MICADO Adaptive Optics control: a story on Pyramid, Optimal regulator and performance

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With the upcoming Extremely Large Telescope (ELT) of 39m-diameter, new challenges arise for its AO systems, particularly in managing disturbances such as windshake, vibrations and petal modes. We present end-to-end simulations for MICADO, the ELT first-light instrument, which features a modulated Pyramid Wavefront Sensor (PyWFS). These simulations, which account for the various disturbances, are conducted using the COMPASS GPU-based simulator.
The baseline controller for MICADO is an optimal Linear Quadratic Gaussian (LQG) regulator for the tip and tilt modes complemented with and integrator regulator for the higher orders. We present first results with this mixed regulator and show how the LQG regulator allows achieving the expected performance despite the harsh environment and the PyWFS non-linearity.