## From AO Simulation to Real-Time Turbulence Correction using the same Software Interface

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## Abstract

We present ALPAO's adaptive optics control and simulation software ACE. We show that thanks to a unified software interface between RTC and simulation environment, the design, integration, and validation process of an adaptive optics system could be much streamlined. First, we discuss recent developments in ACE's simulation layer which include realistic detector models, a diffractive Shack-Hartmann and Pyramid-WFS model and a perturbation data import feature for complex electrical fields produced by third party simulators. Debug tools, calibration and command matrix computation routines developed in the simulation environment can then be readily applied to the RTC in the lab experiment. Since the telemetry data format is identical, all scripts for performance analysis can be reused. The RTC also features open interfaces to read pre-computed perturbation data from disk in real-time that can be used to tamper with the wave-front corrector commands or the wavefront sensor measurements before processing begins. In this way, using a fully software-based approach, the effects of phase perturbation and non-homogeneous flux conditions can be emulated.

Keywords: ACE, ALPAO, RTC, RTC, Simulation, Tools, Integration, Test, Lab experiments

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