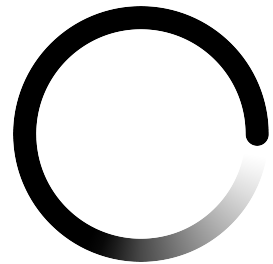


FCC Full Sim Tutorial

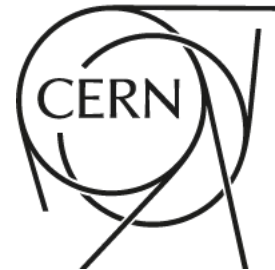
Brieuc Francois (CERN)

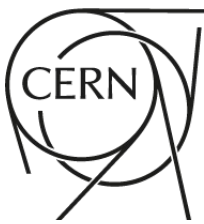
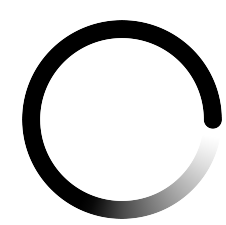
2nd Annual U.S. FCC Workshop

March 27th, 2024

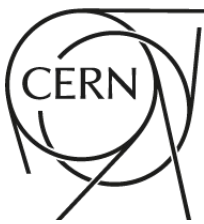
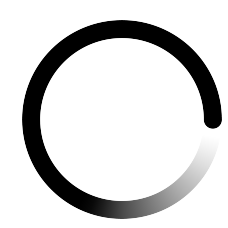


**FUTURE
CIRCULAR
COLLIDER**





- Welcome to the FCC Full Sim Tutorial!
- Let's learn how to run the state of the art Full Sim for each of the FCC detector benchmark
 - **CLD**: ready to be further validated and optimized with **Full Sim analyses**
 - Run CLD SIM + RECO on ZH events and plot a simple Higgs recoil distribution
 - **ALLEGRO**: ECAL ready to be further optimized
 - **Change sub-detector content**, run ECAL SIM + RECO (including MVA calibration), **study different detector designs**: changing LAr to LKr
 - **IDEA**: ready for the **implementation of a tracking algorithm**
 - Produce a sample with digitized vertex + drift chamber hits and plot simple distributions
 - Detector visualization: **see what is actually in the simulation**, useful for most purposes
- This will **allow you to get started if you want to contribute in any of these area!**
- Probably won't have time to cover the full tutorial, you can jump to the part you are most interested in

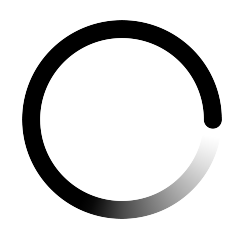


It is time to get your hands dirty!

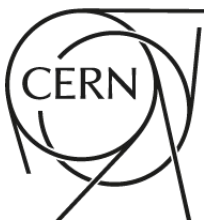
LINK

More Full Sim resource

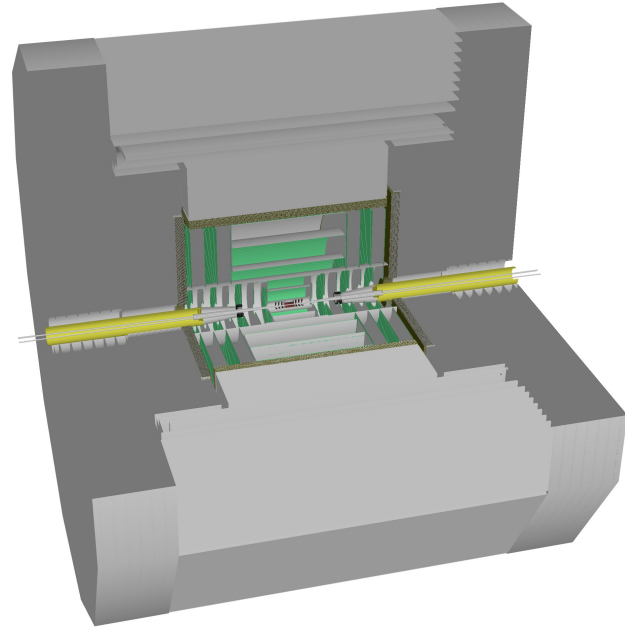
- [Bi-weekly FCC Full Sim working meeting](#)
 - 11 am CERN time but with possibilities for US friendly time slots (already had several)
- [FCC Full Sim webpage](#)
- [Key4hep tutorials](#)



FCC Detectors

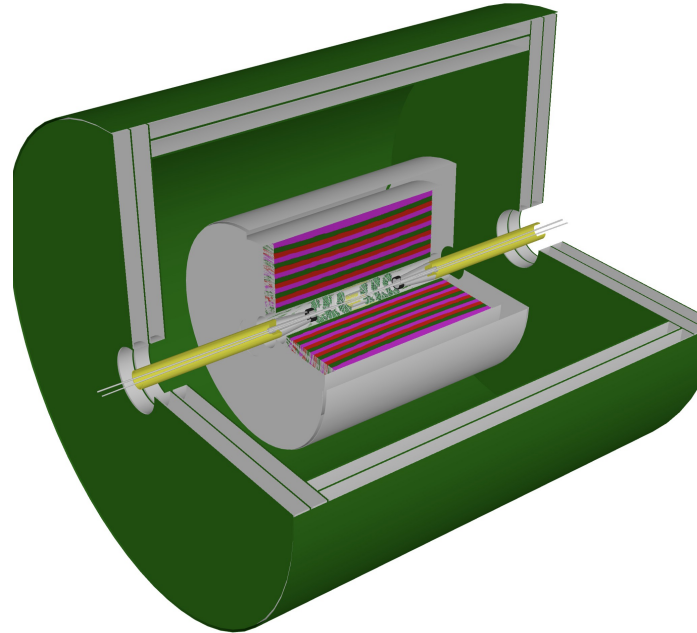


CLD



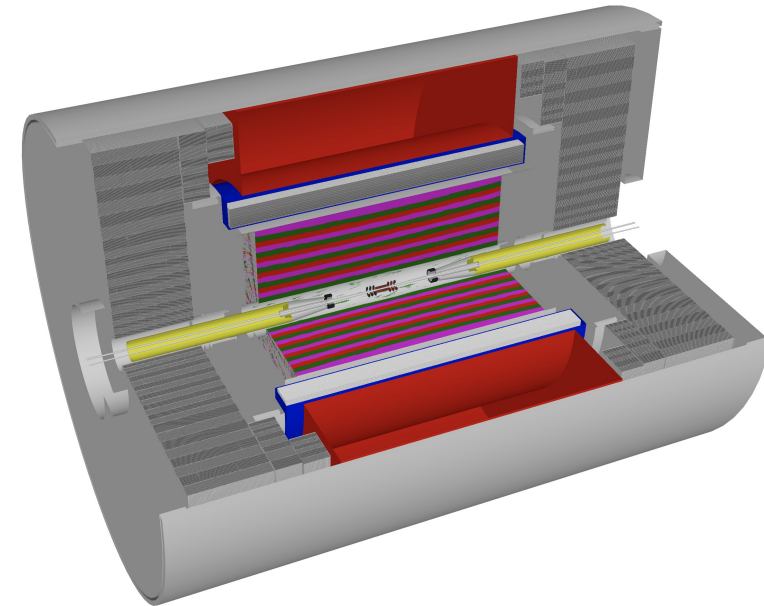
Full-silicon, optimized for particle flow

IDEA



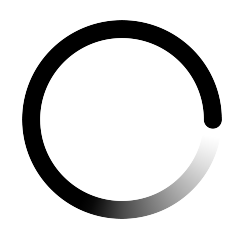
Ultra-light tracker (drift chamber, $\sim 5\% X_0$), dual readout calorimeter

ALLEGRO

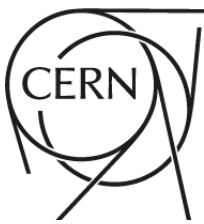


Noble Liquid ECAL/TileCal HCAL with high granularity

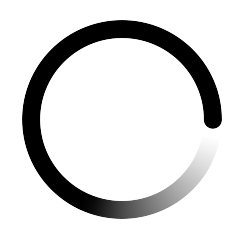
Already a possible task: improve the display with different colors for each sub-detector :-P



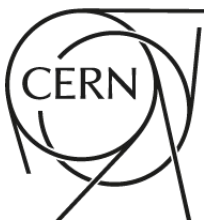
Examples of Open Projects (I)



- Study multiple scattering up to muon chambers (or silicon wrapper) to set lower limit on spatial resolutions (or make the case for lighter inner detectors)
- Study the impact of wires in the drift chamber
- Validate detector implementations and tune the Geant4 physics with available test beam data
 - Drift chamber, muRWELL, dual readout calorimeter, ...
- Validate Delphes cards with full sim (only CLD tracker done so far)
- Implement tracking for the IDEA detector
 - People interested (ML, intuition based), but more are welcome



Examples of Open Projects (II)



- Reproduce detector performance studies with the latest CLD version
 - Revive and evaluate performance of existing reconstruction algorithms (e.g. flavor tagging training, tau reconstruction, ...)
- Study GNN based flavor tagging (as we do currently for Delphes output) for full sim output
- Exercise the background overlay tools
- Study CLD Particle Flow performance w/ and w/o PID detector
- **Prepare and maintain Full Sim physics analyses** (with CLD first, applied to other detectors with minimal changes)
- ...