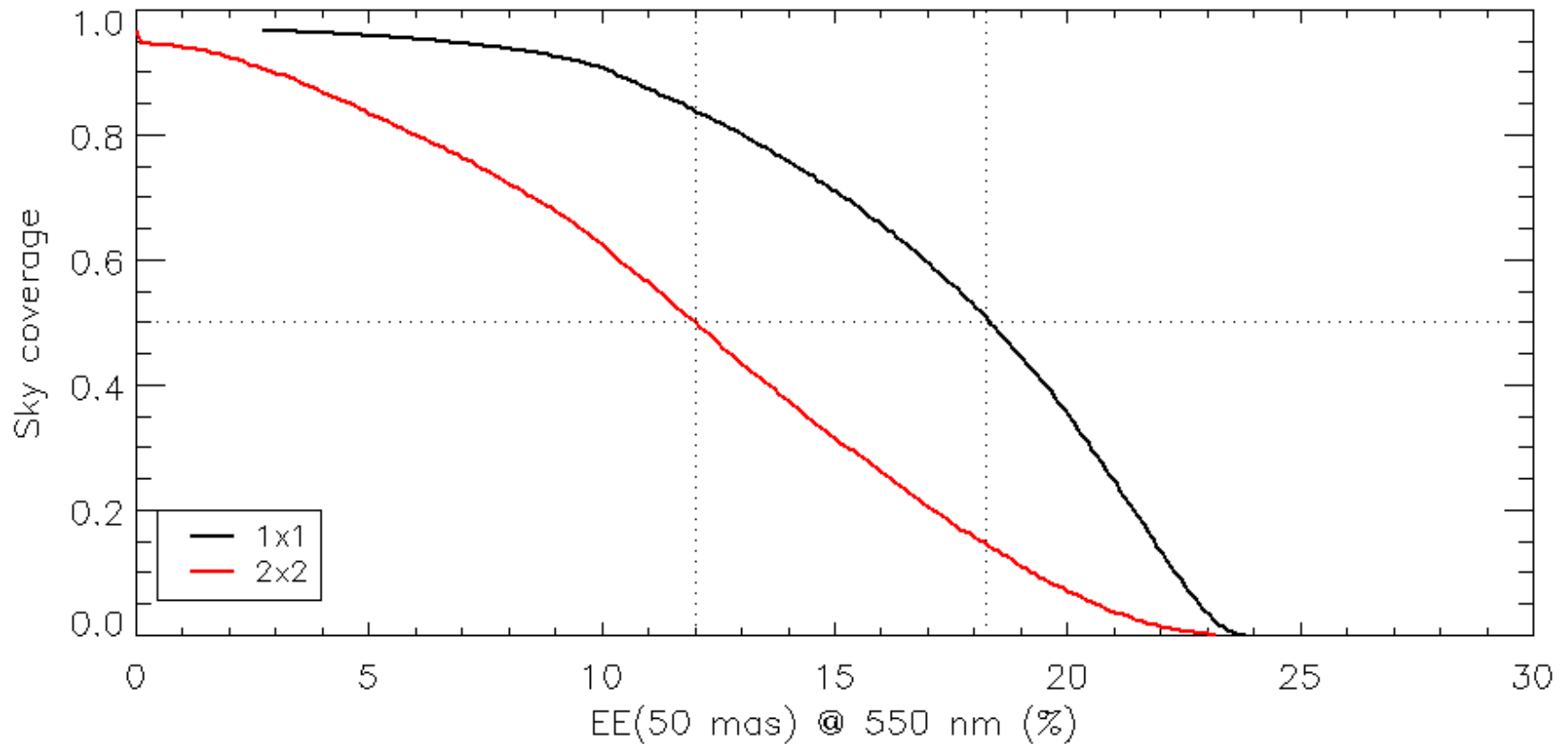
# SUDDEN REALIZATION: TRUTH SENSING

- What was foreseen: 6x6 SH on each NGS
- Options:
  - Split 90/10 inside TT sensor (J+H)
  - Sensor on different camera, different band (Y: 950-1050 nm)
- WFE budget: 20 nm rms
- Avoid limiting sky coverage with:
  - 2x2 sensor
  - Switch instead of split
- Current foreseen solution: switch 1x1 to 2x2 only when it gives better performance (to be studied)



**THANK YOU FOR YOUR ATTENTION**

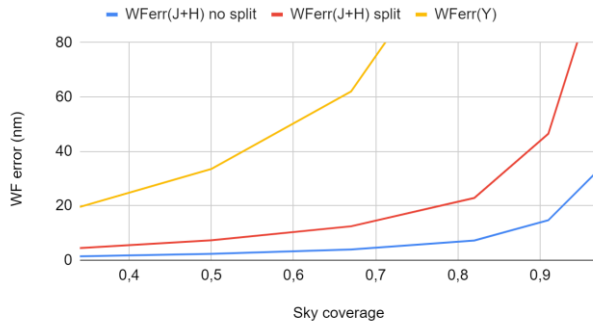
# SKY COVERAGE (W/ PERFECT TRUTH SENSING)



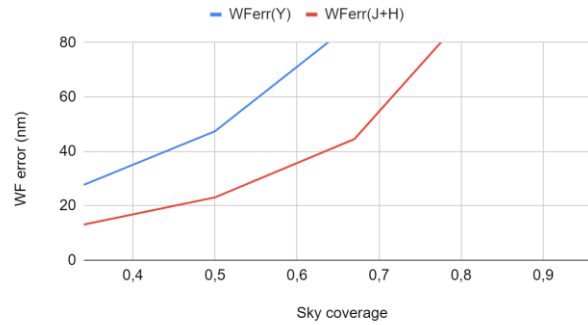
Average performance in 30"x30" imager FoV

# SKY COVERAGE (TRUTH SENSOR ONLY)

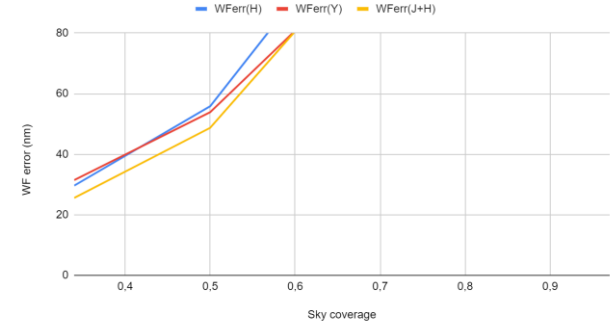
1 star 2 SA



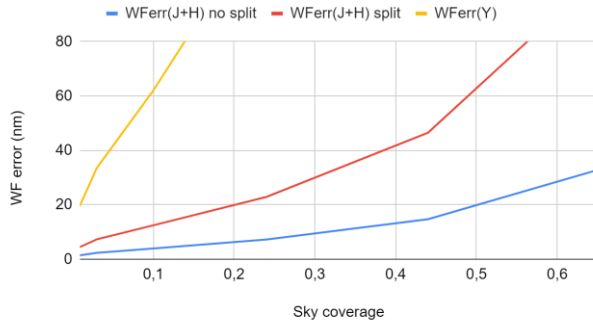
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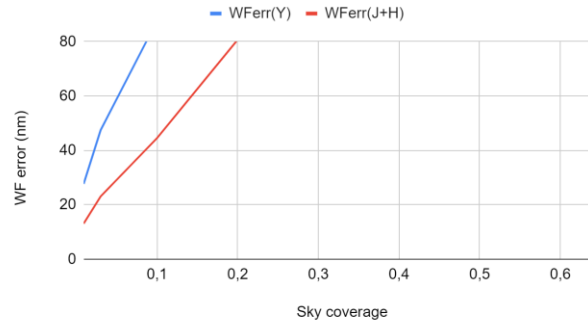
1 star 6 SA



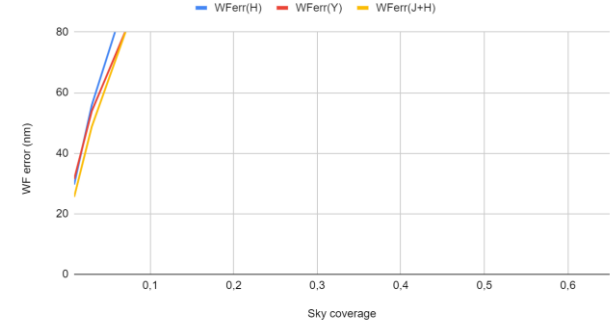
3 stars 2 SA



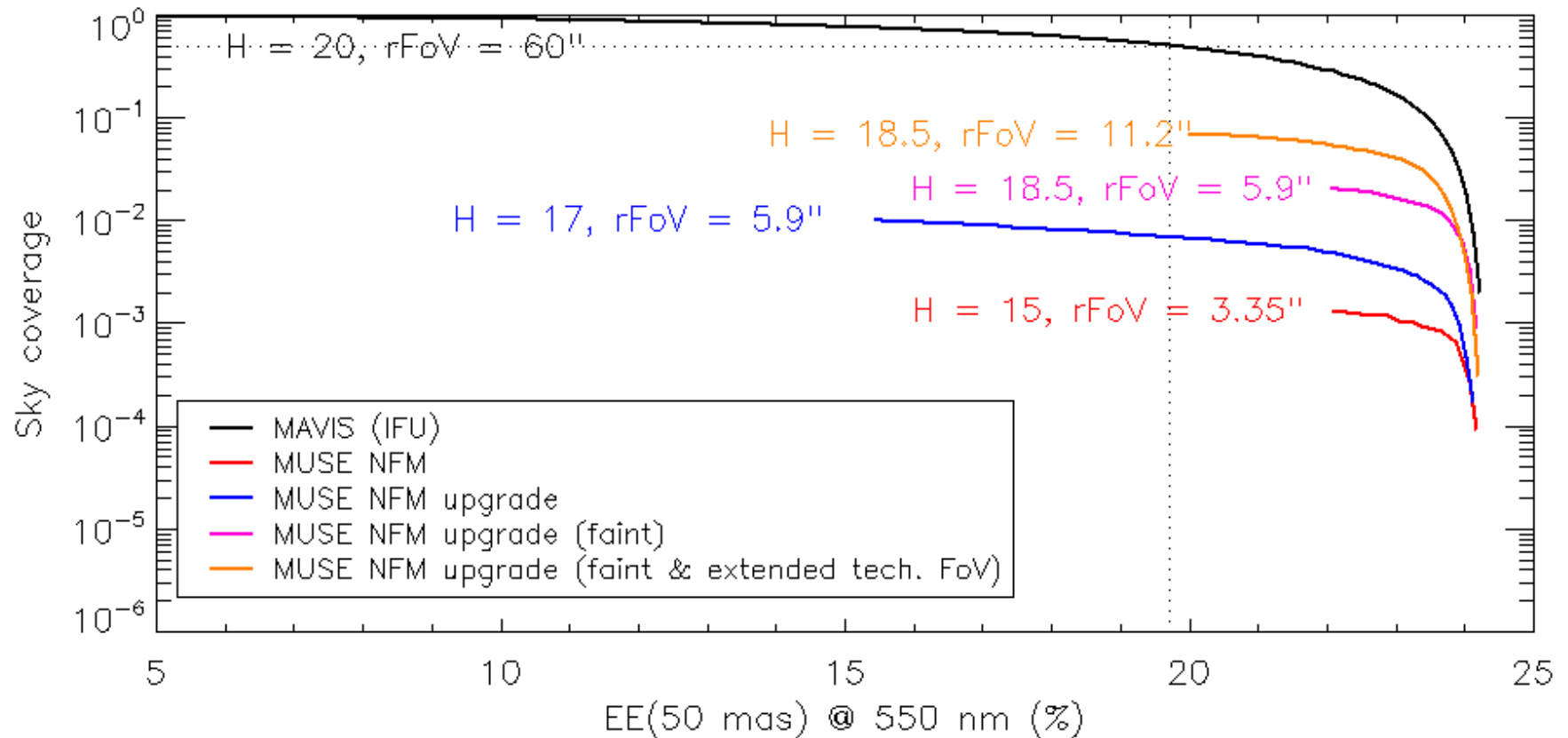
3 stars 4 SA



3 stars 6 SA



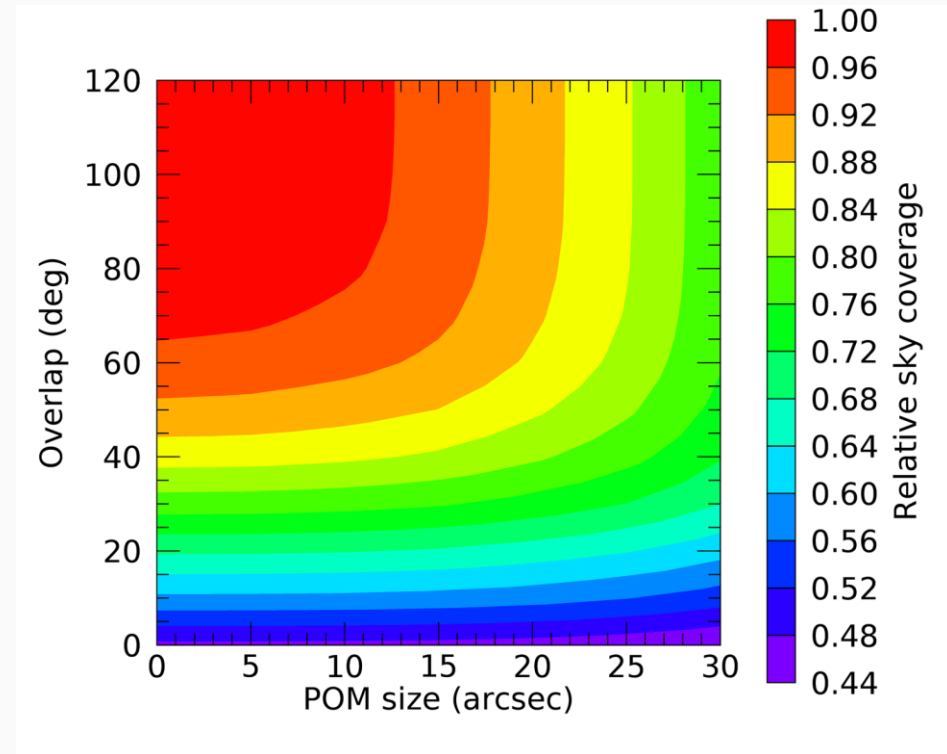
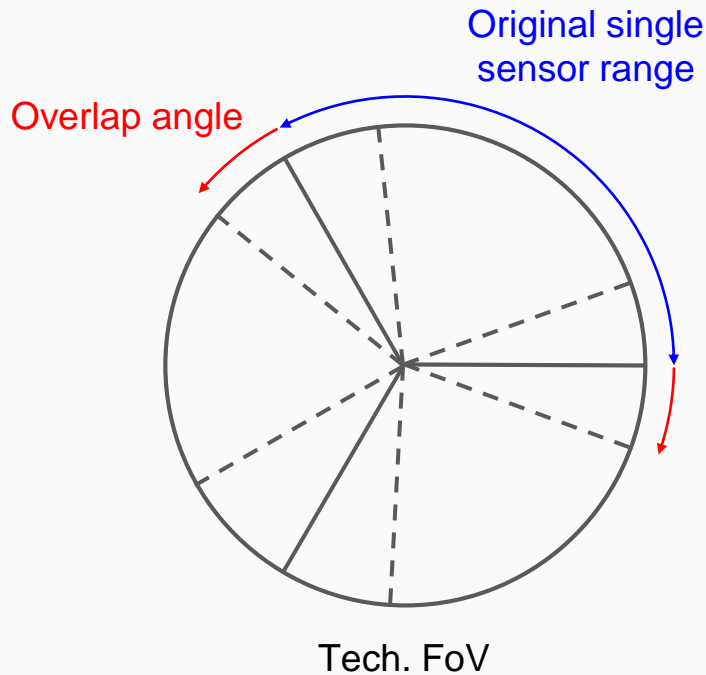
# SKY COVERAGE VS MUSE (1X1 NGS SENSORS, IFU MODE)



Average performance in 2.5"x3.6" IFU FoV  
 Maximum magnitude considered and radius of  
 tech. FoV indicated for each curve

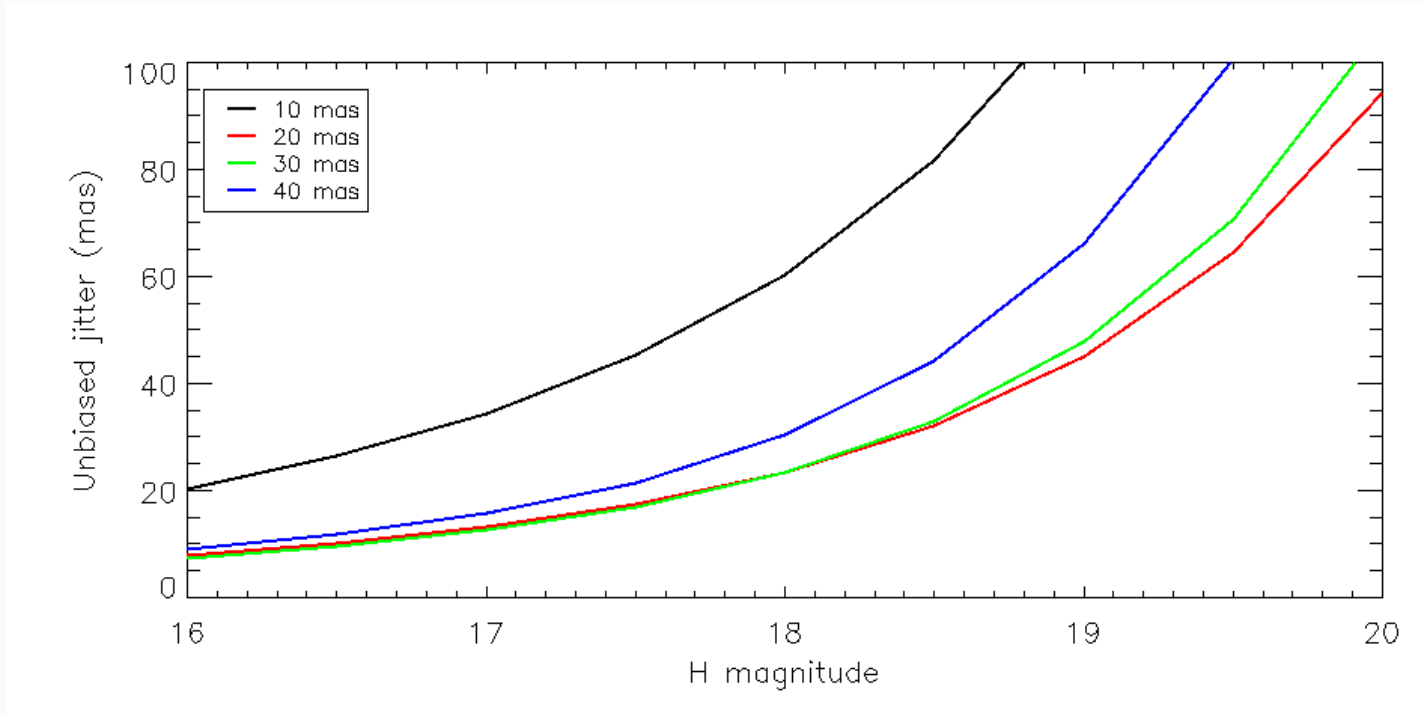


# SKY COVERAGE VS POM SIZE AND OVERLAP



Relative loss of sky coverage with respect to a 0" Pick-Off Mirror (POM) and full FoV coverage of the 3 sensors (overlap = 120°)

# PIXEL SCALE

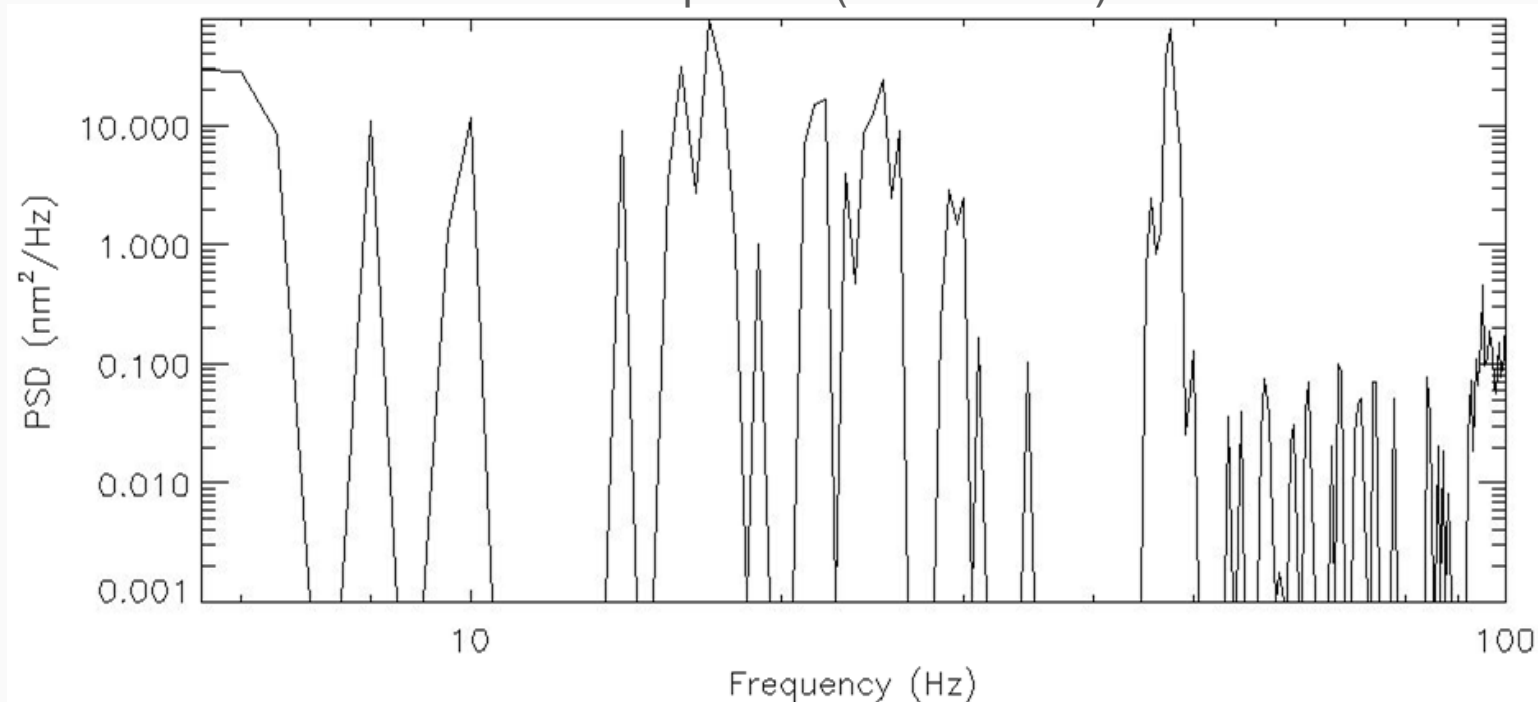


- Error computed for a (unbiased) windowed CoG on the 2x2 central pixels.
- PSF model = sum of 6 monochromatic Gaussians corresponding to regularly distributed wavelengths in the band J+H, scaled by the relative throughput and Strehl ratio.
- Sensor operated at 100 Hz
- SR at 1650 nm = 20% (border of tech. FoV)

Chosen pixel scale = 30 mas → not optimal (20 mas) but much simpler for optical design

# VIBRATIONS

Tip PSD (tilt is similar)



- Vibrations are a forest of peak → hard to correct with classical control laws
- But: amplitude is low (3 mas), though it is TBC
- Smart vibration rejection methods will be considered if the actual amplitude is larger