

The Ingot Wavefront Sensor: Optical Design and laboratory tests

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The Ingot WFS (I-WFS) is a new pupil-plane wavefront sensor based on the Pyramid, and particularly designed to deal with the typical elongation of the extended nature of the Sodium Laser Guide Star (LGS). It has been designed in the framework of the E-ELT, in the peculiar case of a Laser lunch telescope located outside the telescope pupil. In this paper, we present the current optical design of the 3-faces I-WFS, based on a reflective roof-shaped prism, which is able to split the light, at the level of the focal plane, into three beams. In this design, the vertex of the prism is constrained to the lower edge of the Sodium layer in atmosphere, assumed to be the sharpest one, using the tip-tilt term, usually neglected in case of LGS wavefront sensing. In this framework, it has been made a preliminary analysis on a set of Sodium density profiles data, in order to validate the theoretical assumptions related to the I-WFS design. Three re-imaged telescope pupils are then used for the retrieval of the first derivative of the wavefront. A complete automated procedure, relying solely on the illumination observed at the three pupils, to align the prism to the image of the LGS is discussed. We also present the current status of a test-bench able to reproduce, in a scaled manner, the 3D Sodium illumination that the I-WFS will face at the ELT, in order to prove the design and perform tests of phase retrieval.

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