Science verification of the new FlashCam-based camera in the 28 m telescope of H.E.S.S. – Executive summary –

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In October 2019 the central 28 m telescope of the H.E.S.S. experiment has been upgraded with a new camera. The camera is based on the FlashCam design which has been developed in view of a possible future implementation in the medium-sized telescopes of the Cherenkov Telescope Array (CTA). We report here on the results of the science verification program that has been performed after commissioning of the new camera.

The data set comprises observations of the Crab Nebula, PKS 2155-304, PKS 0903-57, and the Vela pulsar. Data from the Crab Nebula have been used to verify that image parametrizations (essentially Hillas parameters) of γ-ray events derived from air shower and detector simulations match the distributions from the observed γ-rays. Data from the Crab Nebula, PKS 2155-304, and PKS 0903-57 have been used to verify that the pointing correction – that was recalibrated after the camera exchange – works as expected, by comparing reconstructed source positions to catalog values. The angular distributions of γ-ray excess data of these sources have been compared to the expected point spread function derived from simulations that match the observational parameters, respectively, demonstrating excellent agreement. The data sets have also been used to verify that the distribution of residual background events after γ-ray selection cuts is flat across the field of view, which validates the procedures to derive background estimates from control regions in the field of view. The reconstructed Crab energy spectrum has been compared to the derived spectrum before camera exchange, to verify that simulated effective areas describe the new camera data well, independently of residual absolute telescope calibration uncertainties. Finally, Vela pulsar observations have revealed the expected pulsed signal from the source close to the energy threshold of the observations, verifying the event time stamping of the system.

The presented results show that the camera works up to expectations. Optimizations of the data reconstruction algorithms are still ongoing, to fully exploit the scientific potential of the ensemble of the world's largest Cherenkov telescope and the first Cherenkov camera based on a fully-digital readout system.

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