



Software for PED studies

Introduction. Status of Things

FCC Software Meeting
CERN, Zoom

May 30, 2023
G Ganis, CERN-EP

Restarting the FCC Software meetings



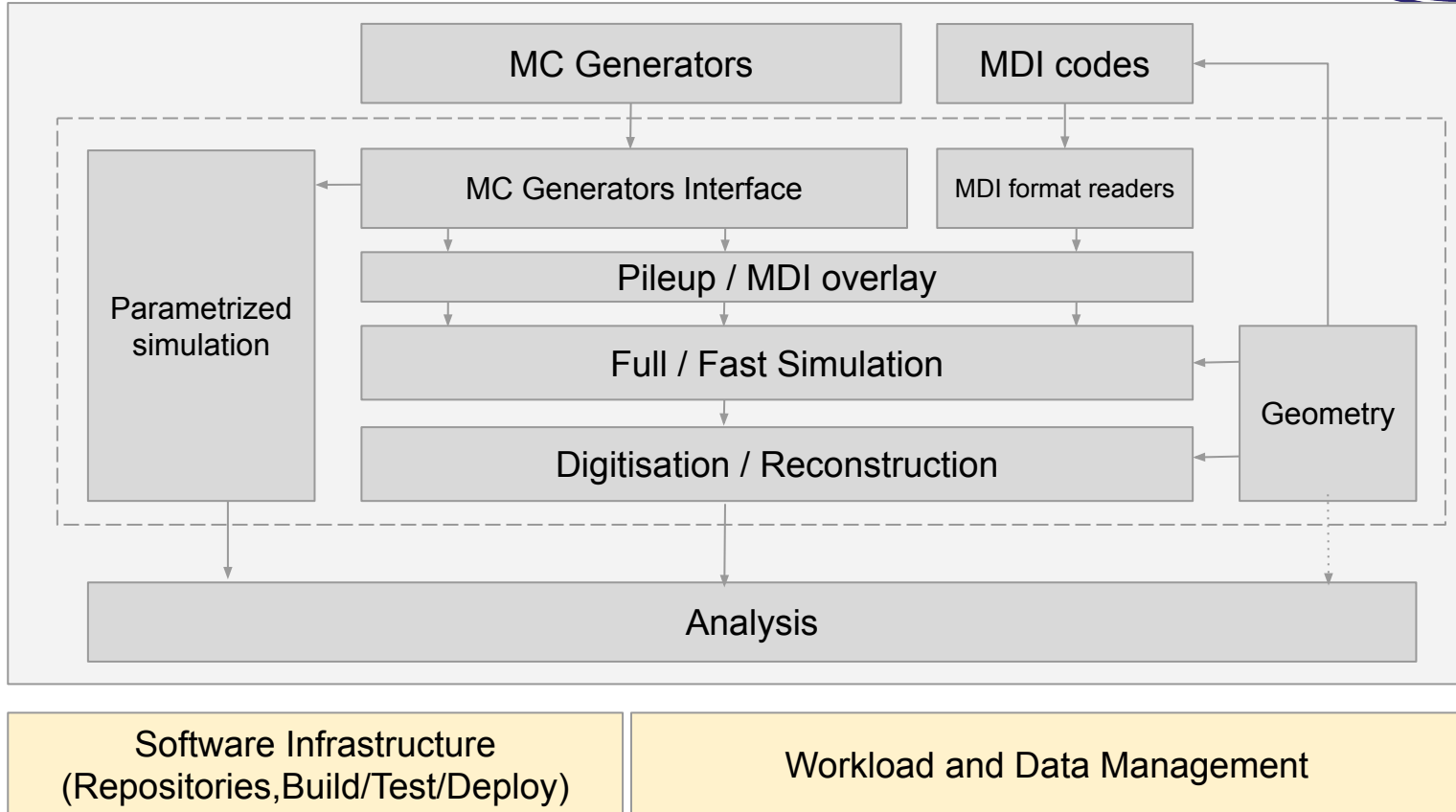
- General FCC Software meetings were sort of paused during the review of the FCC Software and Computing working group mandate
 - Software slots in the Physics Performance and Detector Concepts meetings
- Topical working meetings were organised upon needs
 - This was the case e.g. for analysis tools, IDEA full simulation, ACTS, Pandora, ARC, ...
- The on-going FCC Feasibility Study has triggered a significant increase in the activities and contributions around the FCC software
 - General and inclusive exchange meetings are required to streamline communications
- A monthly frequency was felt adequate to start with
 - Identified in the last Monday at 15h of the month as *initial working solution*
 - Today exception due to Whit Monday and Memorial Day
- Next meeting: June 26th

Events during the “pause” ...



- 5th FCC Physics workshop, ~~Liverpool~~ virtual, Feb 2022
 - Dedicated **software session**
- FCC Week 2022, Paris, May 2022
 - **Plenary** + **software talks** in Physics Performance
- Kick-off Detector Concepts workshop, June 2022
 - **Software session**
- Software tutorials, Oct 2022
 - **Updated set of tutorials** and documentation
- 6th FCC Physics workshop, Krakow, Jan 2023
 - **Software session**
- 1st FCC US workshop, BNL, Apr 2023
 - **Demo/tutorials** and update doc

Workflows to support for FSR



FSR targets



- **Monte Carlo generator and interfaces** ✓=
 - Generator palette ✓
 - General treatment of interaction region (BES, x-angle, packet length, ...) =
- **MDI interfaces** ✓=
 - GuineaPig ✓
 - {SR, beam losses, beamstrahlung} through authors' particle lists ✓=
- **Parametrized simulation** ✓
 - Delphes integration ✓
- **Geometry description and full simulation** ✓=
 - New machine region elements, CLD, LAr calo, IDEA DR calo ✓
 - ARC, IDEA DC, vertex, cristal ECAL, muon on-going =
 - Streamlining procedure to interchange detectors (Plug&Play) =
- **Digitisation** ✓=
 - CLD, LAr calo, IDEA DR calo ✓=
 - ARC, IDEA DC, vertex, cristal ECAL, muon =

FSR targets



- **Reconstruction** ✓≡
 - CLD via wrapper(iLCSoft tools), LAr calo, IDEA DR calo ✓
 - ARC, IDEA DC, vertex, cristal ECAL, muon ≡
 - ACTS, Pandora PFA ≡
- **Distributed computing** ✓≡
 - iLCDirac to be commissioned ≡
- **Analysis** ✓≡
 - FCCAnalysis consolidation
- **Documentation** ✓≡
 - Tutorials ✓≡
 - Reference documentation ≡

- Rather stable core components

- Some work going on on the back to prepare for multi-threaded processing
 - Integration of PoDIO::Frames

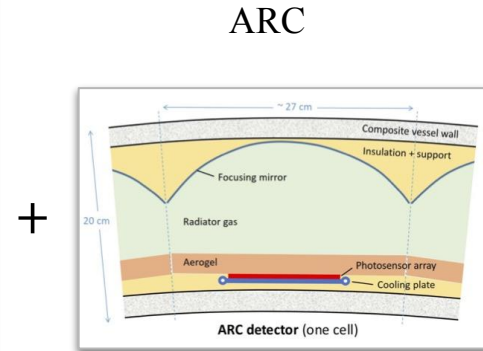
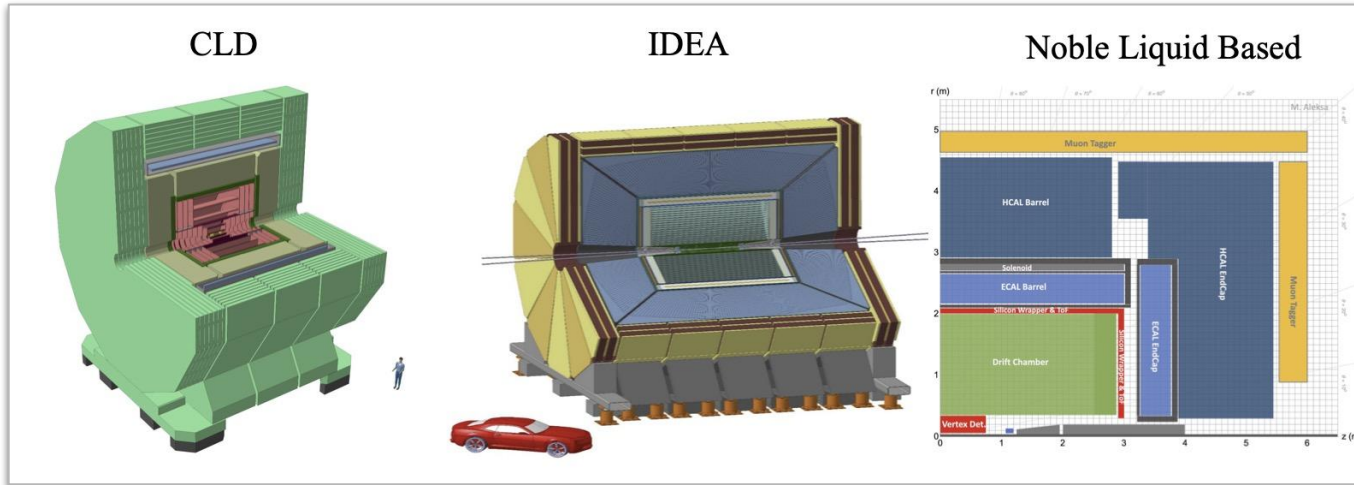
- On-going activities

- Core: Streamlining/consolidation of the build system
 - Rebase on latest Spack; CI consolidation; builds for additional OS (Ubuntu, Alma9, ...)
- Geometry: Enabling of [k4geo](#)
 - Common detector-in-DD4HEP repository, copied from lcgeo
 - Provide versioning scheme which will use to bookkeep FCC detector variants
 - Under discussion / definition
- Full Simulation: Full support for using k4SimGeant4; preparation for k4Gaussino
 - Ironing out differences with ddsim
- Reconstruction: several activities

k4geo: common repository for detector models



- DD4hep detector models spread in several project repositories
 - [iLCSoft/lcgeo](#), [FCCDetectors](#), [CEPCSW/Detector](#)
- [k4geo](#) is an attempt to reduce risk of duplications
 - E.g. CLD will only appear in one place
- Current detector concepts for FCC-ee

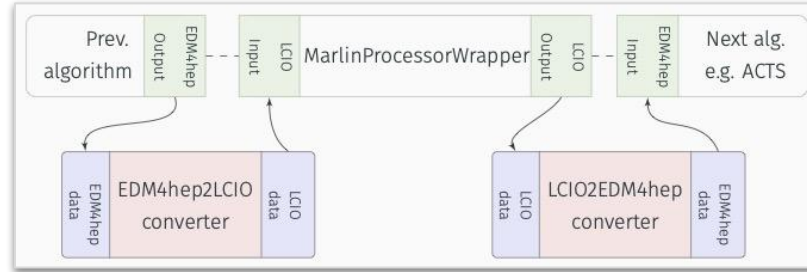


Key4hep: reconstruction

1st ECFA workshop on Reconstruction
2nd coming on July 11-12 2023



- CLD: on-going validation of CLICdp algorithms through k4MarlinWrapper



Possibly the area where there is more room for contribution

- Calo reconstruction algorithms in Gaudi
 - LAr, derived from FCC-hh LAr (see tutorial), IDEA Dual Readout
- Particle Flow w/ Pandora PFA: CLD, CLD/LAr
 - PandoraPFA available through wrapper, native implementation in the pipeline
 - Improved calo clustering k4CLUE, developed for CMS HGCal
- Evaluation of ACTS
 - Start w/ CLD, then IDEA DC; look also at what has been done for EIC

Repository/build/test/deploy infrastructure



- **Repositories on GitHub**
 - Projects [key4hep](#), [HEP-FCC](#)
- **Managed with Spack**
 - Dedicated add-on [key4hep-spack](#)
 - CI based on GitHub actions
- **Deployed in dedicated CernVM-FS**
 - Setup with `/cvmfs/sw.hsf.org/key4hep/setup.sh`
- **Official build are for CentOS7, Gcc 11 (latest: 8 April 2023)**
 - Builds for other platforms in preparation
 - In principle works for newer OSes, such as CentOS8, AlmaLinux9 or Fedora37 because of glibc backward compatibility
- **Legacy build/deploying infrastructure (extension of LCG builds)**
 - Used for quick tests and quick provision of new platforms

Event Producer Workload / Data Management




- Currently still using home-made solution (HTCondor, EOS, ...)
 - Serves well CERN-based productions (latest Winter2023)
- Target is still inclusion of non-CERN resources
 - Main requirements: central file catalogue, replication, remote access
 - Major development for the in-house system
- iLCDirac: LC community DIRAC instance
 - Workload management, file catalogue used by LHCb, Belle II, BES III, JUNO, ILC/CLIC, ...
 - Already serving another VO (CALICE)
 - Connected w/ RUCIO (**dedicated workshop** in Oct 2023)
- FCC @ iLCDirac
 - Re-activated FCC VO
 - Associated CERN FCC resources to FCC VO (HTCondor, EOS area)
 - **Re-Activated discussion about FCC workflows**

Connections w/
- Key4hep
- Physics Performance


Today's meeting











FCC Software Meeting

Tuesday 30 May 2023, 15:00 → 18:00 Europe/Zurich
2/R-030 (CERN)

Videoconference  FCC Software Meeting [Join](#) 2/R-030

Registration  *You are registered for this event.* [Check details](#)

15:00	→ 15:20	Introduction. Status of things Speaker: Gerardo Ganis (CERN)	20m	
15:20	→ 15:50	FCC Analysis Developments Speaker: Juraj Smiesko (CERN)	30m	
15:50	→ 16:20	IDEA Detector Concept: status of full simulation in Key4hep Speaker: Brieuc Francois (CERN)	30m	
16:20	→ 16:50	HepSim Monte Carlo repository and integration of its software with key4hep Speaker: Sergei Chekanov (Argonne National Laboratory (US))	30m	
16:50	→ 17:10	AoB Speaker: All	20m	

Software Talks at FCC Week 2023 in London



Tue Jun 6

10:30 → 12:00 PE&D: Physics Case + Theoretical calculations (II)

11:30 Latest developments in FCC Analysis ↑

Speaker: **Juraj** Smiesko (CERN)

Thu Jun 8

13:30 → 15:00 PE&D: Software and Computing / Detectors

13:30 Status of software for detector studies

Speaker: **Brieuc** Francois (CERN)

13:50 IDEA vertex and drift chamber in Key4hep ↑

Speaker: Armin Ilg (University of Zurich)

14:10 RICH full sim implementation in Key4hep

Speaker: Alvaro Tolosa Delgado (CERN)

14:30 IDEA Dual readout calorimeter in Key4hep

Speaker: Sang Hyun Ko (Seoul National University (KR))

14:45 FCC-ee TileCal simulation and reconstruction

Speaker: Michaela Mlynarikova (CERN)

Backup



Managing interoperability in Gaudi

