**Key4hep: A Turnkey Software Framework for Future Collider Experiments**

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### Event Processing with Gaudi
- Gaudi is an event-processing framework, used by ATLAS, LHCb and others.
- Key4hep provides an interface to Gaudi, enabling the execution of algorithms that read or write EDM4hep data.
- There are more interfaces: to Monte Carlo Generators, Geant4, Delphes and others.
- Ongoing work in other integrations or algorithms:
  - ACTS, for track reconstruction.
  - Pandora Particle Flow Algorithm.
- Porting existing algorithms to work with EDM4hep, like a background overlay algorithm.
- Support for multithreading has been added recently.

### The Marlin Wrapper
- Marlin is an event-processing framework for the International Linear Collider (ILC).
- Key4hep provides an in-memory wrapper for Marlin processors, enabling the integration and reuse of software developed and validated for over 20 years within Key4hep.
- Marlin processors can be combined with other algorithms from Key4hep in the same processing chain thanks to the Marlin wrapper.

### Detector Studies
- Key4hep uses the DD4hep detector description framework based on Geant4.
- The geometries of the detectors are stored in a common repository and deployed on cvmfs.
- Users can easily test them and their different versions.
- Steering files to run a full reconstruction chain are often provided.
- Validation pipeline involving simulation and reconstruction to detect potential issues as the detector evolves.

### The Key4hep Stack
- Complete software stack of over 500 packages that are deployed on cvmfs.
- Nightly build and stable releases.
- Built with spack, a community-driven package manager.
- Supports multiple operating systems: Alma 9, CentOS 7 and Ubuntu 22.04.
- Easy setup by running one of the following commands:
  - source /cvmfs/sw.hsf.org/key4hep/setup.sh
  - source /cvmfs/sw-nightlies.hsf.org/key4hep/setup.sh
- Utilities to setup a working area or to select different releases easily.
- Continuous integration system that ensures all changes are thoroughly tested and validated on both nightly and stable releases.

### Outlook
- Consolidate and finish a stable version of EDM4hep
  - Recent improvements before version 1.0, the first stable version of EDM4hep.
  - In the future, use the schema evolution provided by Podio (the tool that generates EDM4hep) to evolve the data model.
  - Version 1.0 planned to happen soon.
- Participate in and benefit from the FCC studies
  - Already happening: today Key4hep is the software framework used for FCC studies.
  - Increase the number of reconstruction algorithms available.

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**EDM4hep**

- EDM4hep is an Event Data Model and the core component of Key4hep.
- Common language that all the components in Key4hep speak.
- The goal is to be both generic and address all the needs of the experiments.
- EDM4hep evolves through consensus among all the parties involved.

**EDM4hep DataModel Overview (v0.10)**

- Event Processing
- Reconstruction & Analysis
- MCRecoTrackerAssociation
- MCRecoCaloAssociation
- MCRecoParticleAssociation
- EDM4hep2LCIO converter
- LCIO2EDM4hep converter

**The FCC-ee Detector Concepts**

- CLD
- IDEA
- ALLEGRO

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**Validation pipeline**

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**Introduction**

- Turnkey software framework: Key4hep provides a complete data processing framework, from Monte Carlo generation to data analysis.
- Share components across different experiments and communities and avoid duplication of effort.
- International community with participants from CEPC, CLIC, EIC, FCC, ILC and the Muon Collider from CERN, DESY, IHEP, INFN and other institutes.

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**Event Data Model: EDM4hep**

- Generator
- Simulation
- Reconstruction
- Analysis
- Framework (Gaudi)
- Detector Geometry, 14.hep (DD4hep)