

On-sky ELT-elongated LGS wavefront-sensing using CANARY

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Summary

Six Laser Guide Stars (LGS) are included in the design of the European Extremely Large Telescope (ELT), with all of its current Adaptive Optics (AO) systems taking advantage of them using Shack-Hartmann (SH) wavefront sensors (WFS). However, the implementation of LGS wavefront sensing on the ELT raises new concerns. Indeed, the SH images of the LGS will present unprecedented elongation resulting from the perspective effect caused by the size of the ELT aperture combined with the thickness of the sodium layer.

In order to investigate wavefront sensing with an elongated LGS on a SH WFS, the Multi-Object AO demonstrator CANARY and ESO's 20W transportable Wendelstein LGS unit are used in a configuration reproducing the extreme elongation that will be reached on the ELT. The elongated LGS is superimposed on a Natural Guide Star (NGS) and each guide star has its dedicated SH WFS. The comparison between the wavefronts measured with each guide star is used to build an error breakdown of elongated LGS wavefront sensing.

In this presentation, this error breakdown will be described as well as the corresponding results obtained with data acquired during the latest run of observations in September 2017. The error breakdown is used to compare the performances of correlation and center of mass as centroiding methods. Finally, these performances are evaluated for different SH designs, to explore which compromises can be reached with respect to pixel scale and sub-aperture field of view.

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