
PAPYRUS : Shack-Hartmann Path

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Abstract

PAPYRUS (Provence Adaptive optics Pyramid Run System) is a pyramid-based adaptive optics system installed at Observatoire de Haute Provence (OHP), on the T152 (1m52 diameter telescope). It aims to deepen our knowledge on the Pyramid Wavefront Sensor (PYWFS) and to perform on-sky tests.

The PYWFS is more sensible to small phases perturbations than previous WFS concepts but also suffers from a smaller dynamic range : when the phases perturbations reach a certain level, the PYWFS is not able to measure them accurately due to non linearity and modal confusion effects intrinsic to the physics of the system.

Therefore, we compare the PYWFS with the widely used Shack-Hartmann Wavefront Sensor (SHWFS). A SHWFS path has then been installed on PAPYRUS, parallel to the PYWFS path. The technical solution chosen for the SHWFS detector part presents the originality of being a CMOS with low readout noise (2.5e-) sensor : the Cblue One built by the First Light Imaging company.

Both PYWFS and SHWFS control a 17x17 actuators deformable mirror (DM) and are controlled with a Real Time Computer both (RTC) built by the ALPAO company.

The design of the microlenses and their integration on the Cblue Camera, as well as the control Algorithm of the SHWFS have also been done by ALPAO.

In this paper, the conception and integration of PAPYRUS SHWFS path is described, focusing on the error budget, sizing, and alignment of the system.

The performances of the two systems are presented and compared for stars of different magnitude and elevation, these two parameters allowing us to test respectively noise sensibility and response to different turbulence strenght. The extended object case is also discussed, as well as other ideas involving the SHWFS path that we plan to set up in the future.

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