Iqueye, a single photon-counting photometer applied to the ESO new technology telescope

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Abstract

Context. A new extremely high speed photon-counting photometer, Iqueye, has been installed and tested at the New Technology Telescope, in La Silla.

Aims. This instrument is the second prototype of a "quantum" photometer being developed for future Extremely Large Telescopes of 30–50 m aperture.

Methods. Iqueye divides the telescope aperture into four portions, each feeding a single photon avalanche diode. The counts...
from the four channels are collected by a time-to-digital converter board, where each photon is appropriately time-tagged. Owing to a rubidium oscillator and a GPS receiver, an absolute rms timing accuracy better than 0.5 ns during one-hour observations is achieved. The system can sustain a count rate of up to 8 MHz uninterruptedly for an entire night of observation.

Results. During five nights of observations, the system performed smoothly, and the observations of optical pulsar calibration targets provided excellent results.

Key words: instrumentation: photometers / techniques: miscellaneous / instrumentation: miscellaneous

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Iqueye, a single photon-counting photometer applied to the ESO new technology telescope 533 Fig. 2. Encircled energy plot showing the energy distribution on the 100 µm diameter detector in the case of a polychromatic uniformly illuminated FoV of 5 arcsec. Values or telescope oscillations greater than ±1 arcsec manifest themselves as fluctuations of the detected signal. Because of this simulation, the optical design of Iqueye is fairly simple (see Fig. 1). At the Nasmyth focus, where Iqueye interfaces the telescope, a only commercial spherical lenses, yet still obtaining almost optimal performance. Iqueye is a single photon counting very high speed photometer built for the ESO 3.5m New Technology Telescope (NTT) in La Silla (Chile) as prototype of a 'quantum' photometer for the 42m European Extremely Large Telescope (E-ELT). The optics of Iqueye splits the telescope pupil into four portions, each feeding a Single Photon Avalanche Diode (SPAD) operated in Geiger mode. The SPADs sensitive area has a diameter of 100 µm, with a quantum efficiency better than 55% at 500 nm, and a dark count less than 50 Hz. The quenching circuit and temperature control are integrated in each module.