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Implementation of large imaging calorimeters

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The next generation of collider detectors will make full use of Particle Flow algorithms, requiring high precision tracking and full imaging calorimeters. The latter, thanks to granularity improvements by 2 to 3 orders of magnitude compared to existing devices, have been developed during the past 15 years by the CALICE collaboration and are now reaching maturity. The state-of-the-art and the remaining challenges will be presented for all investigated readout types: silicon diode and scintillator for a electromagnetic calorimeter, gaseous with semi-digital readout as well as scintillator with SiPM readout for a hadronic one. We will describe the commissioning, including beam test results, of large scale technological prototypes and the raw performances such as energy resolution, linearity and studies exploiting the distinct features of granular calorimeters regarding pattern recognition. Note that, at the time of conference new results obtained in recent (2021/22) beam tests with a technological prototype of a highly granular silicon tungsten electromagnetic calorimeter standalone and combined with the CALICE analogue hadron calorimeter (SiPM on Tile) will be available. The setup did comprise around 37500 (15500+22000) readout cells. Beyond the mentioned prototypes, the design of experiments addressing the requirements and potential of imaging calorimetry will be discussed. In addition, less established but promising techniques for dedicated devices inverse APD or segmented crystal calorimeters will also be highlighted. In the last year also first results with high resolution timing devices have been obtained. The integration of these devices in the CALICE prototypes is one of the major goals in the coming years.

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