

Author: Sylvain Oberti
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Title: AOF's Laser Tomography Adaptive Optics (LTAO) mode: system tests in Europe

Abstract:

GALACSI is the AO system serving the instrument MUSE in the framework of the AOF project.

GALACSI offers two AO correction modes:

- The Wide Field Mode (WFM) is a Ground Layer AO mode delivering a homogeneous PSF across a Field of View of 1' square.
- The Narrow Field Mode (NFM) is a LTAO mode delivering high resolution in the visible across a small Field of View of 10" diameter around the optical axis.

GALACSI NFM relies mostly on the same main subsystems as the WFM, i.e. a Deformable Secondary Mirror with 1156 voice coil actuators in the pupil, 4 Laser Guide Star Shack-Hartmann Wave Front Sensors (SH-WFS) composed of 40x40 subapertures with 6x6 pixels of 0.8" in each. The main hardware difference comes from the fact that GALACSI NFM makes use of a Low Order Natural Guide Star loop correcting Tip/Tilt and Defocus thanks to an Infrared 2x2 SH-WFS. From a reconstruction standpoint, GALACSI NFM intends to optimize the correction on axis by estimating the turbulence in volume via a tomographic process, then projecting the turbulence profile onto one single Deformable Mirror (DM) located in the pupil, close to the ground.

In this lunch talk, the laser tomography reconstruction process will be described. Several methods (virtual DM, projection method) will be studied, under the constraint of a single matrix vector multiplication. The LTAO control matrix model design will be detailed and the reconstruction parameter space will be explored.

Furthermore, we will present our strategy to define the control basis and split the reconstruction between the Low Order loop and the High Order loop.

Finally, closed loop performance obtained with a 3D turbulence generator will be analysed with respect to the most relevant system parameters to be tuned. We will also verify the robustness of our control baseline to turbulence profile variation and misregistration between DSM and lenslet arrays.