Contribution ID: **157** Type: **Poster**

k4Clue: Having CLUE at future colliders experiments

Wednesday, 26 October 2022 11:00 (30 minutes)

CLUE is a fast and innovative density-based clustering algorithm to group digitized energy deposits (hits) left by a particle traversing the active sensors of a high-granularity calorimeter in clusters with a well-defined seed hit. Outliers, i.e. hits which do not belong to any clusters, are also identified. Its outstanding performance has been proven in the context of the CMS Phase-2 upgrade using both simulated and test beam data.

Initially CLUE was developed in a standalone repository to allow performance benchmarking with respect to its CPU and GPU implementations, demonstrating the power of algorithmic parallelization in the coming era of heterogeneous computing. In this contribution we will outline CLUE's capabilities outside CMS and more specifically, at experiments at future colliders. In order to do so, CLUE was adapted to run in the key4hep framework (k4Clue): it was integrated in the Gaudi software framework and it now supports EDM4hep data format for inputs and outputs.

Implementation details and physics performance will be shown not only for several options of highly granular calorimeters for e+e- linear and circular future colliders, but also for the new Open Data Calorimeter detector, a recent extension to the Open Data Tracking detector, whose aim is to build a simulation-on-the-fly testbed for future algorithm R&D.

Significance

At the latest ACAT in 2021, the performance of the CLUE algorithm for future experiments was not yet presented. On top of this, the work done to include the calorimeter detector in the Open Data Detector was also never presented before.

References

- CLUE: A Fast Parallel Clustering Algorithm for High Granularity Calorimeters in High Energy Physics, https://arxiv.org/abs/2001.09761
- CLUE: a clustering algorithm for current and future experiments, E. Brondolin, ACAT 2021, https://indico.cern.ch/event/855454/con

Experiment context, if any

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Session Classification: Poster session with coffee break

Track Classification: Track 2: Data Analysis - Algorithms and Tools