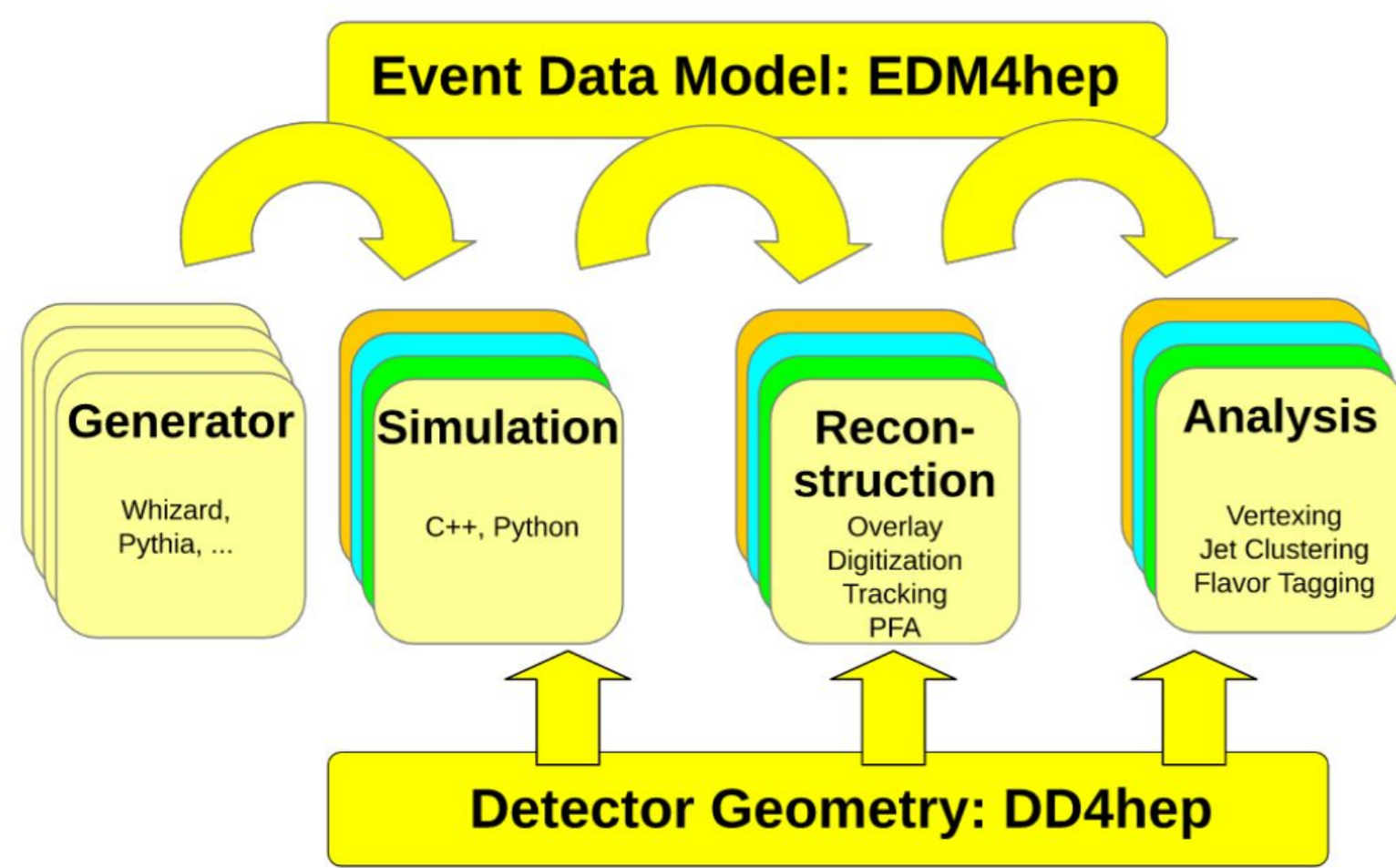


The Key4hep software stack: Beyond Future Higgs factories

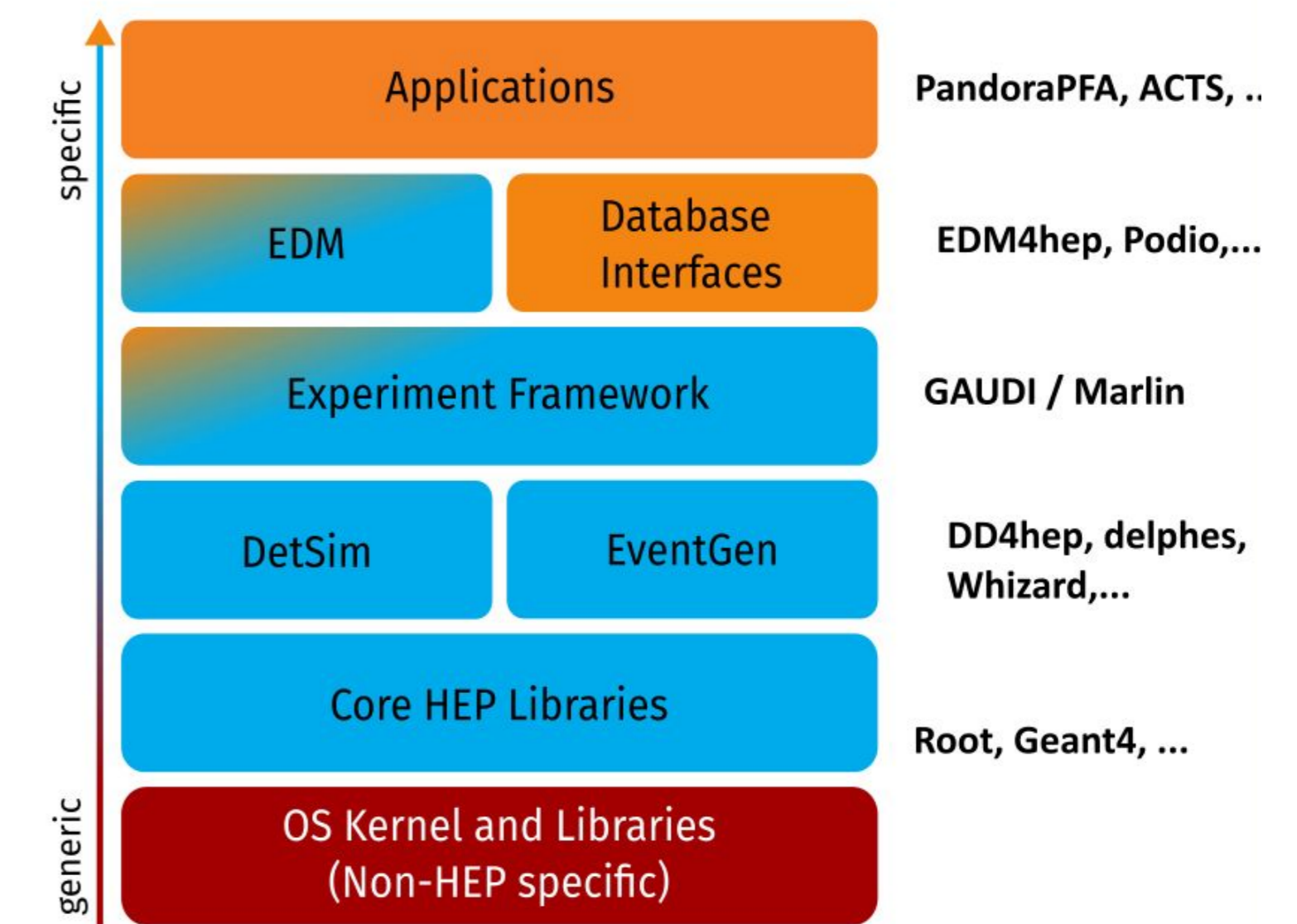
V. Völkl¹ for the Key4hep Developers Team
1: CERN, Geneva, Switzerland



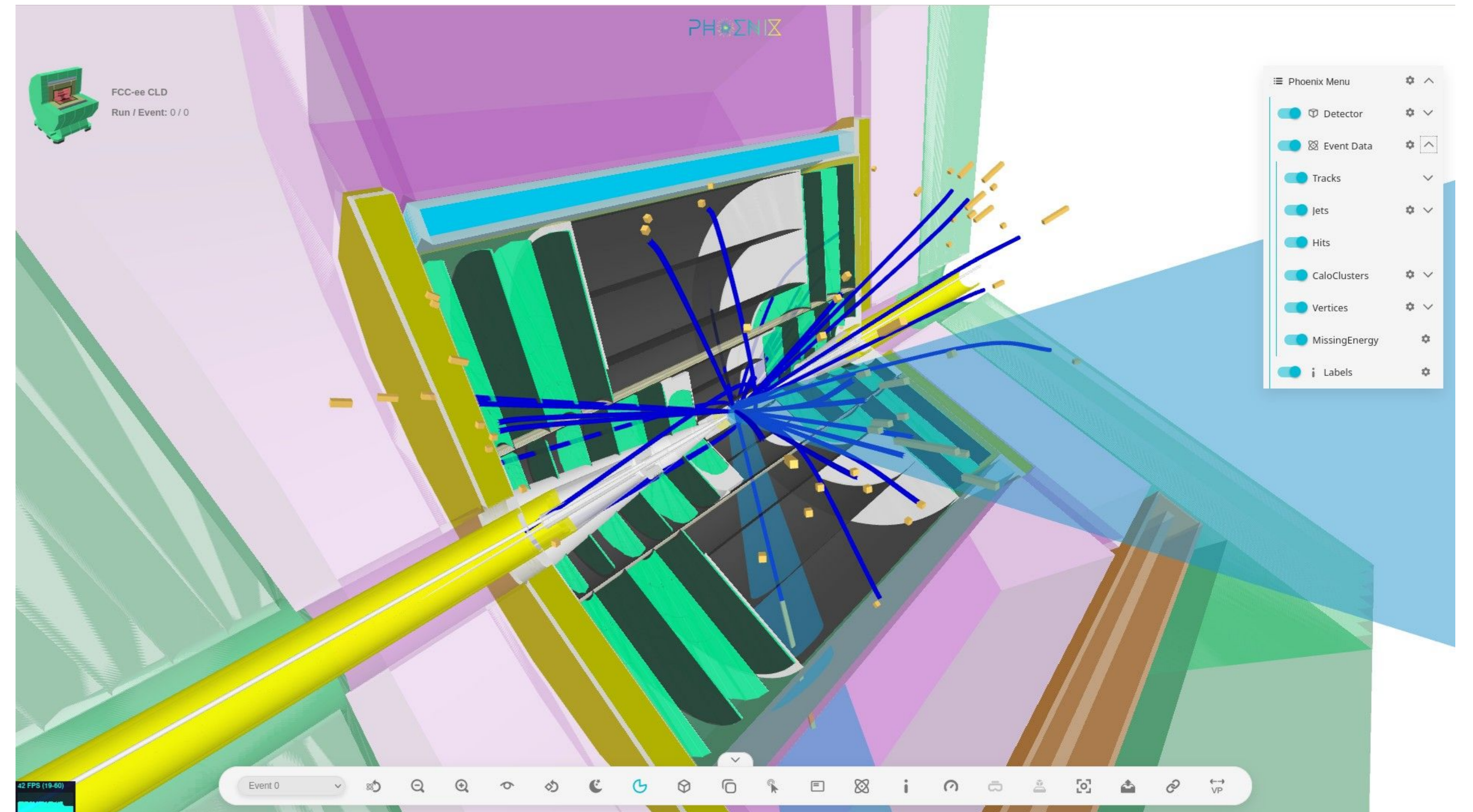
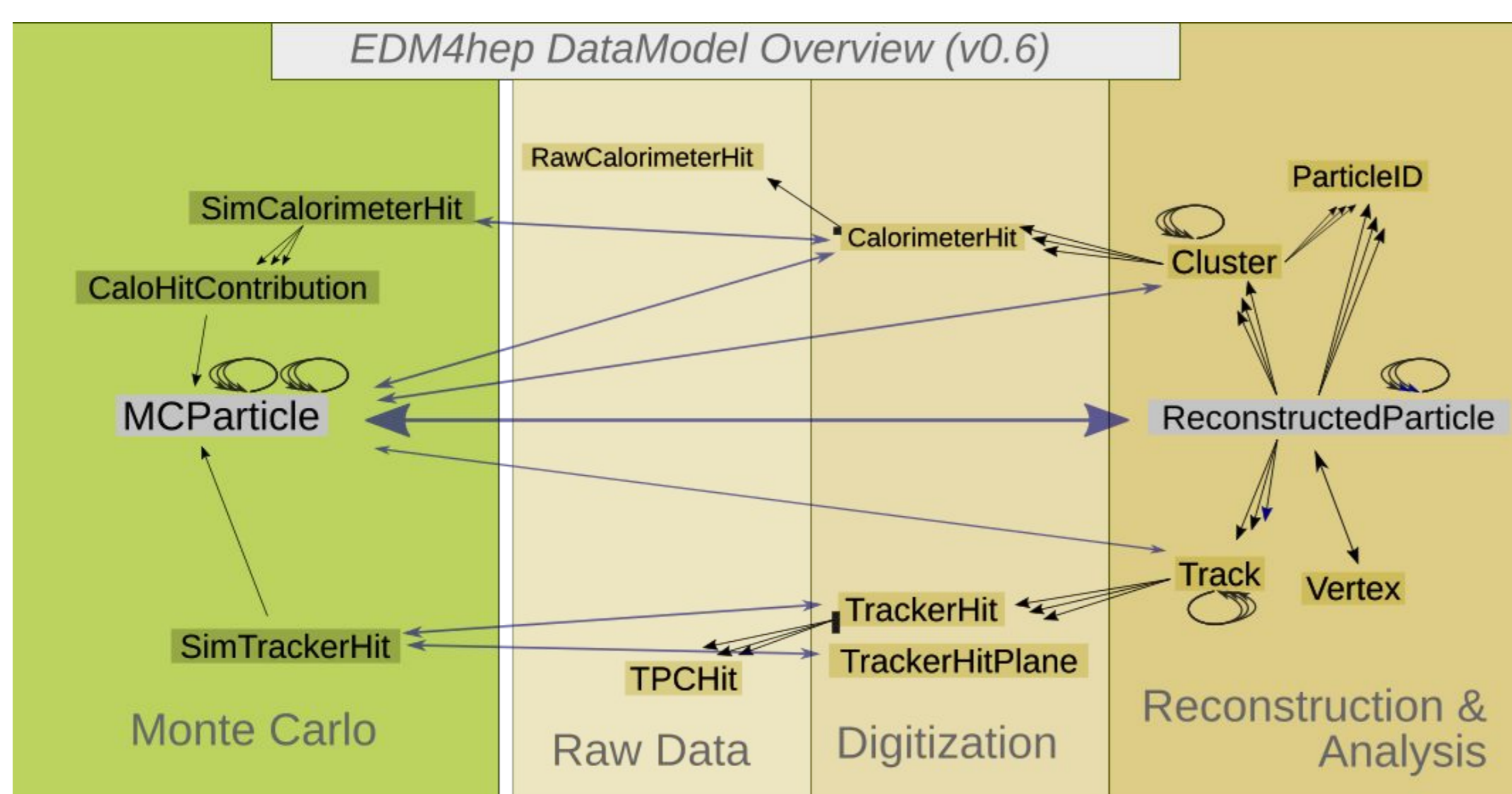
The Key4hep software stack



The Key4hep project aims to provide a turnkey software solution for the full experiment life-cycle (see left diagram), based on established HEP community tools. Several future collider communities (**CEPC**, **CLIC**, **EIC**, **FCC**, and **ILC**) have joined to develop and adapt their workflows to use a common data model (**EDM4hep**), a common geometry description (**DD4hep**) and a common framework (**Gaudi**). Key4hep also tries to maximize the re-use of established solutions and packages to benefit from existing community developments, for example, **ROOT**, **Geant4** and **PODIO** (see figure on the right).

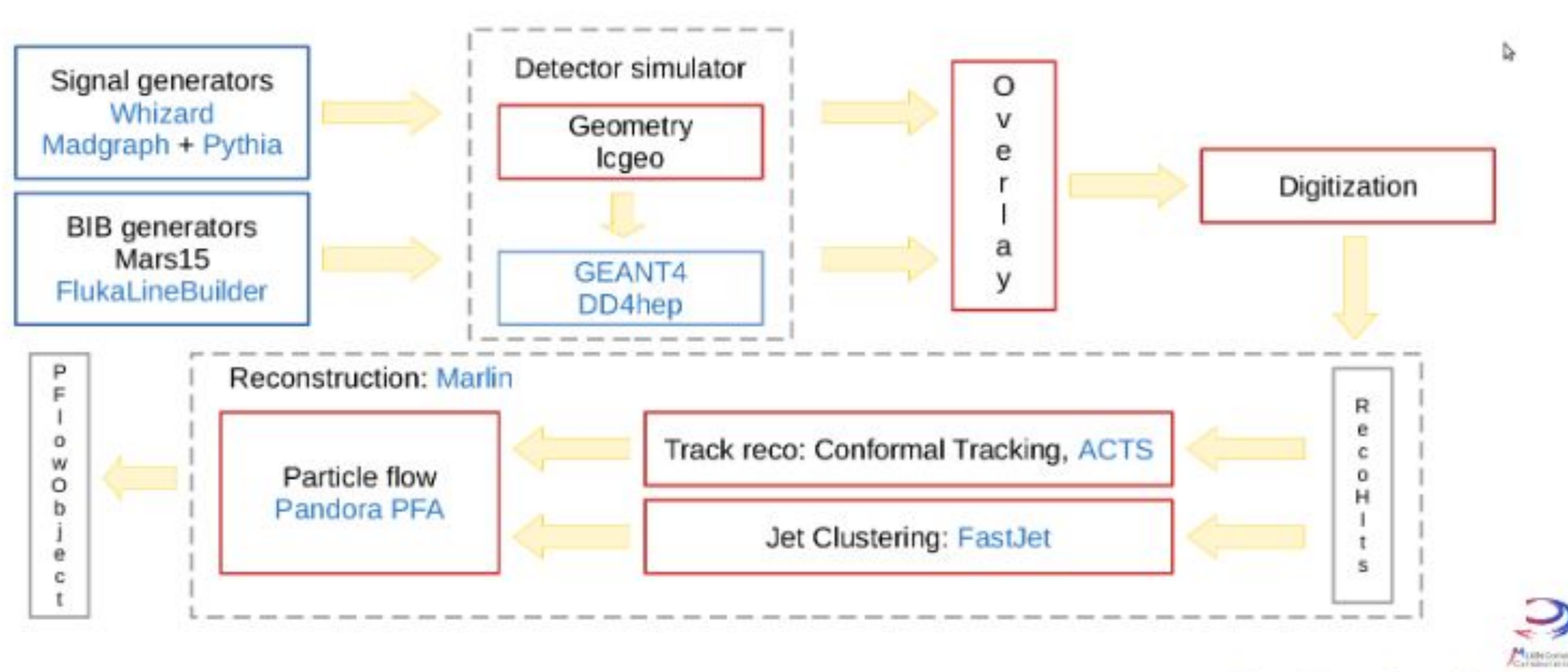


The EDM4hep Data Model

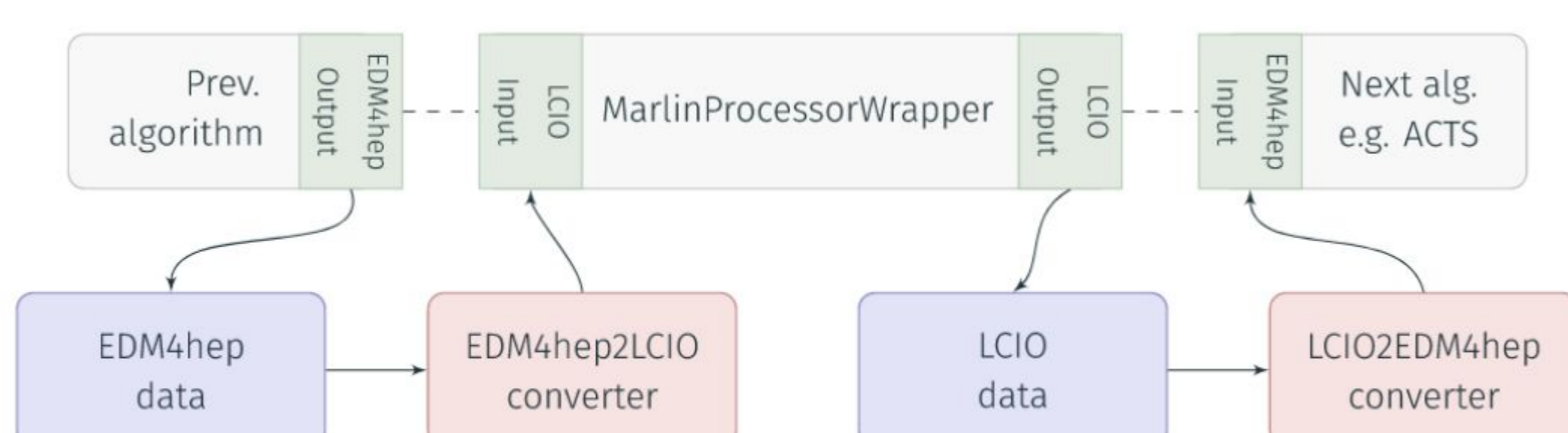


The EDM4hep data model (see association graph above) provides the basic data interface for all applications, and is powered by the PODIO toolkit for performant and thread-safe I/O (see dedicated [poster](#) at this conference). EDM4hep data can now also be converted to json and visualized with [PHOENIX](#) (see figure right).

Extending the Key4hep Collaboration: Muon Collider

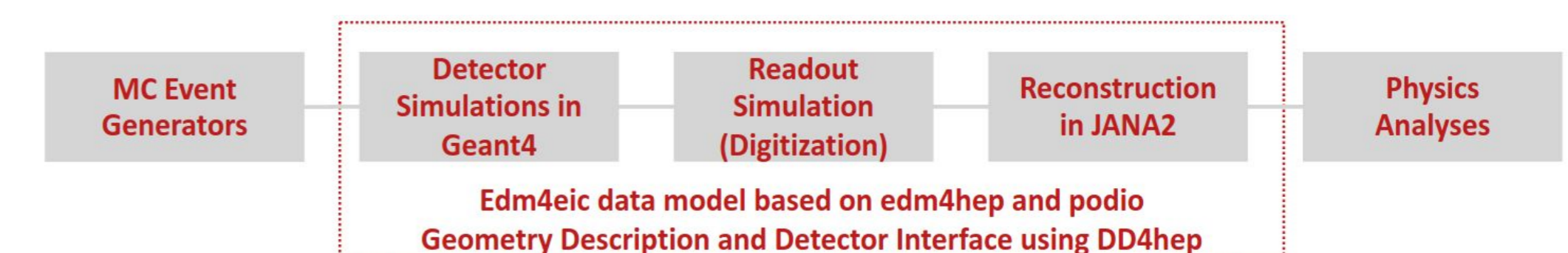


The Muon Collider Design Study already uses large parts of iLCSoft for full simulations (see diagram above). Discussion on full adoption of Key4hep are ongoing. The k4MarlinWrapper compatibility layer can be used to seamlessly combine legacy iLCSoft components with new Key4hep components (see figure below)



Extending the Key4hep Collaboration: EIC

The Electron-Ion Collider (EIC) will adopt PODIO to create an EDM4hep-based data model (adapted to its continuous readout), but uses a different event processing framework: JANA2 in place of Gaudi (see diagram below). The common use of EDM4hep allows a broad collaboration nonetheless, and developments concerning a compatibility layer between Gaudi and JANA2 are ongoing, see <https://github.com/eic/algorithms>



Extending the Key4hep Collaboration: Outlook

Beyond the existing collaboration members and interested future collider experiments, Key4hep could be adapted to the needs of planned and existing experiments. Especially small experiments may profit from a ready-to-use software solutions, for example, LUXE.

Besides sharing of existing experiment workflows, one focus of the Key4hep project is the development and integration of new experiment independent software libraries. Ongoing collaborations with projects such as **ACTS**, **CLUE** (see [poster](#) at this conference), **PandoraPFA** and the **OpenDataDetector** show the potential of Key4hep as an experiment-independent testbed and development platform.

References

- ACAT 2021 (poster): <https://indico.cern.ch/event/855454/contributions/4604989/>
- Ganis, G., Helsen, C. & Völkl, V. Key4hep, a framework for future HEP experiments and its use in FCC. Eur. Phys. J. Plus 137, 149 (2022). <https://doi.org/10.1140>
- Key4hep Status and Plans at [CHEP 2021](#)
- Podio/EDM4hep at [CHEP 2021](#)
- EPS/HEP Presentation on Key4hep: <https://indico.desy.de/event/28202/contributions/105603/>