

Readout ASICs for High Granularity Calorimeters and SiPMs

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Calorimeters have recently evolved to provide much greater granularity in order to better identify particles within showers and improve energy resolution, particularly for jets. "Imaging calorimetry" has been studied in detail by the CALICE collaboration since the mid-2000s and, more recently, has been chosen by the CMS experiment to equip its endcap calorimeter (Si and SiPM). Additionally, timing information with an accuracy of a few tens of picoseconds has recently been incorporated into energy measurements, providing valuable supplementary information.

All these advancements have been made possible by high-performance readout ASICs, which handle the large dynamic range of calorimeters with high-speed, low-noise performance while operating at low power (~20 mW/channel). In the future, granularity will continue to increase, necessitating even lower power operation. This will be achieved through further advancements in the analog front-end and also in advanced on-chip data processing.

The OMEGA laboratory has been developing the SKIROC/SPIROC/HARDROC ASIC family for the CALICE readout and, more recently, the HGCROC for CMS HGCAL, which is now undergoing final testing before fabrication for the HL-LHC. Their design and performance will be reviewed, focusing on the SiPM readout, and architectural choices and prototypes for future experiments with streamed readout (CALOROC) will be presented.

Christophe de La Taille is the founder of the OMEGA Microelectronics Laboratory at IN2P3/CNRS and École Polytechnique, a professor at École Polytechnique and an expert in low-noise and radiation-resistant integrated circuit design. He coordinated the development of readout systems for detectors used in LHC experiments, notably ATLAS and CMS at CERN.