

# Future Software Implementations

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IAS HEP 2020  
Experiment / Detector / Software Mini-Workshop

Hong Kong, 17 Jan 2020  
G Ganis (CERN)  
Xingtao Huang (Shandong Univ.)

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# Introduction

- The following slides give a list of items that we think should be addressed next
- The list is the result of an initial comparison of the FCC and CEPC needs, integrated with aspects emerged from today discussions
- The list is meant to drive the final discussion

# Framework

- Get quickly a first version of Key4hep, with a core component and a data service based on EDM4hep
  - Git repository for Key4hep
  - FWCore component from FCCSW / CEPCSW
- Decide how we want to collaborate?
  - Evaluate algorithm porting solution vs algorithm wrapping solution
  - Coordination to common git repository?
  - Force development through approved-PR merging
  - Single place for common drivers, tools, ...

# Event Data Model

- Track parametrization choice(s)
- Navigation between reconstructed and generated hits
  - Access issues in pLCIO, e.g. between TracketHit and SimTrackerHit
  - Address this in EDM4HEP, e.g. by using appropriate helper functions
- Benchmark I/O performance
  - Also in MT mode
- Investigate/implement possibility to generate automatically simple lambda functions for usage in RDataFrame

# Detector Geometry

- Common interfaces for reconstruction in DD4hep
- Validate DD4hep-based (Unified-Geometry)-Service simulation + reconstruction solution for CEPC
- Detector Geometry Visualization
  - geoDisplay ?
- DD4hep of IDEA
  - Dual Readout calorimeter
  - Muon system

# Detector Simulation

- Streamline Gaudi/FCCSW/G4 interface
- Develop a parallelized simulation solution for CEPC
  - Based on Geant4-MT and MPI
- Digitization IDEA Dual Readout calorimeter and Muon system
- Develop a coherent simulation framework allowing mixing of full and fast simulation
  - Test setup available in FCCSW ?
- Fast simulation with Delphes
  - Validation of Delphes cards for proposed solutions
  - Uniformize {full sim + reco} and Delphes outputs

# Reconstruction

- 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
- ...

# Other items / areas of work

- Generation

- Investigate ways of streamline access to generator services
- Interface / enabling / validation of generators relevant for Z, WW, HZ, tt

- MDI

- Shared data formats for the several existing codes
- Implementation and validation of the event overlay mode

- Analysis

- Develop a solid end-user analysis system via RDataFrame
  - ntuple reduction
  - intuitive and flexible access to variables

# Discussion

- ...