

Design of a drift chamber tracking system for the IDEA experiment at FCC-ee

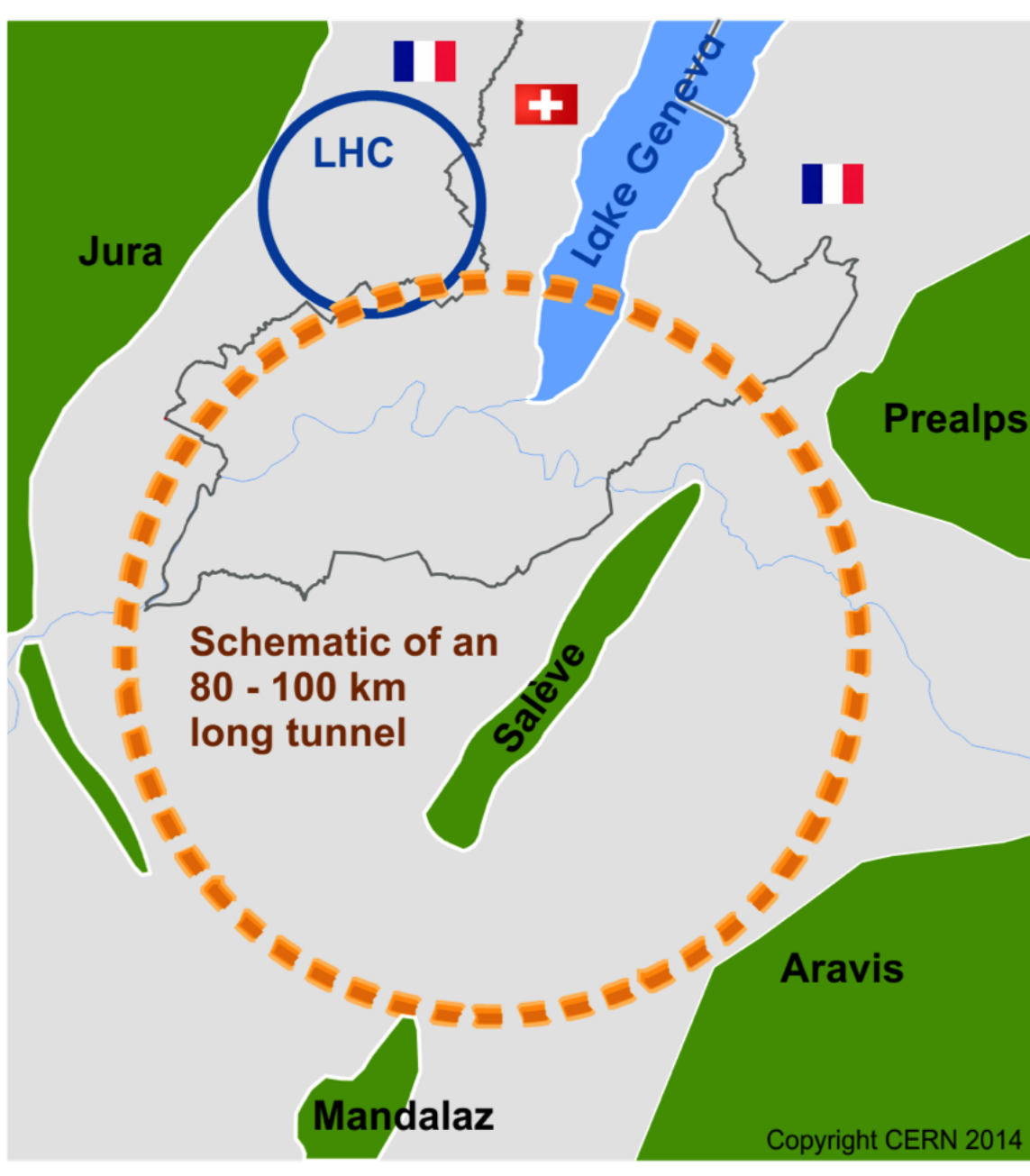
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The Future Circular Collider Experiment (FCC)

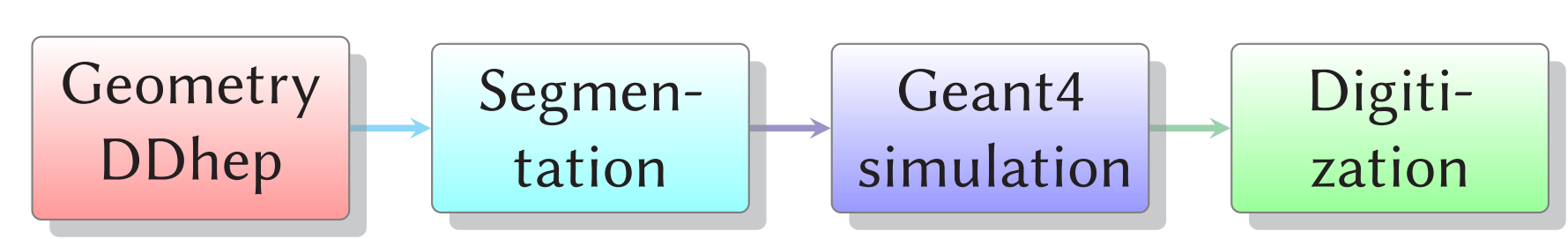
- A future possibility for the post-LHC era
- 3 options of circular colliders
 - FCC-ee: electron - positron collisions
 - FCC-hh: proton - proton collisions
 - FCC-eh: electron - proton collisions
- ~100 km tunnel in Geneva area
- FCC-ee collider parameters:

| Stages | Z | WW | H (ZH) | t \bar{t} |
|----------------------------|------|-----|--------|-------------|
| Beam energy [GeV] | 45.6 | 80 | 120 | 182.5 |
| Average bunch spacing [ns] | 19.6 | 163 | 994 | 3396 |



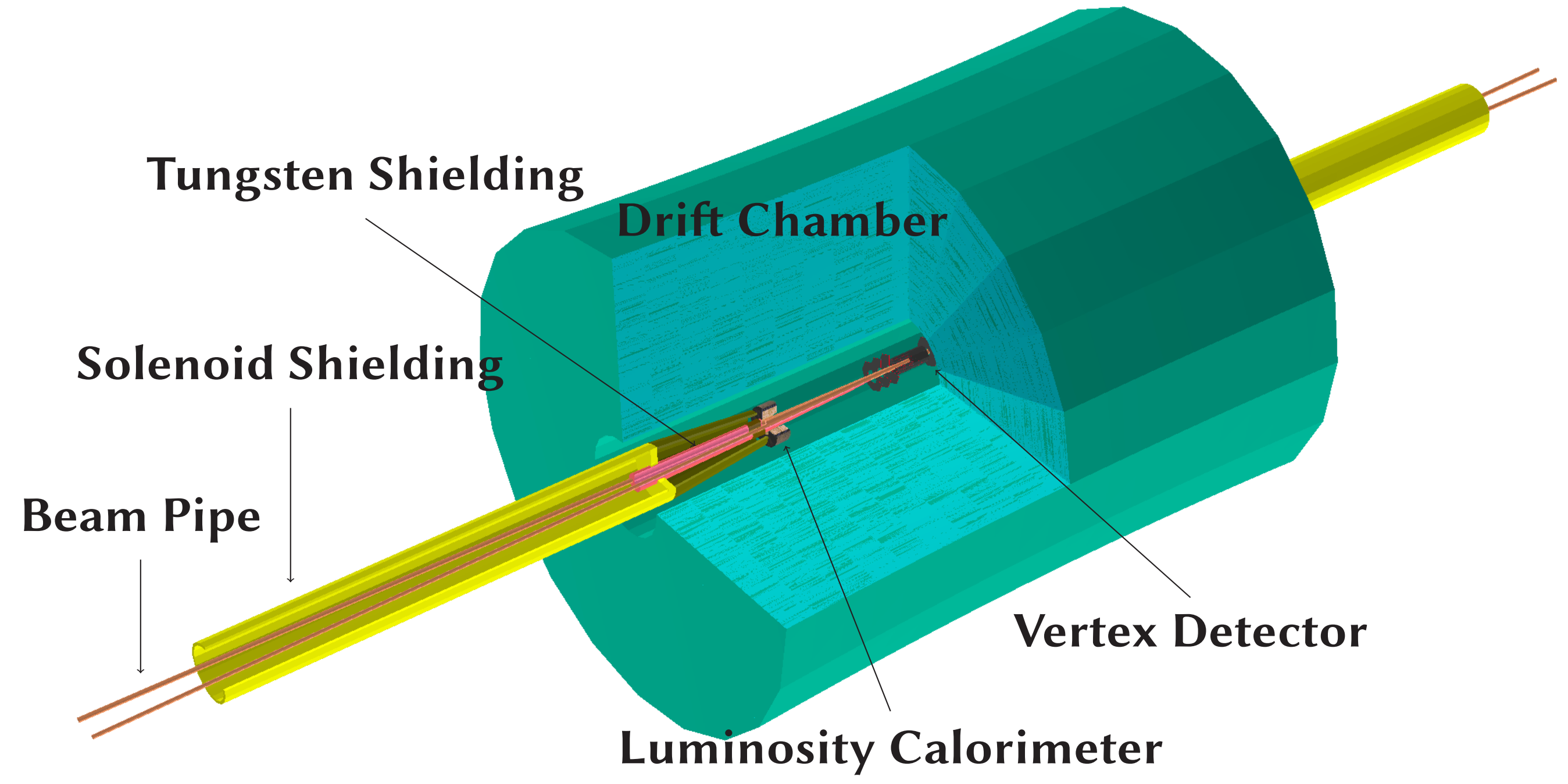
FCCSW: Physics and Detector simulations with FCCSW

- 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 with other CERN experiments
 - Gaudi from LHC
 - DD4hep from CLIC & LHCb
 - New solutions where needed



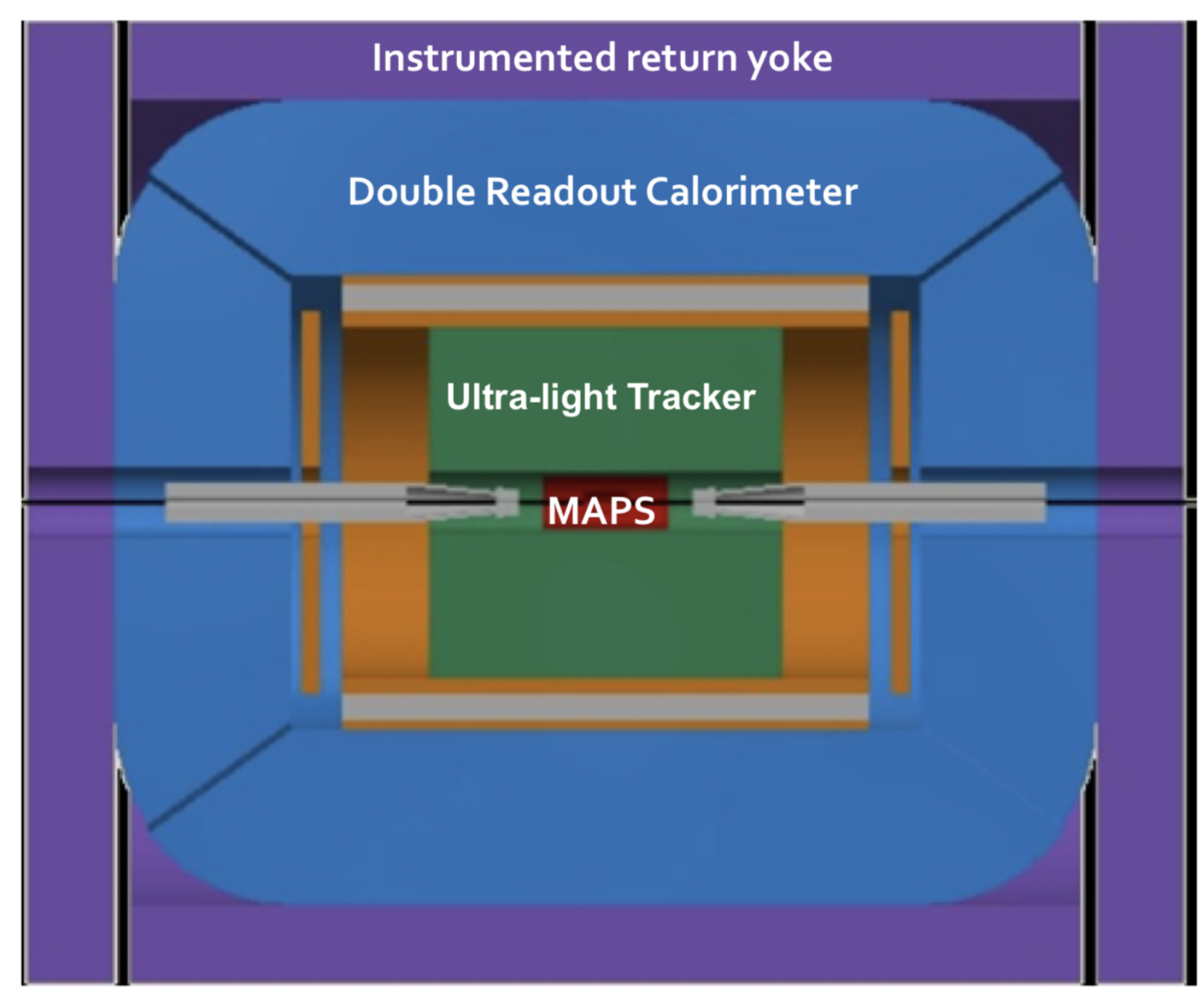
Simulation of the IDEA drift chamber within FCCSW

- The IDEA detector as simulated with FCCSW



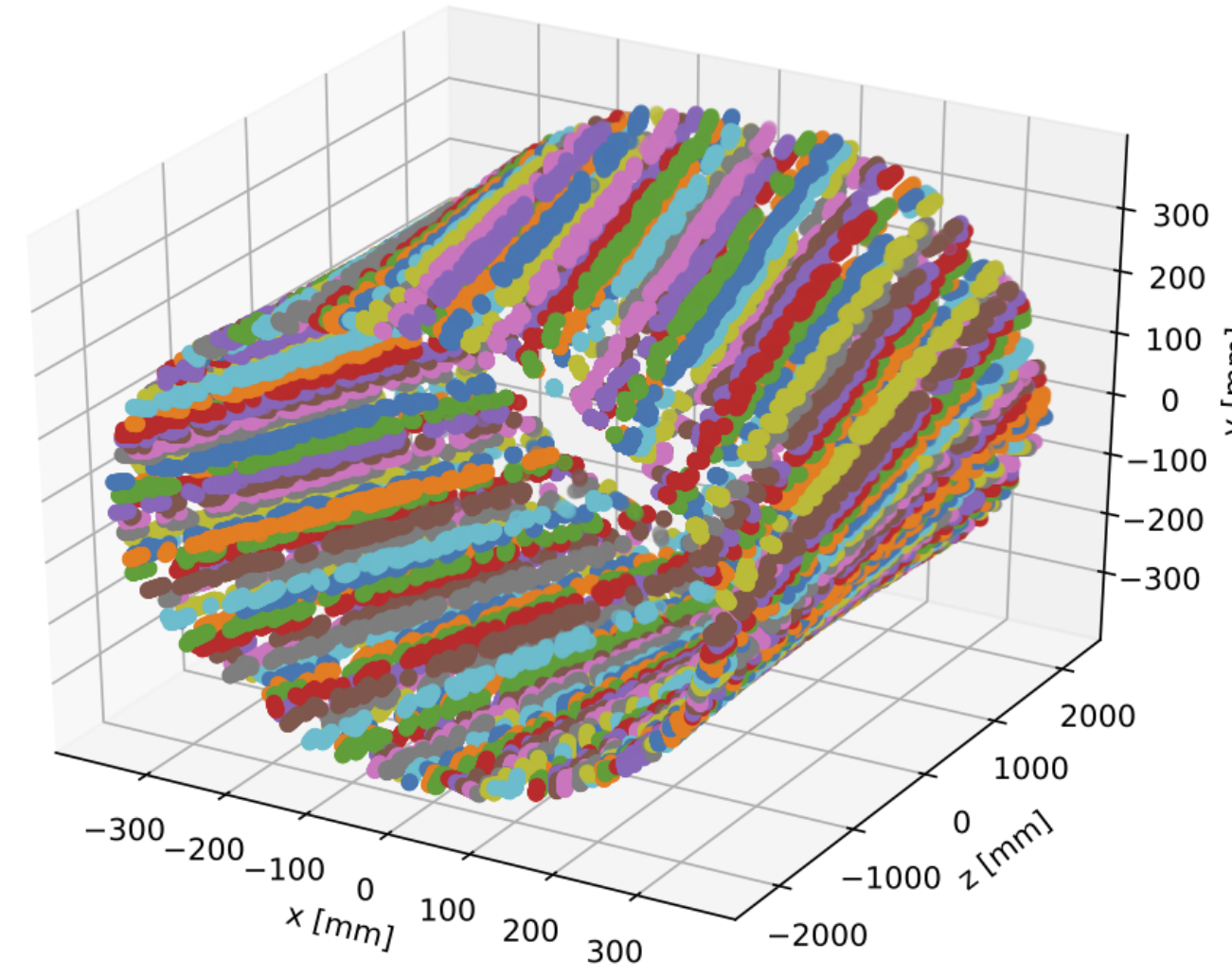
The IDEA detector concept for FCC-ee

- The IDEA detector is one of the two detector concepts for the FCC-ee experiment
- Ultimate goal for the IDEA detector concept
 - Vertex detector: MAPS
 - Ultra-light drift chamber with particle identification
 - Double readout calorimetry
 - Additional silicon disk layers placed in the space between the drift chamber and the dual readout calorimeter to increase the forward coverage
 - 2 T solenoidal magnetic field
 - Instrumented return yoke
 - Large tracking volume ($R \sim 8$ m) for very weakly coupled (long-lived) particles

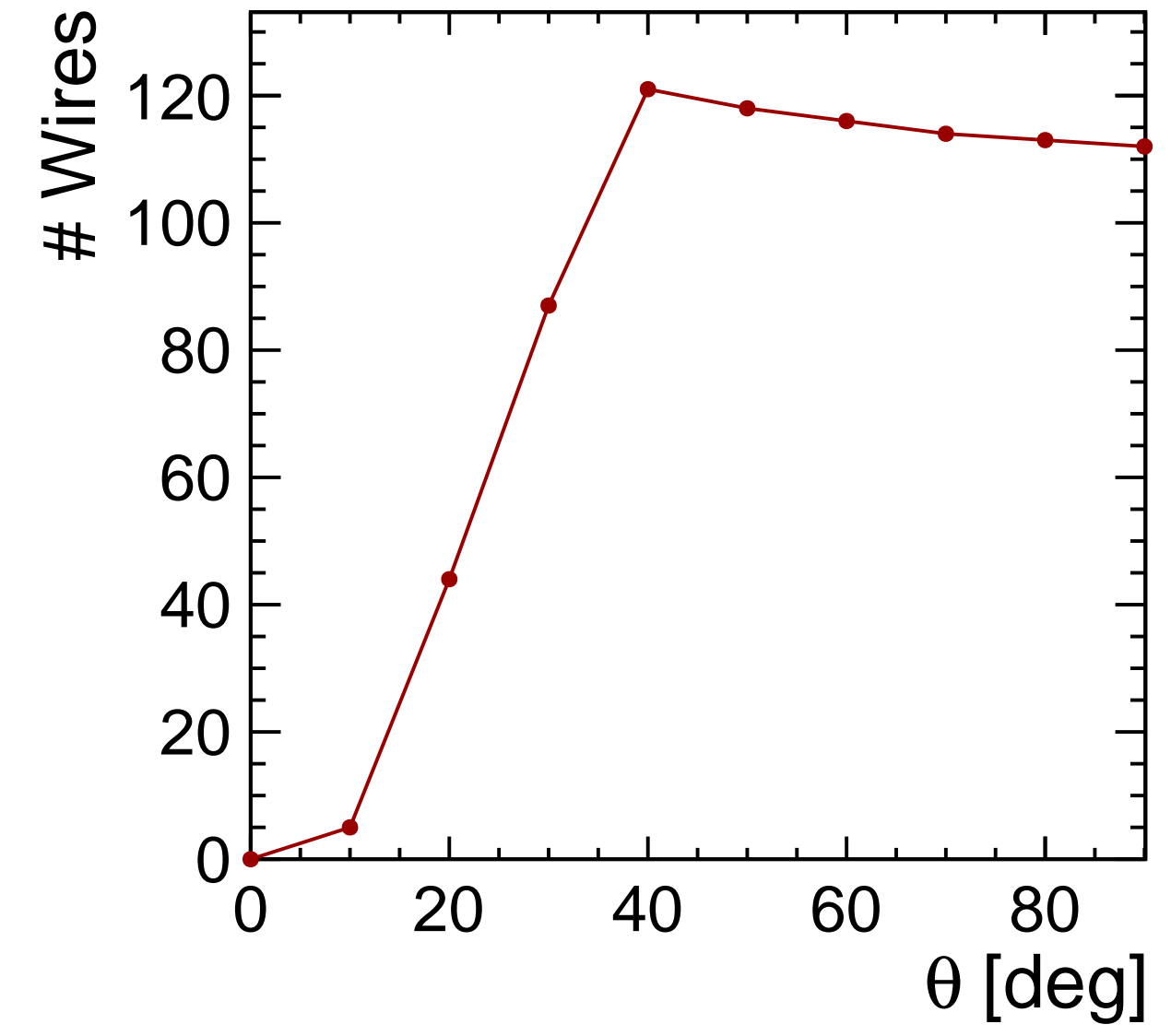


The simulation of the drift chamber & coverage

- The first layer of the drift chamber
- Wires are illustrated using different colors
- The wires are rotated by a stereo angle to increase the hit resolution



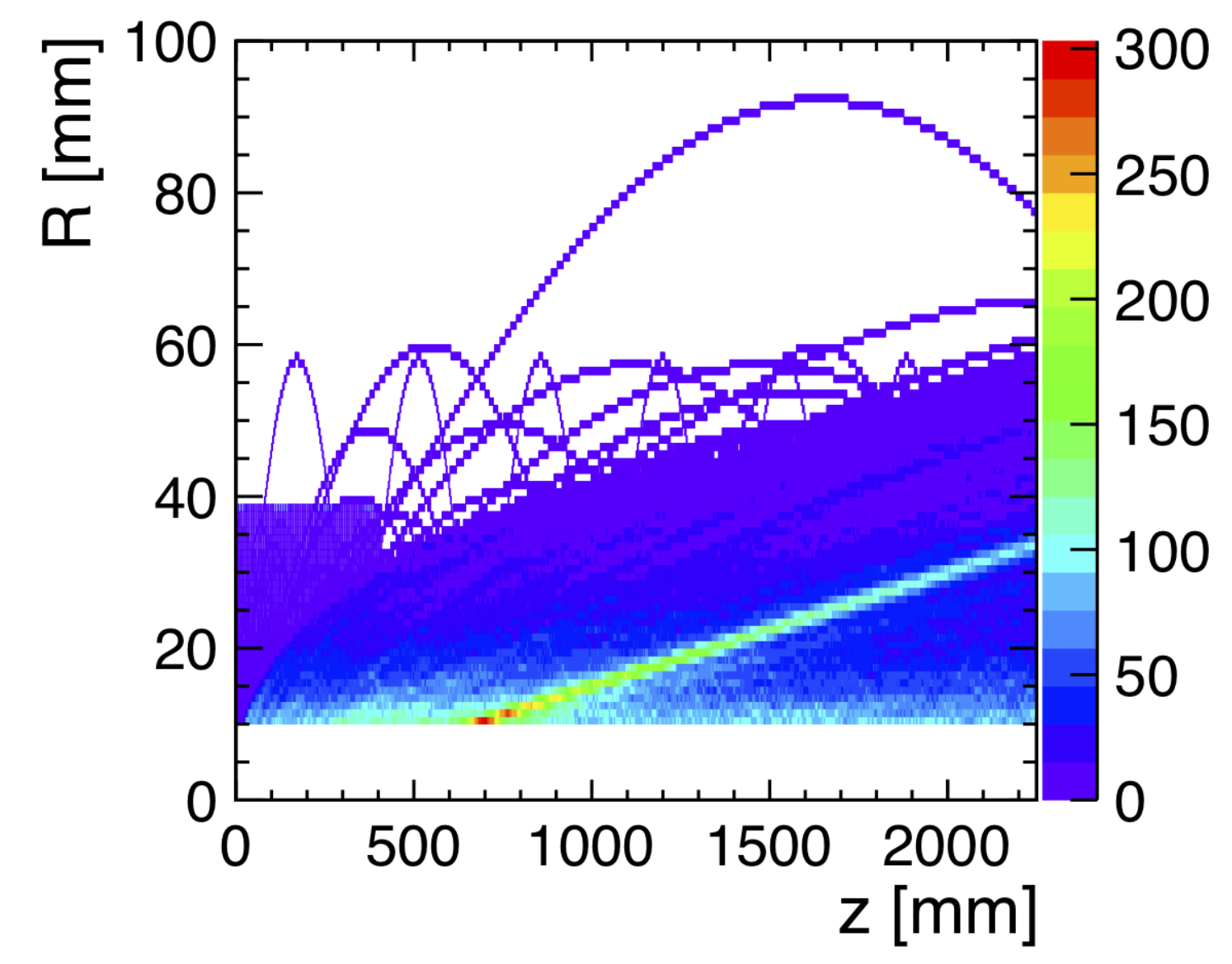
- In the barrel region, the drift chamber has a high coverage of ~ 112 wires in average.
- In the forward region, silicon disks are foreseen to increase the number of layers measuring the tracks.



Main sources of beam-induced backgrounds

- Three main sources of beam-induced backgrounds
 - Incoherent e^+e^- pairs du to bremsstrahlung photons \Rightarrow highest source of background
 - $\gamma\gamma \rightarrow$ hadrons \Rightarrow Expected to have a very low impact
 - Synchrotron radiation (SR) \Rightarrow Dictates the design of the interaction region (IR)
 - Defines the beampipe radius, the design of the shielding (in Tungsten)
 - Mostly stopped by the shielding, few SR photons can hit the detector

- The trajectory of the e^+e^- pairs in a 2 T magnetic field.



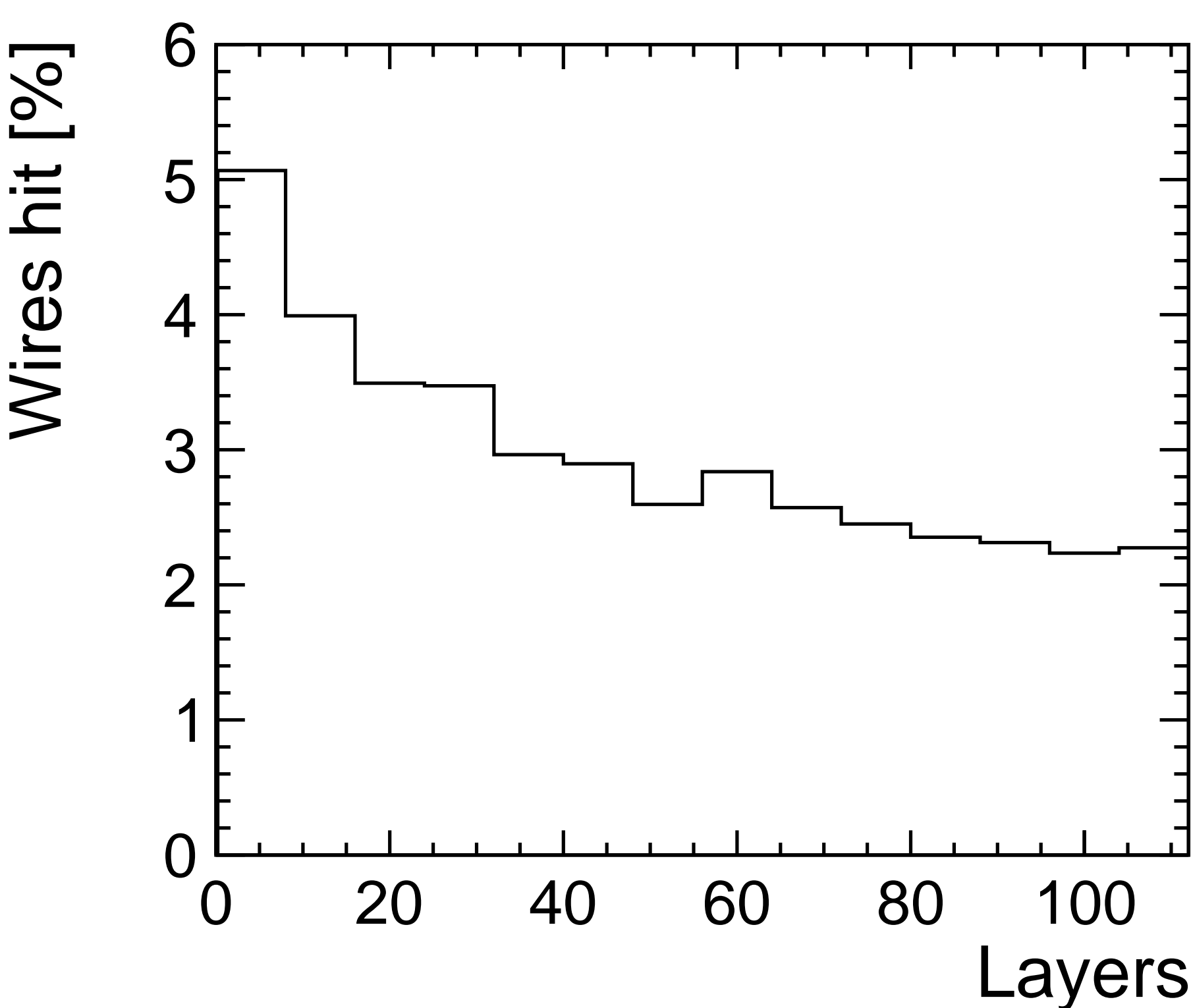
Summary of beam-induced backgrounds & conclusions

| Background | Average occupancy | |
|------------------------------------|---------------------|--------------------|
| | $E_{cm} = 91.2$ 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% |

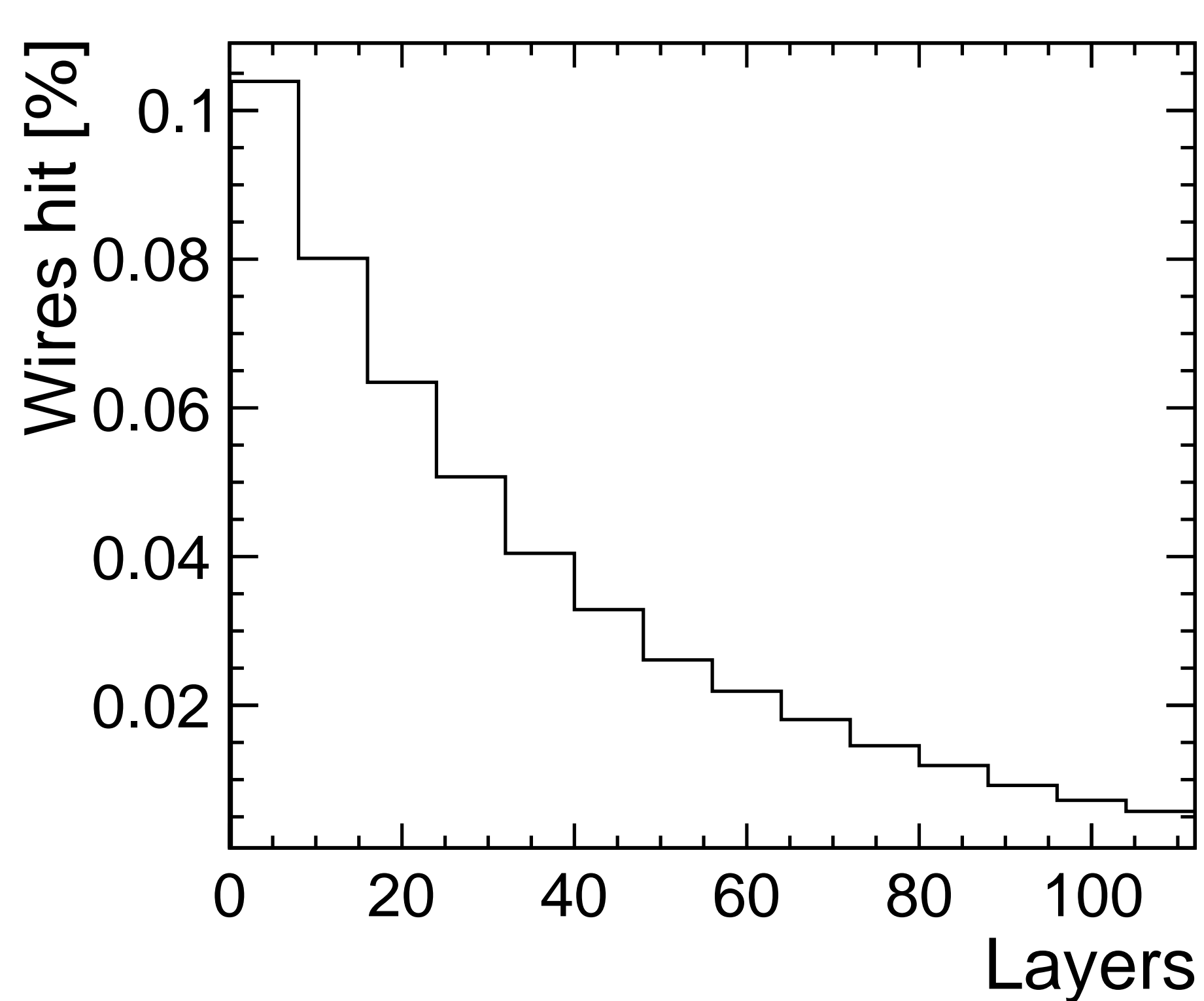
- The overall impact remains low and the results are promising for the track reconstruction with this detector.

3 main sources of beam-induced backgrounds at the top stage

- Incoherent e^+e^- pairs



- $\gamma\gamma \rightarrow$ hadrons



- $\gamma\gamma \rightarrow$ hadrons

