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The AdvCam project: Designing the future cameras for the Large-Sized Telescopes of the Cherenkov Telescope Array Observatory

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An international collaboration composed of Italian, Japanese, Spanish and Swiss institutes, is developing the advanced camera (AdvCam), the next-generation camera for Imaging Atmospheric Cherenkov Telescopes (IACTs), designed specifically for the Large-Sized Telescopes (LSTs) of the Cherenkov Telescope Array Observatory (CTAO). AdvCam incorporates cutting-edge Silicon photomultipliers and a fully digital readout system, setting new standards for performance and efficiency.

The AdvCam will feature four times more channels than the existing PMT-based camera installed at LST-1. Covering the same field of view, this upgraded camera design enables finer image resolution and significantly improves the angular precision and background noise rejection. To cope with the increase in number of channels, many technological challenges are being tackled, from low-power and high-speed integrated chip design to real-time data processing on hardware accelerators.

This technological leap will lower the energy threshold by allowing telescopes to operate at a lower minimum signal level and providing brighter images. The increase in effective area, angular resolution and energy resolution of this new-generation of IACTs will enhance CTAO's sensitivity, unlocking new potential for gamma-ray astronomy. In this work, we present the performance of the AdvCam's core building blocks and its innovative architecture capable of enabling unprecedented triggering capabilities. We also showcase the latest performance results based on Monte Carlo simulations that have been tuned to reflect the latest stages of the on-going technological developments, highlighting the transformative capabilities of this next-generation IACT camera.

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