Status of the IDEA software

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On behalf of the IDEA software group

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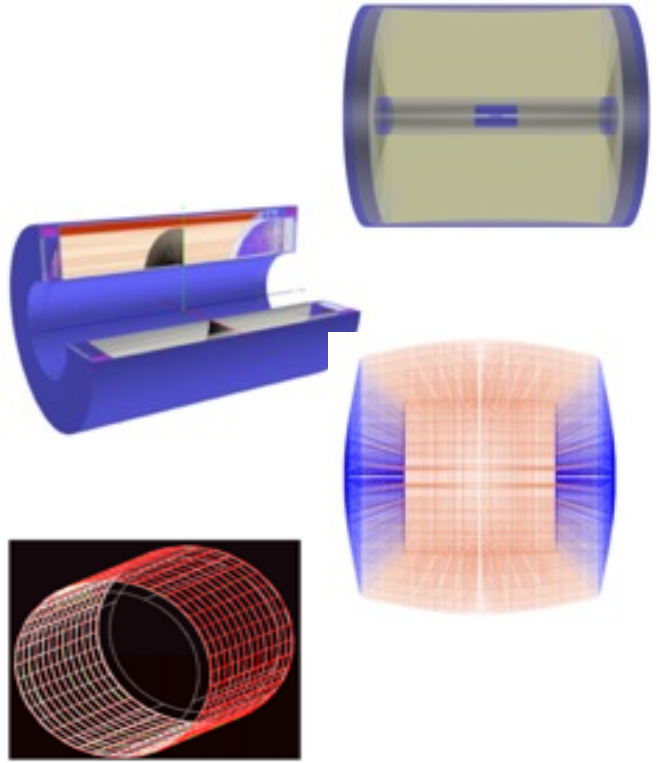
Geant4 full simulation of IDEA

- A full standalone geant4 simulation of the IDEA **Silicon Vertex (and Si wrapper), Drift Chamber, DR Calorimeter (and Muon system).**
  - **DCH** is simulated at a good level of geometry details, including detailed description of the endcaps; hit creation and track reconstruction.
  - **SVX and Si wrapper** are simulated as simple layer or overall equivalent material.
  - **Dual Readout calorimeter** is simulated, combining DR fibers and crystals (in a fully compensating segmented calorimeter.
  - **Muon detector**: in progress by the group of Ferrara (Isabella,...).

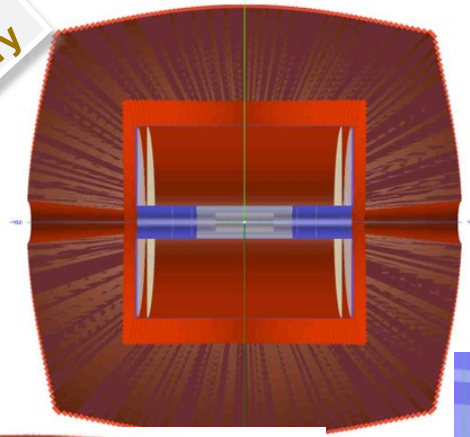


Geant4 full simulation of IDEA

The integration of the **Calorimeter geometry** description with IDEA **Silicon Vertex (SVX), Drift Chamber (DCH)** has been performed.

(calorimeter+Drift chamber)

Visualization for the Integrated Geometry



Phi volume (barrel)

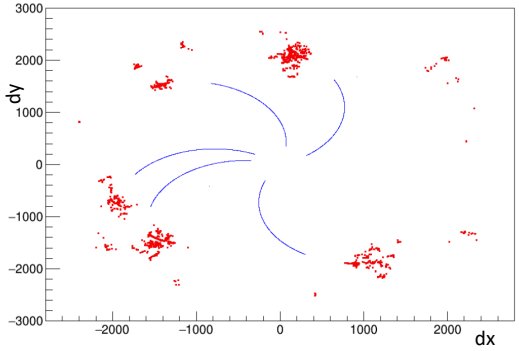
Phi volume (Endcap)

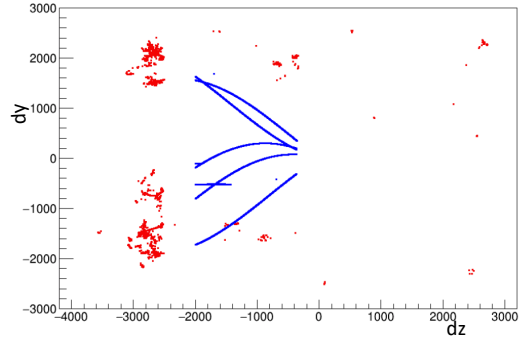
G. Tassielli, N. De Filippis, W. Elmetenawee

Hits display

https://github.com/welmeten/DriftChamberPLUSVertex/tree/Key4hep

Simple display for the hits of negative energy pions of 870 MeV as seen in the different detectors (DCH & DR calo).





IDEA Drift Chamber simulation
Migration to EDM4hep and Key4hep

Goal: port the simulation and the algorithms to a common FCC framework to develop studies, physics analysis and algorithms in the standard/final environment.

Standalone

Geant4 Monte Carlo hits
(possible other data structures)
reconstructed tracks

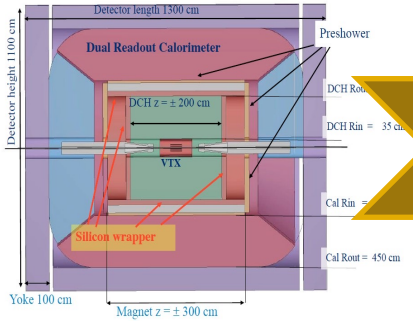
done

Covert to

FCC framework

EDM4HEP

simulation + reconstruction



To be done

port the geometry
port the algorithms
port the data format

Key4HEP

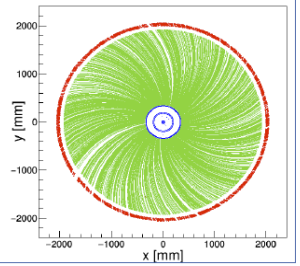
Thanks to Lia

present only the tracker hits: silicon vertex tracker, drift chamber, pre–shower

Example of simulation

particle
- 1090 events
- 1 muon/event
- theta in [88.5, 90.5] deg
- energy = 1 GeV

geometry
- Beam pipe
- SVX
- DCH
- PSHW
- magnetic field = 2.0 T



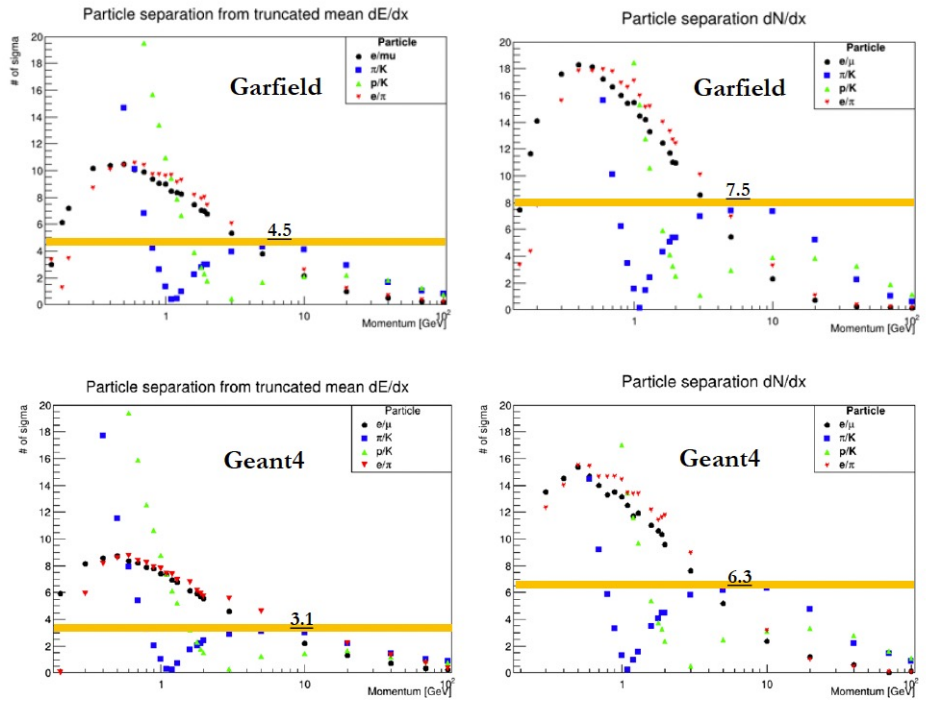
The calorimeter hit will be done by Iacopo soon

To be done

IDEA Drift Chamber simulation - Cluster Counting/Timing

- A simulation of the ionization process in 1 cm long side cell of 90% He and 10% iC4H10 has been performed in Garfield++ and Geant4.
- Geant4 software can simulate in details a full-scale detector, but the fundamental properties and the performances of the sensible elements have to be parameterized or an "ad hoc" physics model has to be implemented.
- Three different algorithms have been implemented to simulate in Geant4, *in a fast and convenient way*, the number of clusters and clusters size distributions, using the energy deposit provided by Geant4.

F. Cuna, and et al.



We are assuming a cluster counting efficiency of 100%.

To be ported inside the full detector simulation