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Key4hep software Stack for Detector Studies

Detector optimisation and physics performance studies are an integral part of the development of future collider experiments. The Key4hep project aims to design a common set of software tools for future, or even present, High Energy Physics projects. Based on the iLCSoft and FCCSW frameworks an integrated solution for detector simulation, reconstruction and analyses is being developed. This presentation will give a short overview of the major ingredients of the Key4hep turnkey software; the common event datamodel - EDM4hep, the Gaudi based event processing framework, some dedicated packages developed on top of these, and the use of the spack package manager, which enables installations on a variety of platforms.
A first example highlights the synergies that were already achieved by the collaboration of the different collider communities (CEPC, CLIC, FCC, ILC). It shows the seamless integration of fast simulation with Delphes and the LCFIplus vertexing processor from iLCSoft. This combination is possible due to EDM4hep, the processor wrapper (k4MarlinWrapper), and the k4SimDelphes framework integration in Key4hep. As a second example, the multi-threaded execution of the iLCSoft processors in the Gaudi framework making use of the k4MarlinWrapper will be show cased. The third example will demonstrate the execution of multi-threaded simulation of a drift chamber in the CEPC experiment. The chosen application will take information of primary ionizations generated by an incident charged particle as input and will create the waveform as the final output, which represents the signal collected by the chamber's signal wire. The simulation algorithm is based on a neural network model which can be used to simulate the effects from the ionization electron's drift and avalanches.
Using these examples we review some of the challenges and issues that we encountered as well as how they were addressed in the end. We close with a brief discussion of the next steps for the Key4hep project.

Significance

Compared to previous presentation, where the Key4hep ingredients and progress was detailed, this submission aims to focus on existing workflows possible with the Key4hep framework.

References

Proceedings:
Key4hep Status and Plans at the last CHEP https://www.epj-conferences.org/articles/epjconf/abs/2021/05/epjconf_chep2021_03025/epjcon
Podio/EDM4hep at the last CHEP https://www.epj-conferences.org/articles/epjconf/abs/2021/05/epjconf_chep2021_03026/epjconf_chep2
EPS/HEP Presentation about key4hep: https://indico.desy.de/event/28202/contributions/105603/

Speaker time zone

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