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IAS mini-workshop Software for e+e- colliders

Concluding Discussion

- Representatives from all four e+e- collider projects were present (CEPC,CLIC,FCC,ILC).
- general agreement to continue the collaboration on common software tools (Key4hep)
  - addressing the needs of all four communities
- discussion about the next steps that are necessary to make progress
- see also slides:
  - http://ias.ust.hk/program/shared_doc/2020/202001hep/workshop/exp/20200117_1038_pm_Gerri%20GANIS_Xingtao_HUANG.pdf
  - http://ias.ust.hk/program/shared_doc/2020/202001hep/workshop/exp/20200117_1038_pm_Paolo_GIACOMELLI.pdf

Framework

- identified the need to quickly get a first version of Key4hep with a core component and a data service based on EDM4hep

concrete steps

- setup a mailing list
- start to have regular meetings for Key4hep
- setup a Key4hep project in Github
- add some initial packages there:
  - FWCore
  - * Spack configurations: core + experiment specific (FCC,CEPC,ILD,CLICdp)
  - * ideally a Key4hepExamples package
  - experiment specific configuration packages
    * with configuration files for running simulation and reconstruction
  - geometry package with DD4hep detector descriptions for FCC/CEPC
    * similar to `lcgeo` used for ILC and CLIC
- need for good documentation
  - use Github and markdown (potentially together with `Reads The Docs`)
  - package documentation
  - howtos, workbooks,. . .
- use Github issues also for questions

– could setup dedicated package `Key4hepDoc` with general documenta-
tion and use this issue tracker for questions

Event Data Model

- goal to make quick progress with the classes needed for tracking

concrete steps

- implement TrackerHits, TrackState, Tracks etc in EDM4hep
  – based on what's in pLCIO currently
- adress in parallel what would be needed for ACTS (CEPC group)
  – once this is also available, we need to see how the possibly different
  approaches can be merged or treated in a unified way
- investigate automatic generation of lambda functions for RDataFrame
- benchmark the I/O performance also in MT mode
  – note: this is a general feature of ROOT I/O and not directly connected
  to EDM4hep

Detector Geometry

- common interface for reconstruction in DD4hep

  – there are already generic classes that describe all the subdetectors
  currently in use for ILC and CLIC and partly in FCC and CEPC
  – need to address new subdetectors, in particular the dual readout
  calorimeter and a drift chanber

- validate DD4hep-based (unified-geometry)-Service simulation and recon-
  struction for CEPC

- DD4hep description of IDEA, need to implement

  – dual readout calorimeter
  – muon system

Simulation

- streamline Gaudi/FCC/G4 interface
- important to allow existing DDG4 plugins to be available in Gaudi
  – or alternatively foresee to keep standalone ddsim simulation for inter-
  ested groups (ILC, CLIC)
- provide fast simulation via Delphes cards
  – note: no validated cards for ILD exist

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Reconstruction

mid-term goals:

- Provide vertexing, solid Particle ID and c,b tagging
  - Migration of all existing algorithms from Marlin to Gaudi-based frameworks
    * For tracking, Particle-Flow, Jet Flavor tagging
    * Validation of the migrated algorithms
- Integration of ACTS
- Integrate Particle Flow (Pandora, Arbor, . . .)
- Integration of tensorflow and ML techniques for reconstruction

near term

- can put together running reconstructions based on Gaudi-Marlin wrapper for CEPC, CLIC and ILD based on the existing chains for CLIC, ILC and CEPC - would still use LCIO for now

open issue

- need to understand how we want to integrate various existing tools and algorithms
- should allow for the wrapping of existing standalone tools (PandoraPFA, MarlinTrk, ACTS)
  - there is no performance gain loss involved in this light-weight wrapping really
  - advantage is that the groups maintaining these tools do not need to switch to Gaudi but can keep maintaining the software in current environment

general ideas

ACTS tracking

- CEPC groups are interested in getting ACTS to work
  - eventually all groups would be
- CEPC could contribute ACTS gaudi wrapper
- potentially need extension to EDM4hep (Trackerhits, track state,. . .)
  - see point above under Reconstruction
- need of pattern recognition algorithms
  - should investigate porting the ConformalTracking from CLIC
  - in a first step run this in the Marlin-wrapper ?

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regular F2F meetings

- Paolo suggested to have 'regular' software workshops around every 6 months
  - agreed to be a good idea
  - should aim for having a meeting in June/July in Europe
  - possibility to attach it to another meeting ?