Sky coverages on ELTs with a reference stars area much larger than the compensated one.

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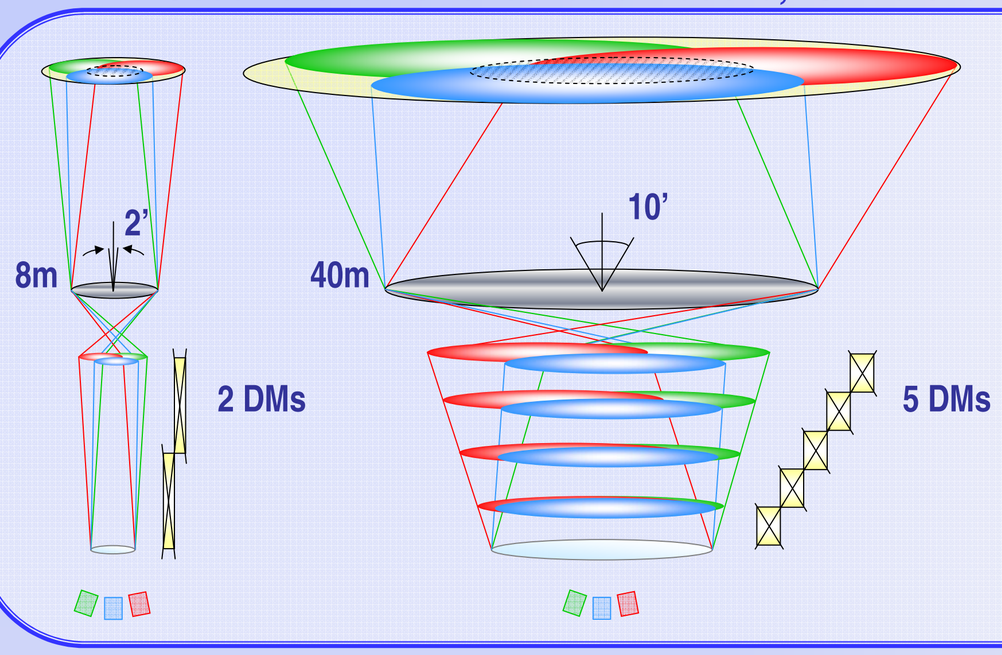
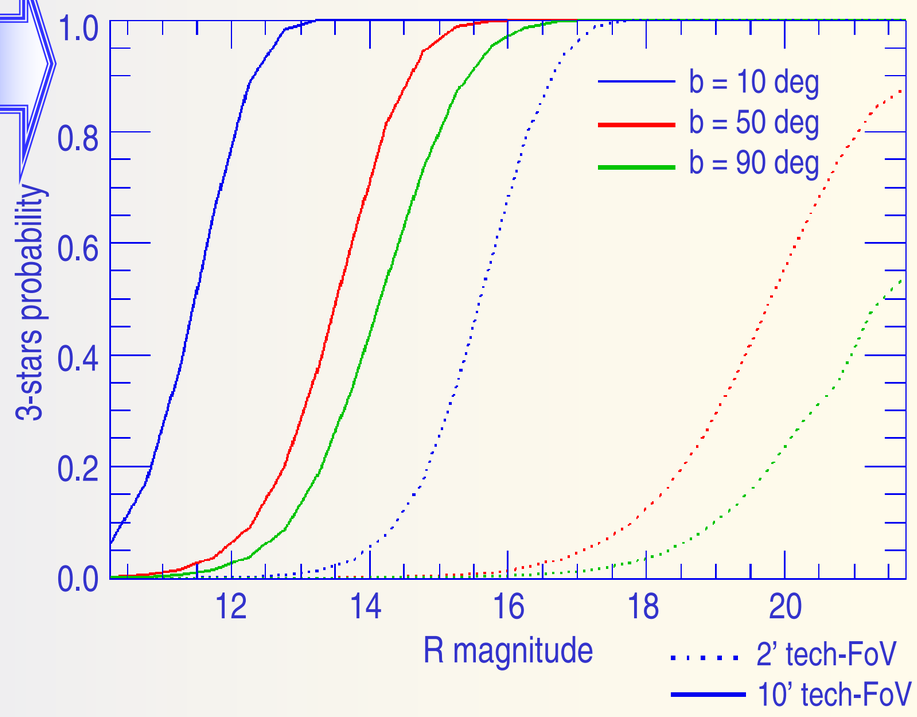
[a]INAF - Osservatorio Astronomico di Padova, [b]Università di Padova – Dipartimento di Astronomia, [c]INAF - Osservatorio Astronomico di Bologna



From Large to Extremely large telescopes:
enlarging the telescope entrance pupil allows to search for THE SAME NUMBER of guide stars in a WIDER FoV to sense the same fraction of the metapupil at a given height.

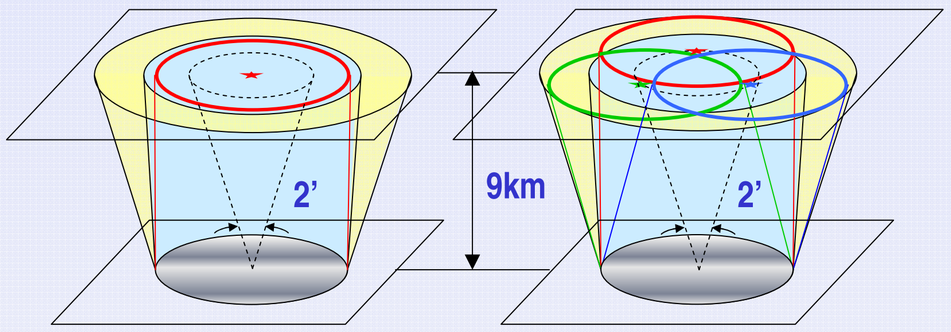
More DMs (real or virtual) are needed, because of the FoV vs thickness rule.

GAIN in SKY COVERAGE!



Simulations with Poisson stars distribution (mean stellar density provided by the Bahcall-Soneira Galactic model)

Metapupil coverage @ 9km height: 3 NGSs extreme cases



36.7% of the 10' metapupil
78.3% of the 2' metapupil

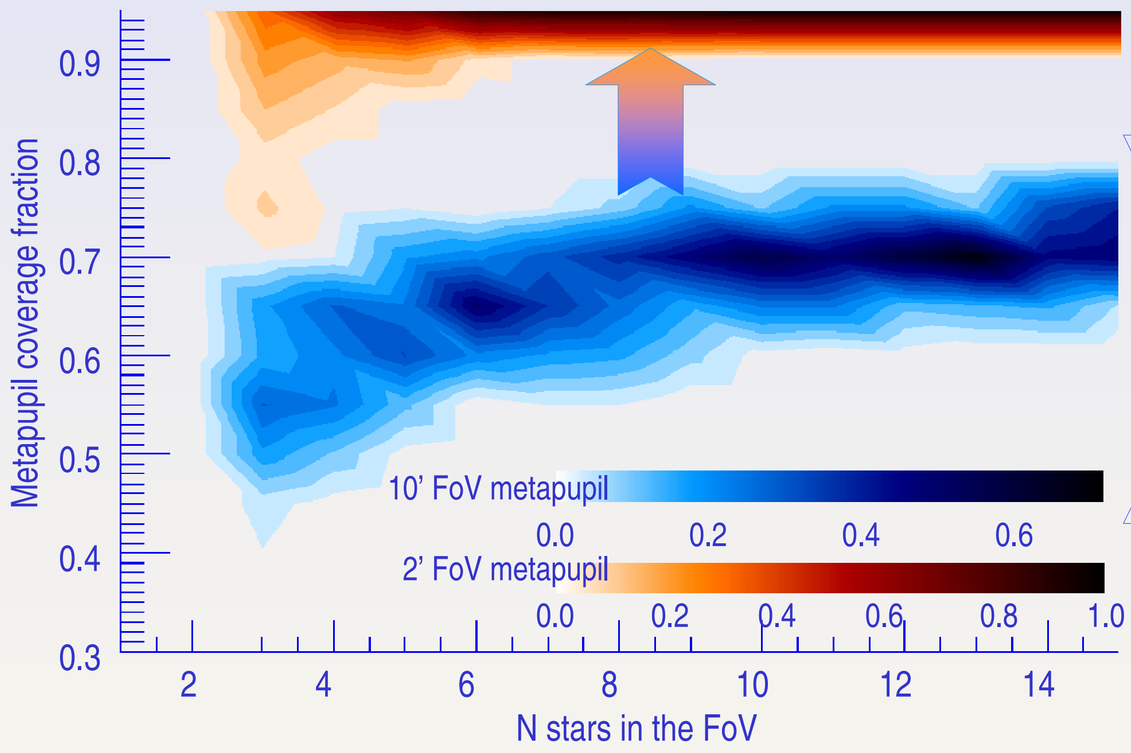
87.6% of the 10' metapupil
100% of the 2' metapupil

10'FoV projection @ 9km
2' metapupil projection @ 9km
10' metapupil projection @ 9km

Pupil projections in the NGSs directions

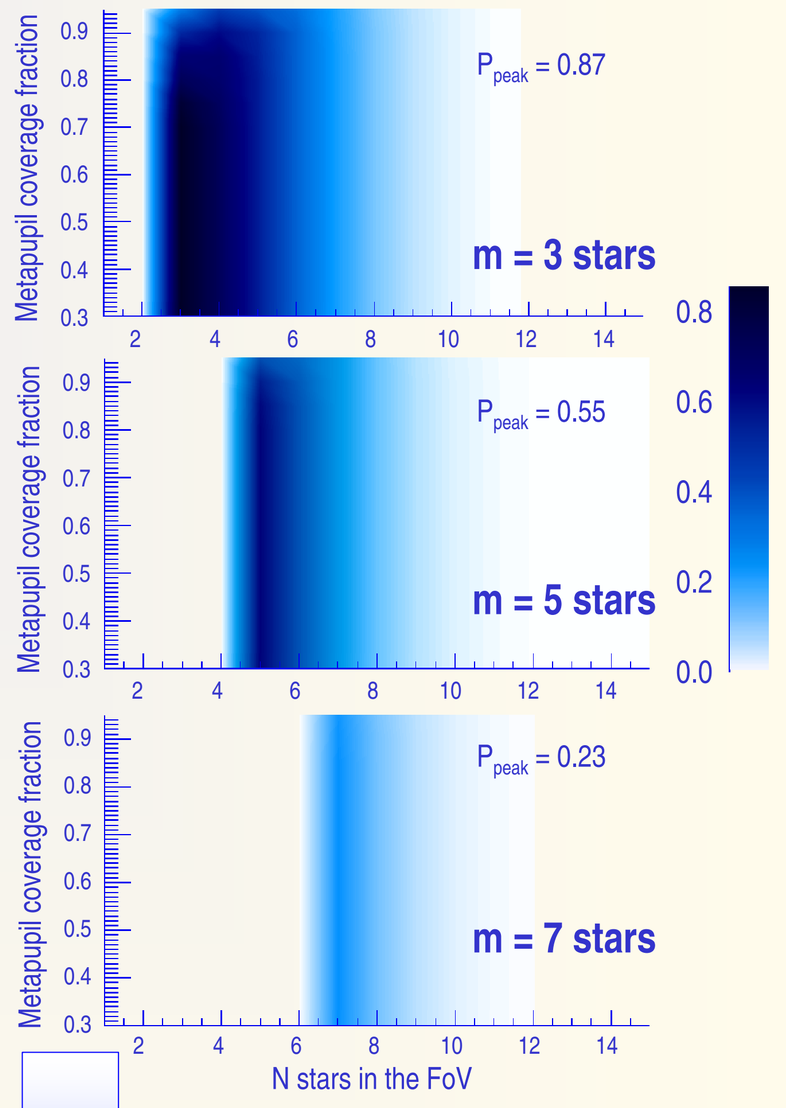
Probability to find N stars in a 10' tech-FoV

Considering N stars in the technical 10' FoV, which is the probability to cover a certain metapupil fraction, with the BEST 3-stars constellation?



Probability to cover with a m-stars constellation a certain 2' metapupil fraction @ 9 km

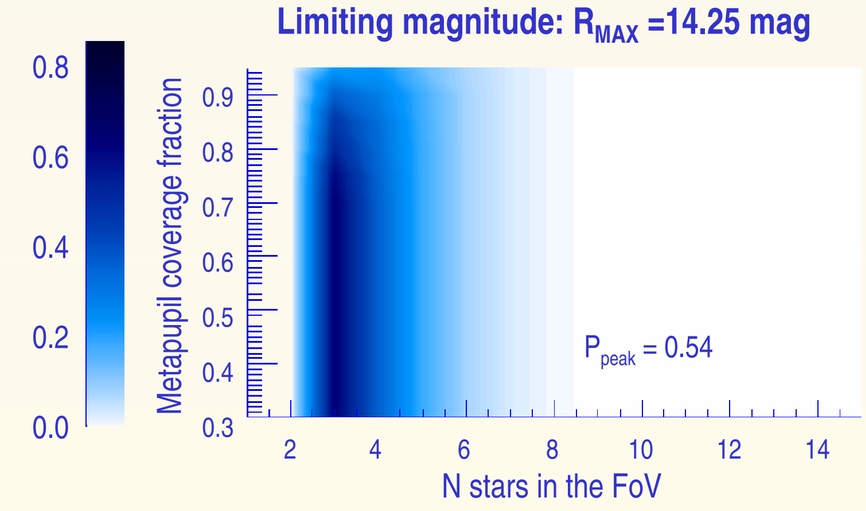
m-stars constellations results: (R_{max}=15.25 mag, b = 90 deg)



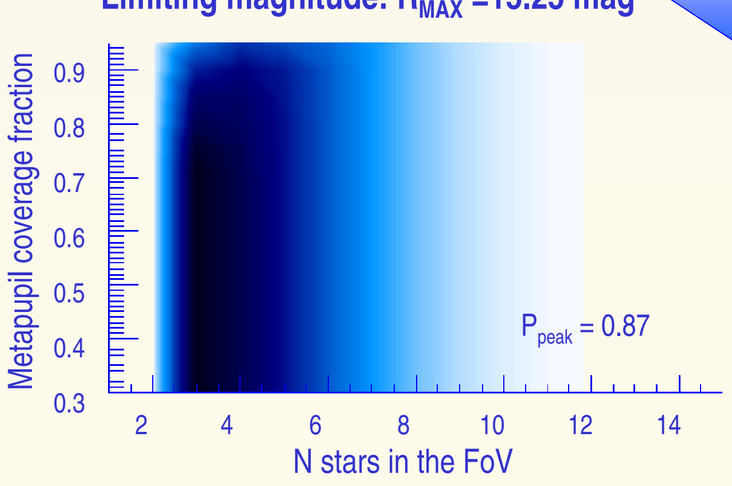
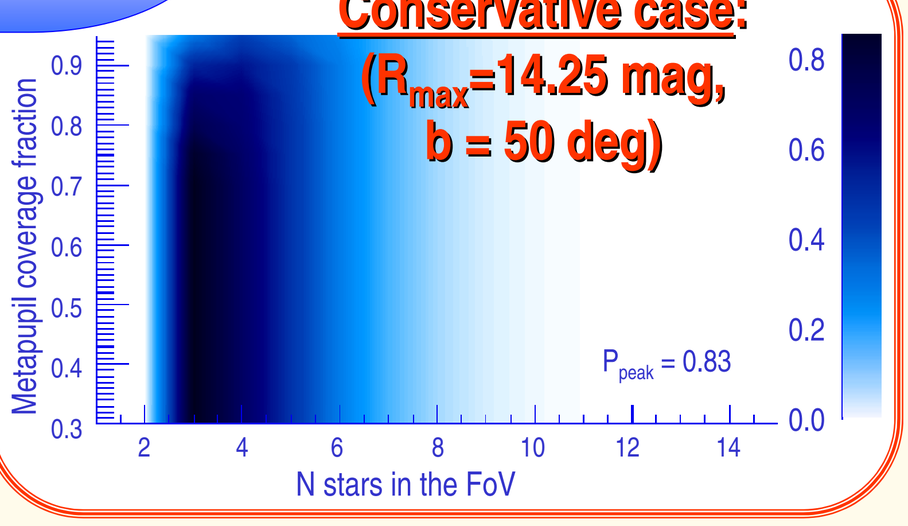
COMPARISON: With respect to the predicted performances for a 40m telescope equipped with a 3-stars AO system with a technical FoV=scientific FoV=10' (same performances of a 8m telescope with a technical FoV=scientific FoV=2'), there is a great improvement in the maximum achievable metapupil coverage if considering the actual E-ELT case, in which the technical FoV and the scientific FoV, to be corrected with AO, are 10' and 2' wide, respecitvely.

Superior of 3,5,7 stars constellations results, for b = 90deg:

Limiting magnitude: R_{MAX} =14.25 mag



Limiting magnitude: R_{MAX} =15.25 mag



Conservative case: (R_{max}=14.25 mag, b = 50 deg)