Full simulation of the FCC-ee IDEA detector with FCCSW

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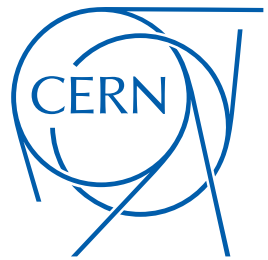
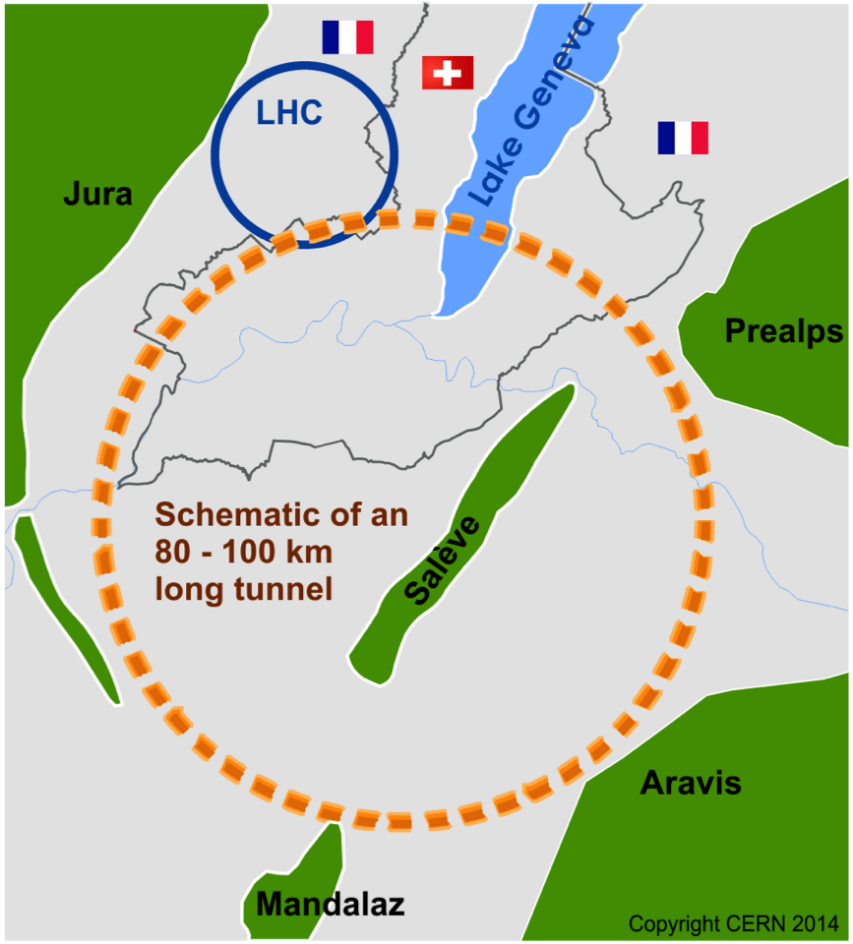


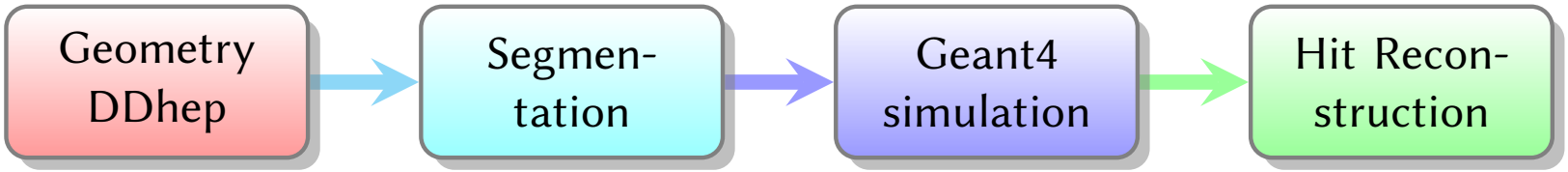
FCC Software: FCCSW

- Common software for all FCC experiments
  - ee, hh & eh
- Detector and physics studies
  - Fast & full simulations
  - One software stack from event generation to physics analysis
- Collaborative approach
  - LHC: Gaudi
  - CLIC: DD4hep
  - New solutions ⇒ where needed

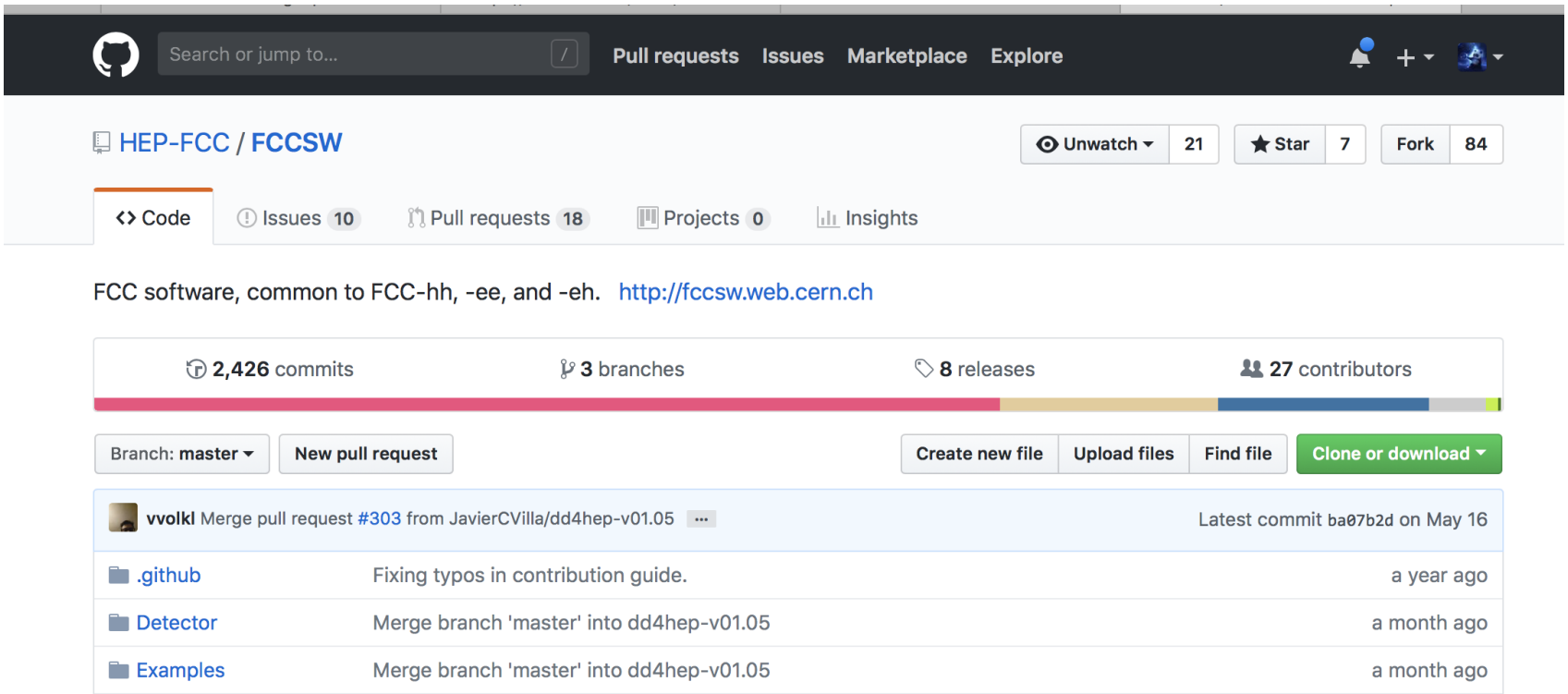


- The IDEA concept is under development within FCCSW
  - Impact of beam-induced background is under study

FCCSW simulation chain



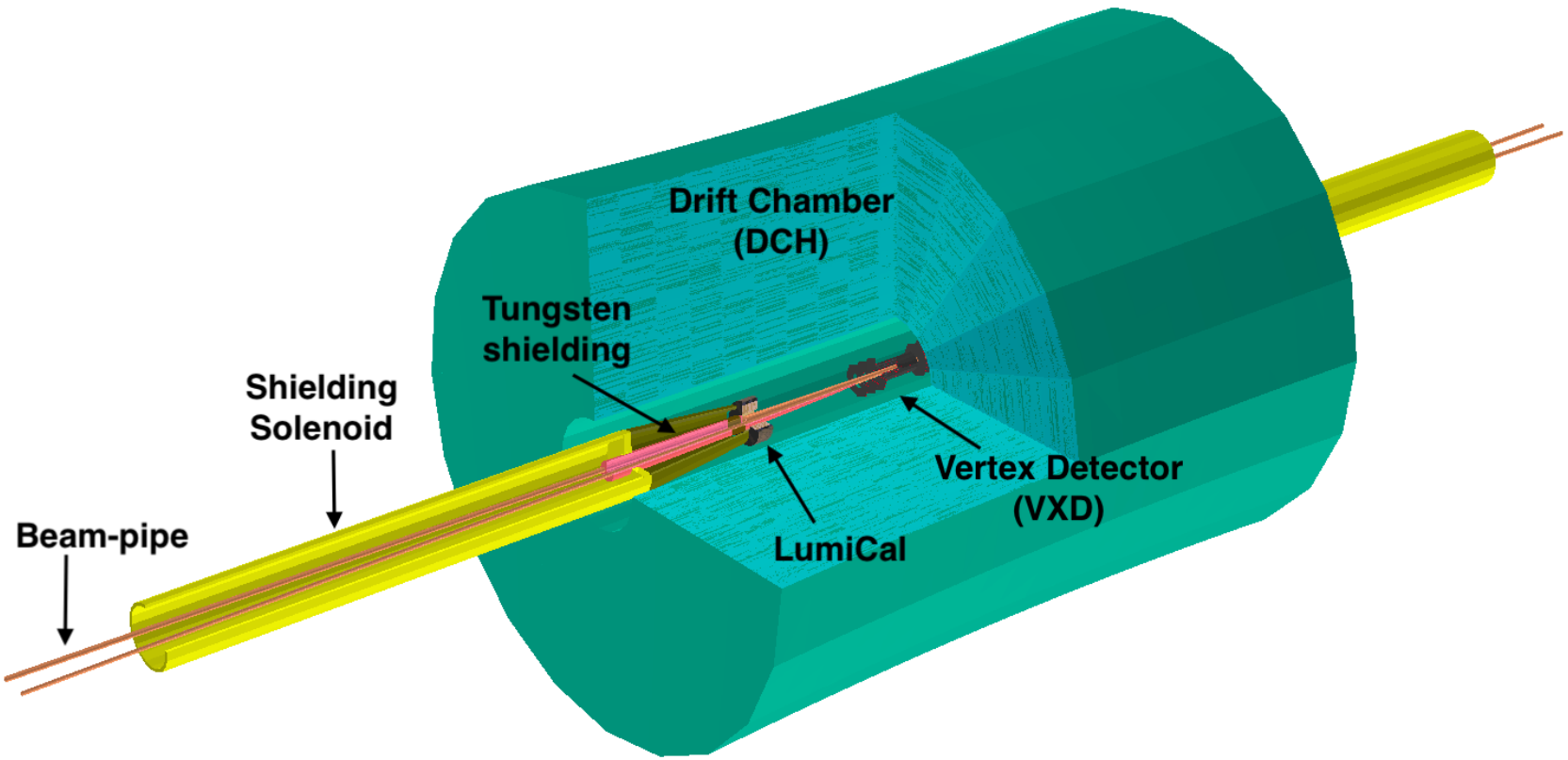
- Webpage and tutorials: http://fccsw.web.cern.ch/fccsw
- GitHub link for the code: https://github.com/HEP-FCC/FCCSW



The interaction region as implemented in FCCSW

- Beam-pipe, beam instrumentations and the vertex detector are taken from the CLD concept
  - Temporary design of VXD for the IDEA detector ⇒ ultimate goal: MAPS
- The DCH implemented from scratch in FCCSW
- Missing elements
  - Alice-like ITS, solenoid magnet, dual-readout calorimeter, instrumented return yoke

Visualisation with FCCSW

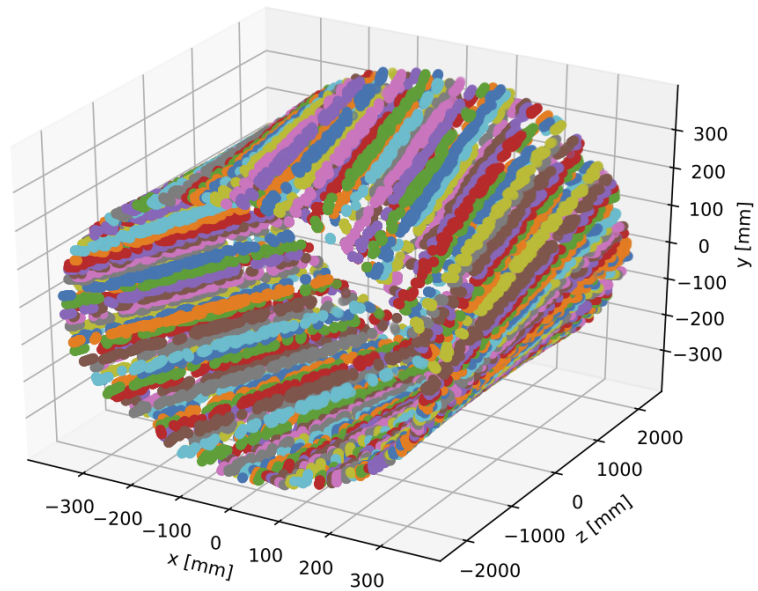


The drift chamber (DCH)

Parameters of the DCH

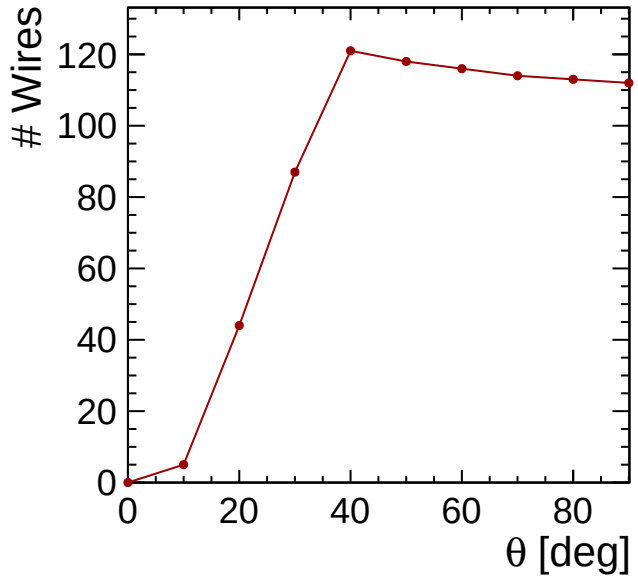
Length	4500 mm
Inner radius	345 mm
Outer radius	2000 mm
Number of sensitive wires	56448
Single cell resolution (transverse plane)	0.1 mm

- The segmentation concept is used to access the information on the positions of the wire

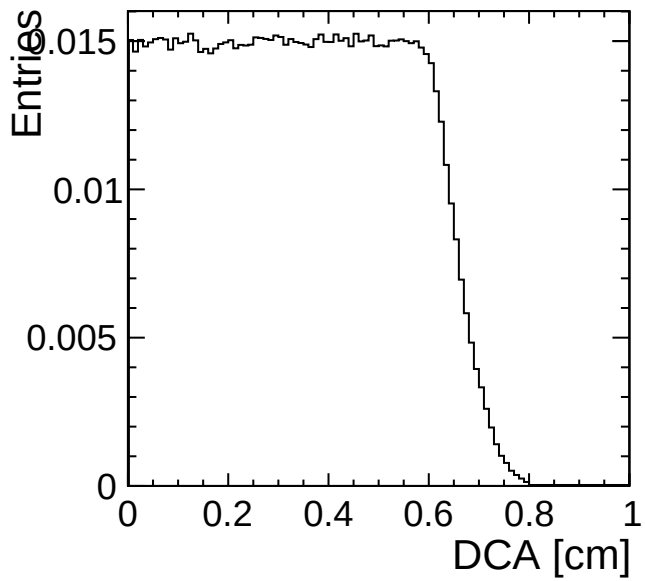


Coverage of the drift chamber

- The number of wires as a function of θ
- The coverage in the forward region will be improved by the placement of disks



- The distance of the closest approach (DCA)
- Provides the information on the drift time
- Maximum drift time (corresponding to the corners): 400 ns

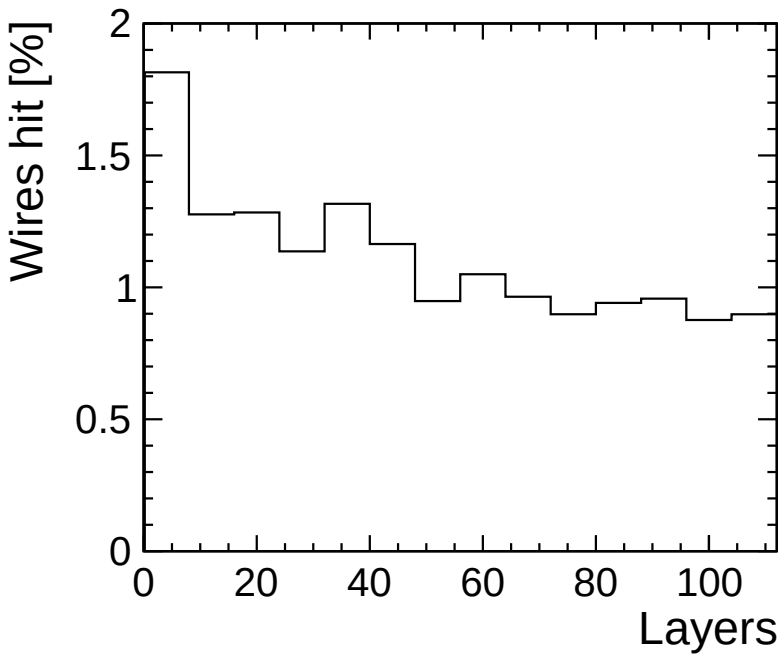


Beam-induced backgrounds at FCC-ee

- Incoherent e^+e^- pairs
- $\gamma\gamma \rightarrow$ hadrons
- Synchrotron radiation (SR)

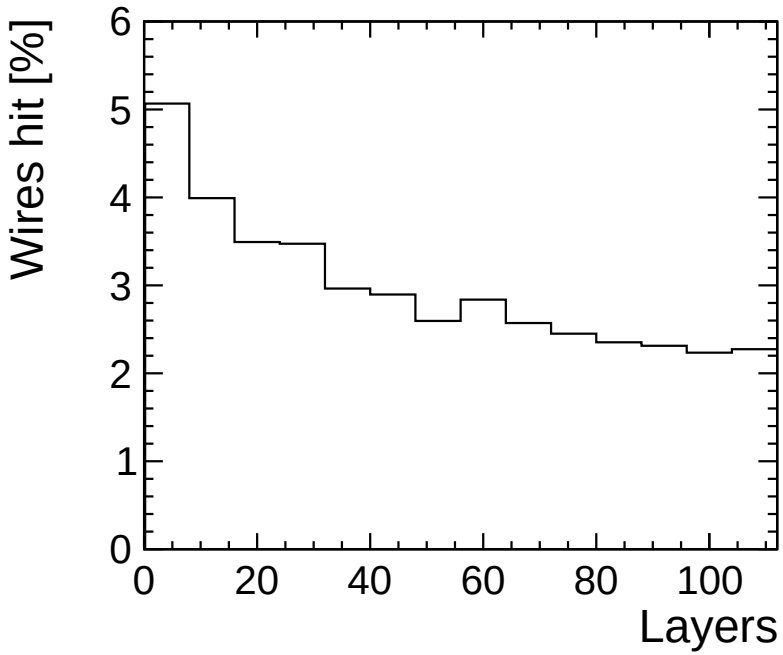
Incoherent e^+e^- pairs

E_{cm} = 91.2 GeV (Z stage)



- Average occupancy: 1.1%

E_{cm} = 365 GeV (top stage)

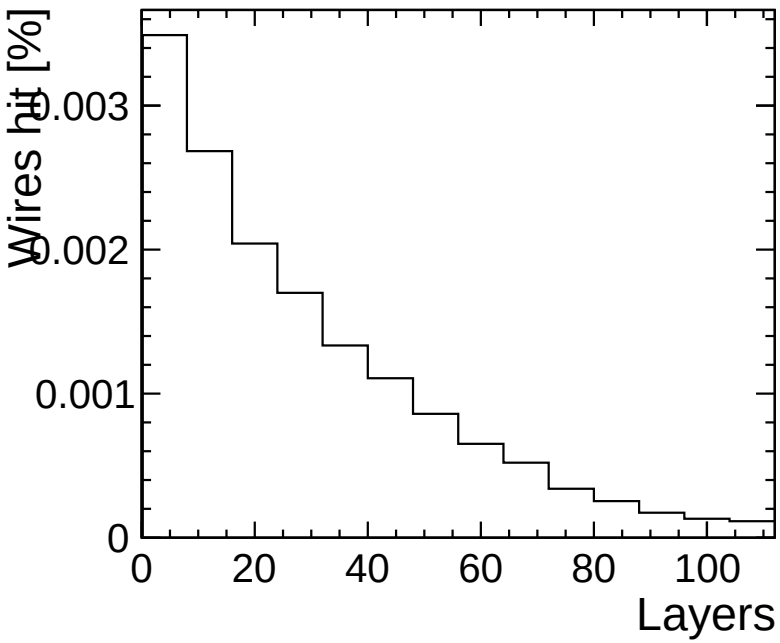


- Average occupancy: 2.9%

- The effect of this background does not pose problem for the track reconstruction.

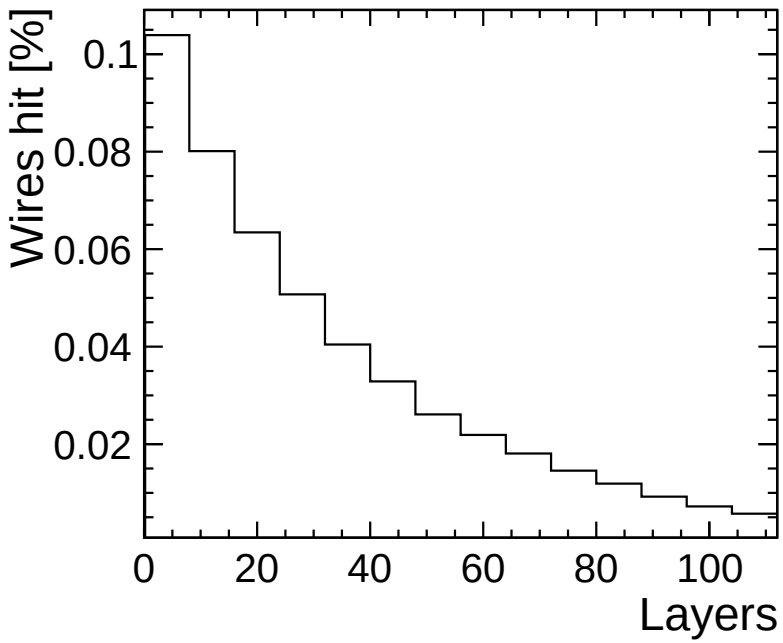
$\gamma\gamma \rightarrow$ hadrons

E_{cm} = 91.2 GeV (Z stage)



- Average occupancy: 0.001%

E_{cm} = 365 GeV (top stage)

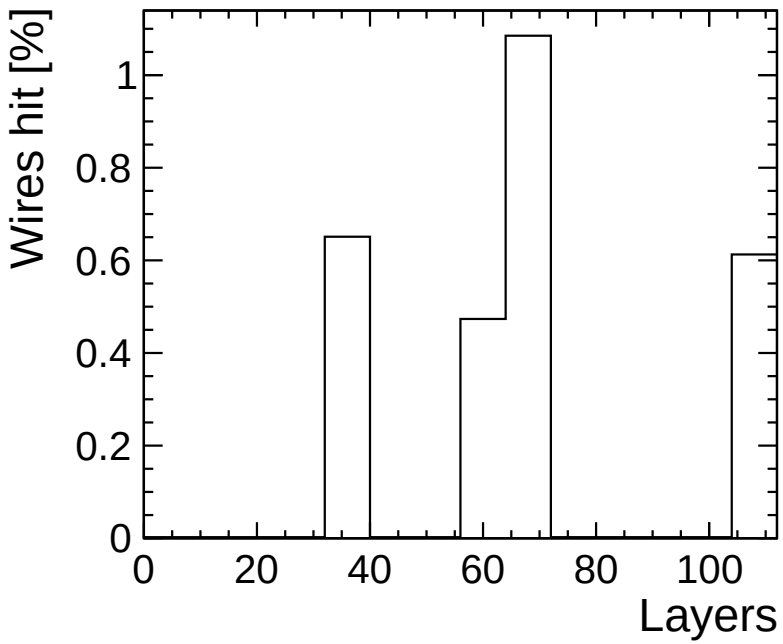


- Average occupancy: 0.035%

- Very small effect $\Rightarrow$ no problem for tracking

Synchrotron radiation: E_{cm} = 365 GeV

- The shielding stops most of the SR photons.
- Average occupancy: 0.2%



Summary: background occupancy in DCH

Background	E_{cm} = 91.2 GeV	E_{cm} = 365 GeV
e^+e^- pair background	1.1%	2.9%
$\gamma\gamma \rightarrow$hadrons	0.001%	0.035%
Synchrotron radiation	-	0.2%

Conclusions

- The FCCSW is ready for the full simulation of the IDEA detector
- Background estimations in full simulations have been performed for the drift chamber
  - Low effect
- Contributions for the implementation of other detectors are more than welcome
  $\Rightarrow$ Dual-readout calorimeter