

# Performance of the new CLUE3D clustering algorithm in the HGICAL test-beam data

## Scientific context

The CMS experiment at the Large Hadron Collider operates at the energy frontier, with a broad research programme searching for evidence of new massive particles predicted in extensions of the standard model (SM). The high-luminosity phase of the LHC (HL-LHC) will start in 2027 with a target integrated luminosity of  $3000\text{fb}^{-1}$ . For the HL-LHC, the CMS collaboration decided to replace the end-cap calorimeters by a new radiation-resistant and highly granular detector (HGICAL). The reconstruction of particle showers in a detector featuring 6M channels is a novel challenge in the field but several important improvements have been done in the last year and the most recent algorithms have been found to perform well in the simulation.

## Internship project

The goal of the project is to study the performance of the recent 3D clustering algorithm (CLUE3D) in test beam data, which have been recorded in 2018 with a HGICAL prototype. We would like to demonstrate that the recent improvements perform well not only in the simulation but also in real data. Samples of electrons at different energies will be used to perform comparisons with a dedicated simulation of the test beam setup.

## Host team at the Laboratoire Leprince-Ringuet

The CMS group at LLR is a founding member of the CMS Collaboration. It has designed, built, and is responsible for the operation of the L1 trigger for the electromagnetic calorimeter (ECAL). It has also designed the calorimeter mechanics and contributed to the front-end readout electronics. It has major involvement in particle reconstruction and identification with the e/gamma and tau Physics Object Groups, and contributed to the development of the Particle Flow event reconstruction. It is among the leading protagonists within the CMS collaboration in diboson, multiboson and Higgs physics, as well as in heavy ions physics. The group is currently heavily committed in the design, test tests and the realization of the future HGICAL detector.

## Other information

This internship is intended for students at the M2 level.



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