Of Spiders and elongated spots

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Abstract: In this poster, we present the latest simulation results obtained on the TMT end-to-end simulation tool for the E-ELT's AO instruments. These simulations include effects such as the spot-truncation on the LGS-wavefront sensors on tomographic AO systems - which has an impact on the necessary number of CCD pixels on the LGS WFS. Another effect that is investigated, using the Frim reconstructor, is the impact of a thick spider on LTAO performance.

LTAO

What is the impact of a thick spider on LTAO performance?

Here, we study the performance of an LTAO system up to 10mas. On the left, the performance on-axis, at various wavefronts, for different positions of the LGS constellation. As expected, for 5-10 µm, the optimal position is still the same, but the impact is much reduced. We also looked at the impact of the position of the NGS (2x2 sensor is assumed). We can see (on the right) that a 1¹ will provide still good performance in the 5-10 µm range.

In the plot above, we investigated the differences in performance of a 2x2 and 1x2 NGS sensor at a range of 10mas positions. We can see that the 2x2 sensor provides worse performance on-axis, but it rapidly gains performance compared to the 1x2, as the off-axis angle is increased. Of course, using more TT stars for TT tomography might help to get better performance with a higher order sensor. Note that we also investigated the impact of the NGS position (size and thickness) but not taken into account here.

Comparing reconfigurators for MCAO

Here we compared the performance of various reconfigurators for MCAO. In black, the "reference" matrix-solver. In blue, the "MCAO reconfigurator". In green, "Frim with "naive" optimization". In red, "Kacemuran with wide field optimization". All methods provide very similar performance, but the "cheaper" methods provide a significant improvement in computational complexity. Note that the performance can be "improved" (naive optimization vs. flat performance in the field). This can be a significant feature for some astrophysical applications.