Physics and Innovations for Future Experiments

Future Circular Collider

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Lavori in corso

23 Febbraio 2022

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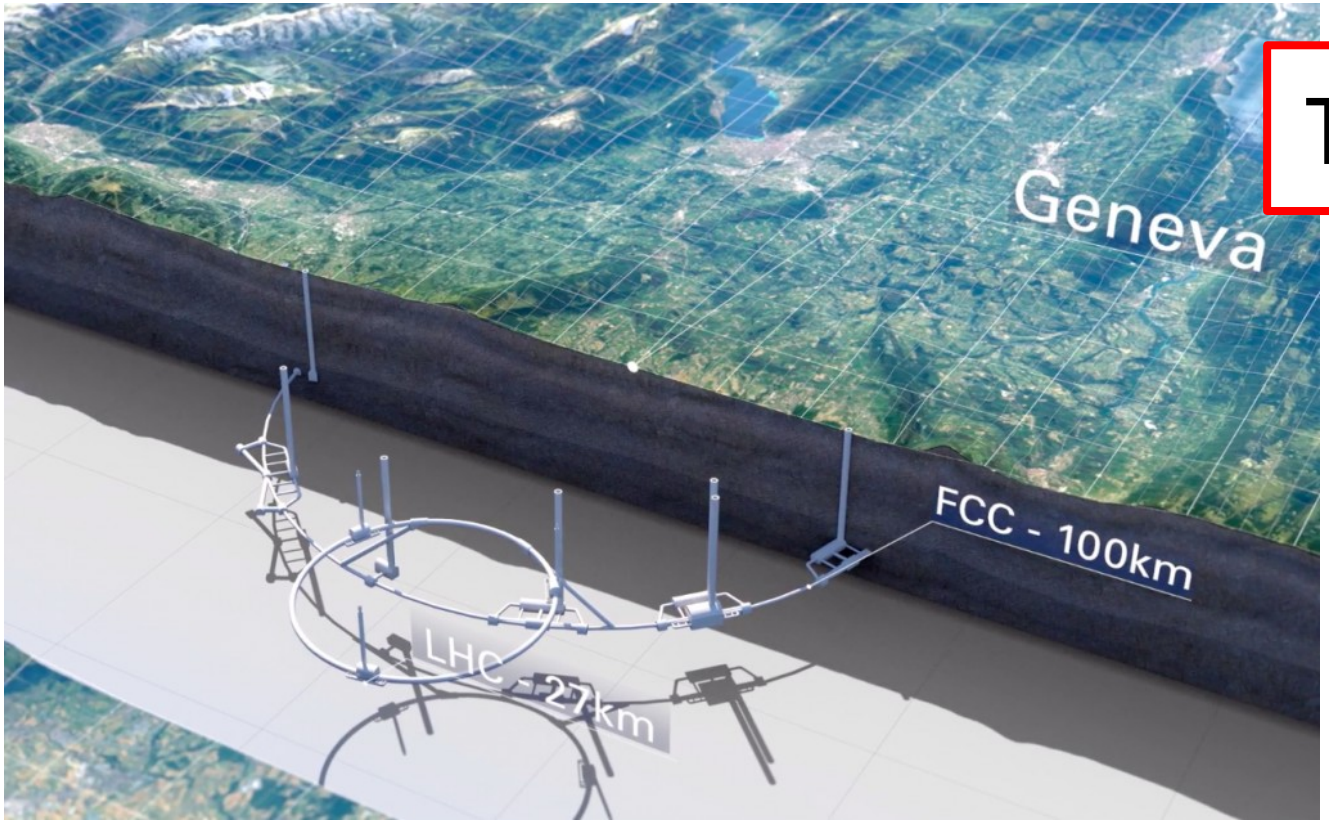
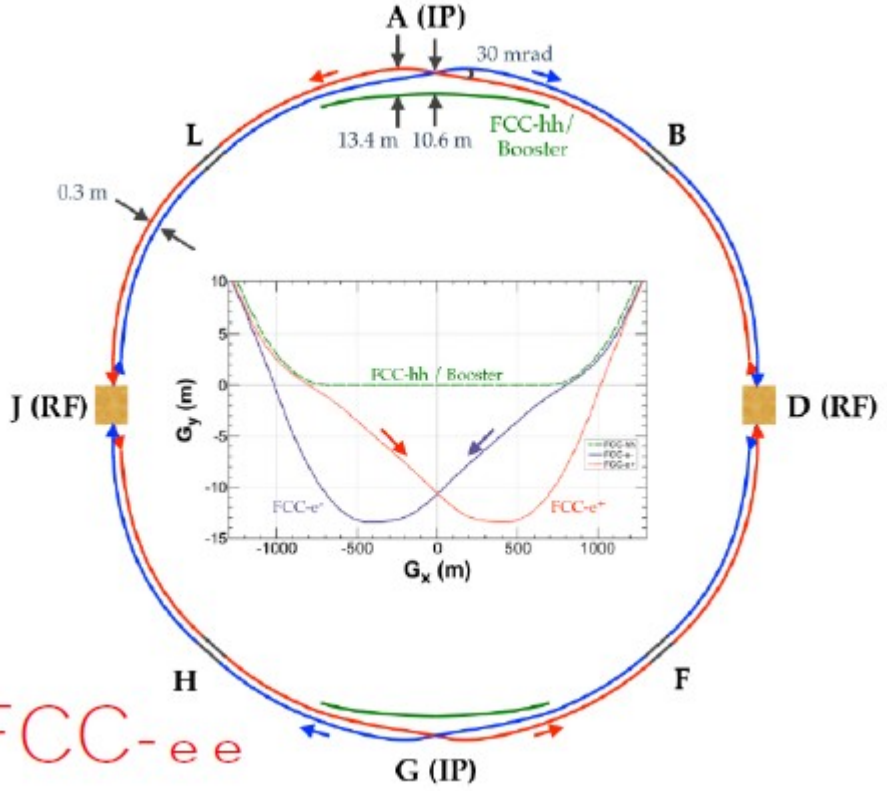
Sezione di Ferrara

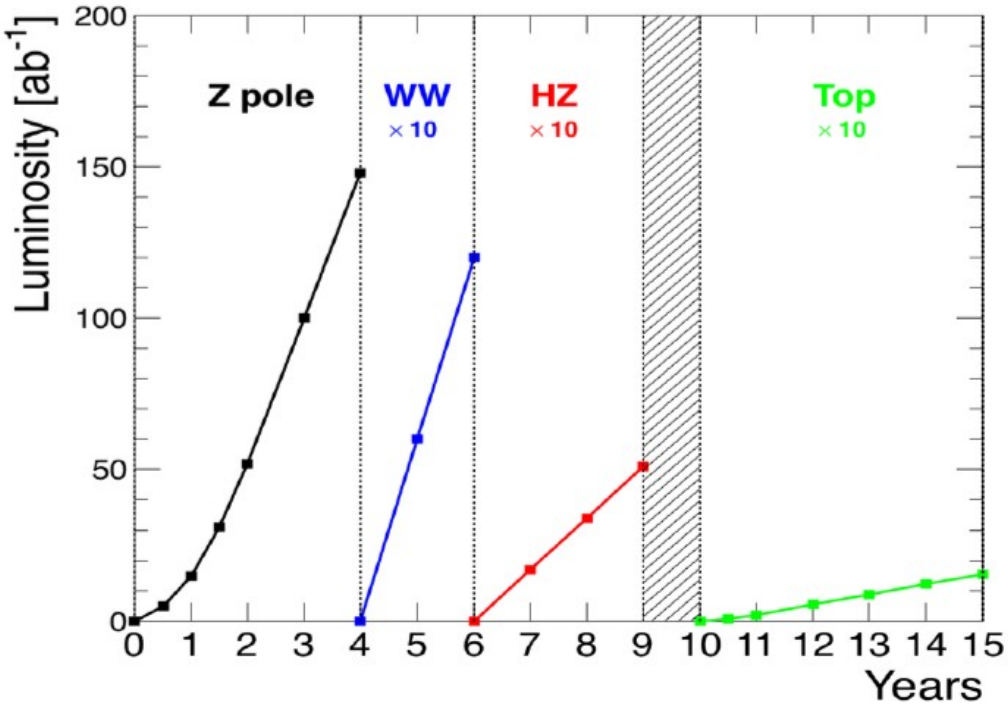
Dipartimento di Fisica e Scienze della Terra

The what



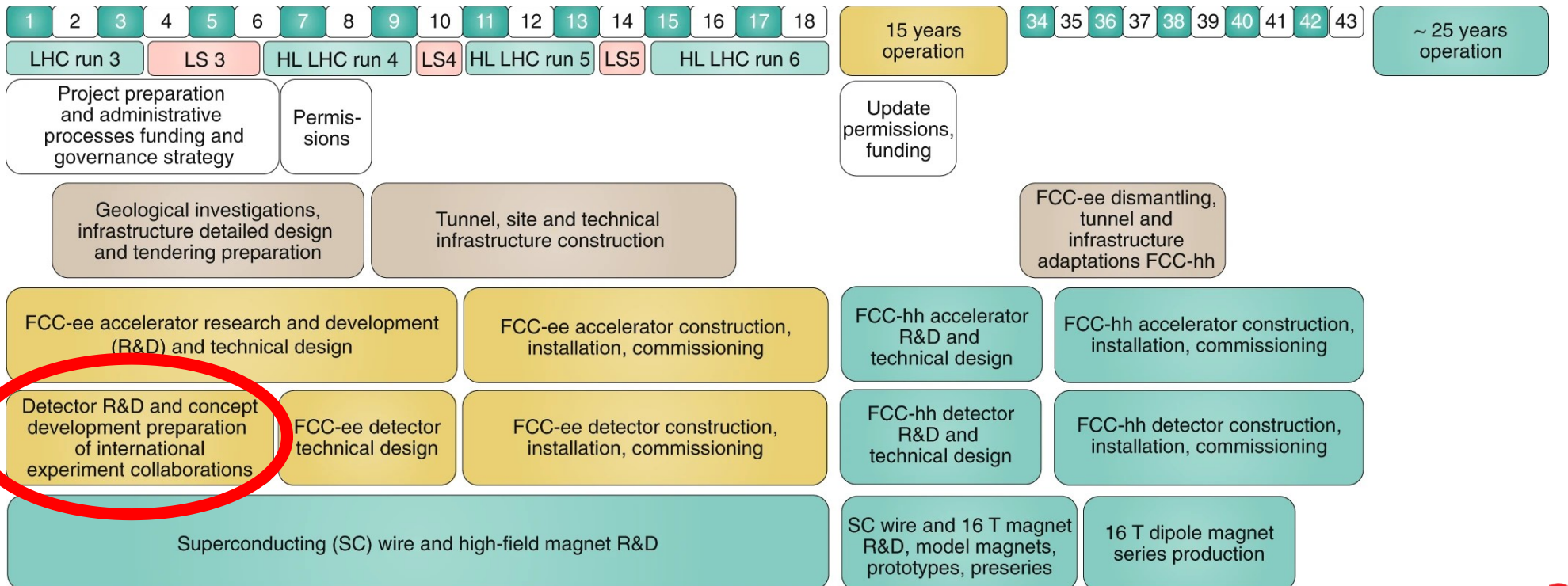
1) Stage 1: FCC-ee (Z, W, H, tt) as Higgs factory, electroweak & and top factory at highest luminosities
2) Stage 2: FCC-hh (~100 TeV) as natural continuation at energy frontier, with ion and eh options



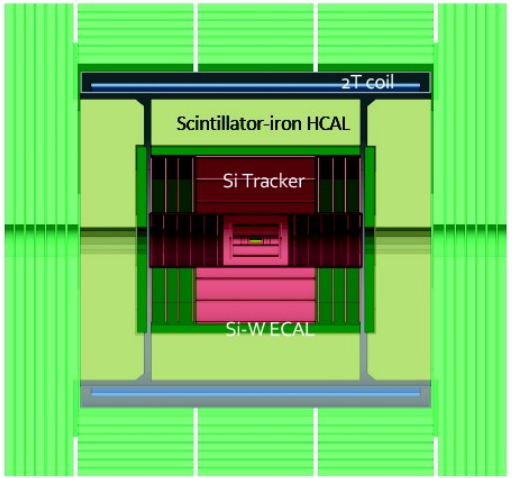


1) Stage 1: FCC-ee (Z, W, H, tt) as Higgs factory, electroweak & and top factory at highest luminosities
2) Stage 2: FCC-hh (~100 TeV) as natural continuation at energy frontier, with ion and eh options

The plan

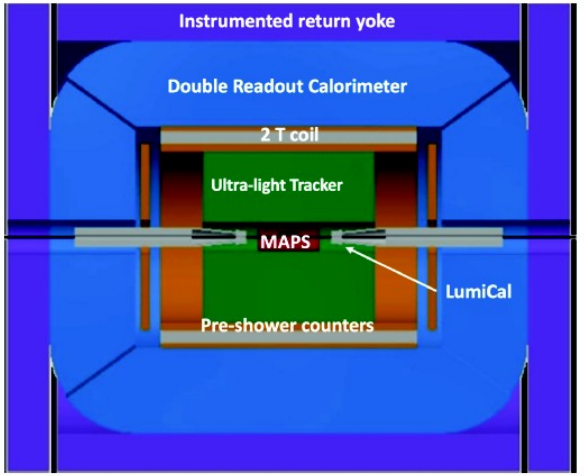

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
LHC run 3
LS 3
HL LHC run 4
LS4
HL LHC run 5
LS5
HL LHC run 6
15 years operation
34 35 36 37 38 39 40 41 42 43
~ 25 years operation
Project preparation and administrative processes funding and governance strategy
Permis-sions
Update permissions, funding
Geological investigations, infrastructure detailed design and tendering preparation
Tunnel, site and technical infrastructure construction
FCC-ee dismantling, tunnel and infrastructure adaptations FCC-hh
FCC-ee accelerator research and development (R&D) and technical design
FCC-ee accelerator construction, installation, commissioning
FCC-hh accelerator R&D and technical design
FCC-hh accelerator construction, installation, commissioning
Detector R&D and concept development preparation of international experiment collaborations
FCC-ee detector technical design
FCC-ee detector construction, installation, commissioning
FCC-hh detector R&D and technical design
FCC-hh detector construction, installation, commissioning
Superconducting (SC) wire and high-field magnet R&D
SC wire and 16 T magnet R&D, model magnets, prototypes, preseries
16 T dipole magnet series production

CDR: Two Complementary Detector Designs



CLD

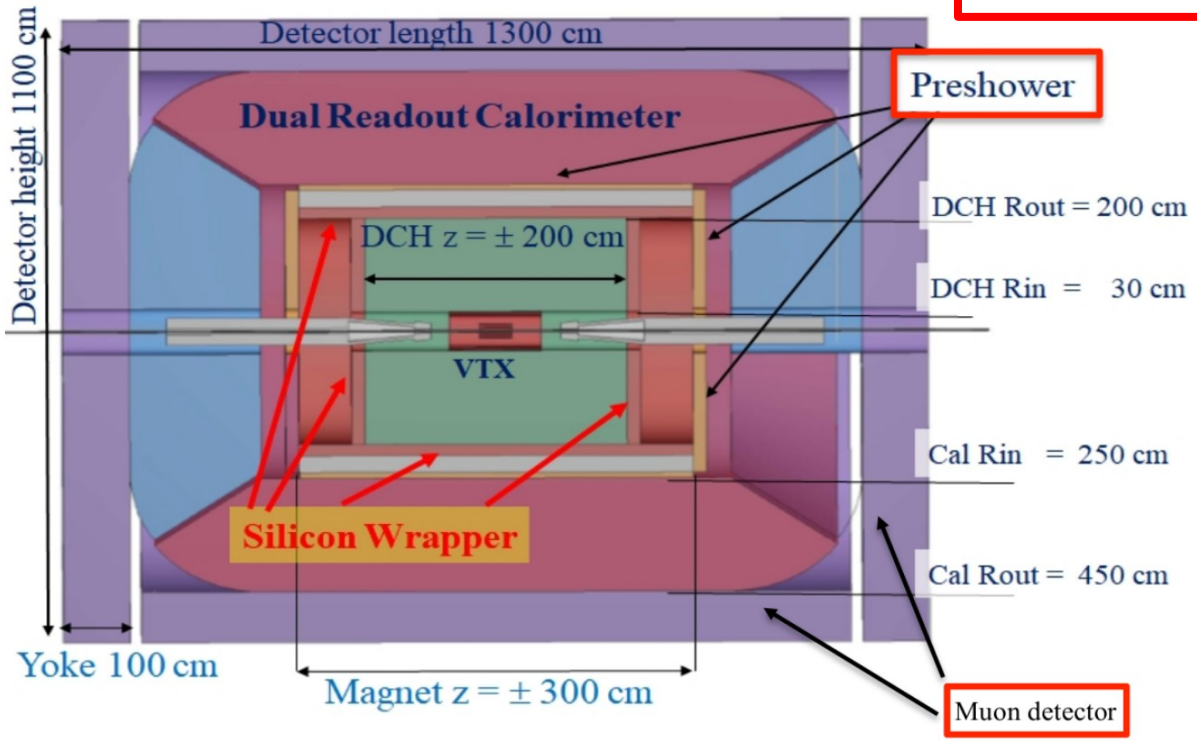
- Consolidated option based on the detector design developed for CLIC
  - All silicon vertex detector and tracker
  - 3D-imaging highly-granular calorimeter system
  - Coil *outside* calorimeter system
- Proven concept, understood performance

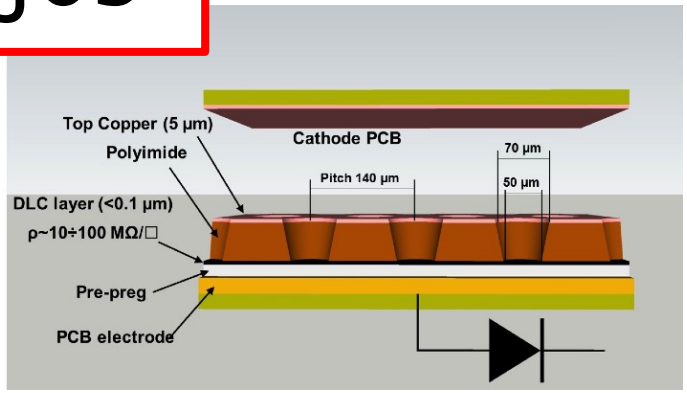


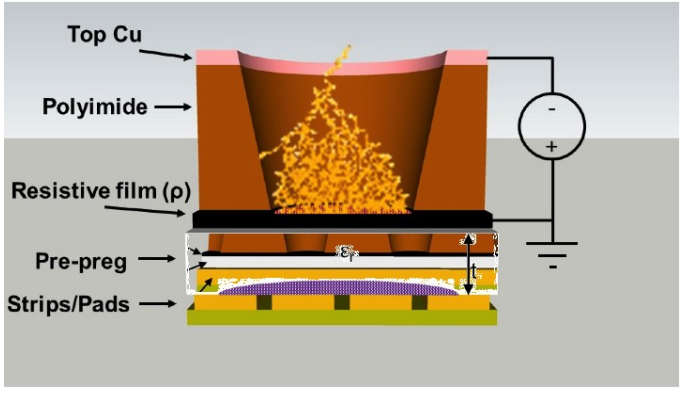
IDEA

- New, innovative, possibly more cost-effective design
  - Silicon vertex detector
  - Short-drift, ultra-light wire chamber
  - Dual-readout calorimeter
  - Thin and light solenoid coil *inside* calorimeter system

The job







Preshower and the Muon Systems are designed with the μRWELL technology

The team

CERN

Bologna

LNF

Ferrara

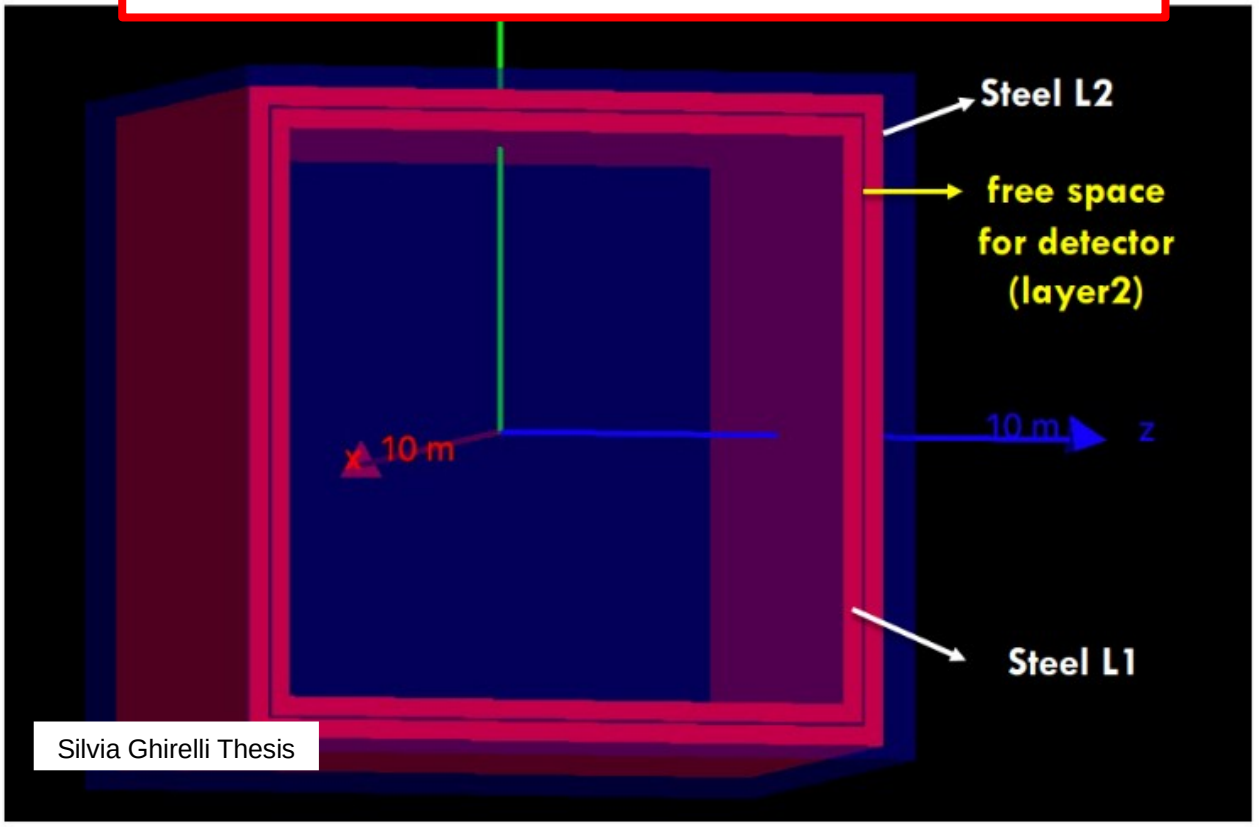
Pisa

Bari

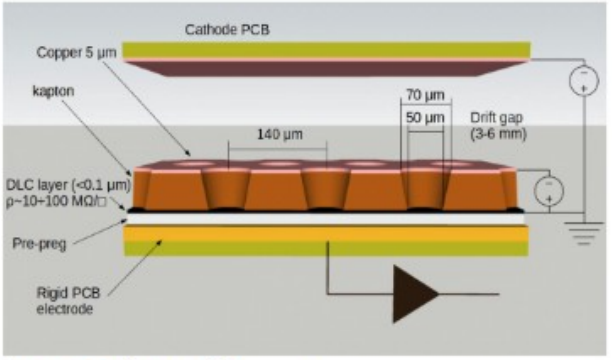
Padova

Lecce

Detector simulation



Silvia Ghirelli Thesis



From sketch

to simulation

and tuning

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Simulating the charge dispersion phenomena in Micro Pattern Gas Detectors with a resistive anode

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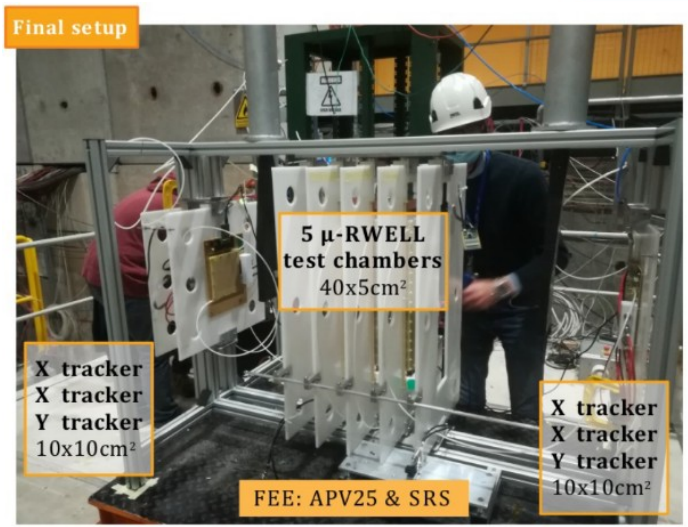
$$\rho(x,y,t) = \frac{Nq_e}{2\pi(2ht+w^2)} exp\left[-\left(x^2+y^2\right)/\left(2\left(2ht+w^2\right)\right)\right]$$

$$\rho(x,t) = \frac{q}{\sqrt{2\pi}\left[\sigma_0\left(1+\frac{t-t_0}{\tau}\right)\right]} exp\left[-\frac{(x-x_0)^2}{2\sigma_0^2\left(1+\frac{t-t_0}{\tau}\right)^2}\right]\Theta(t-t_0)$$

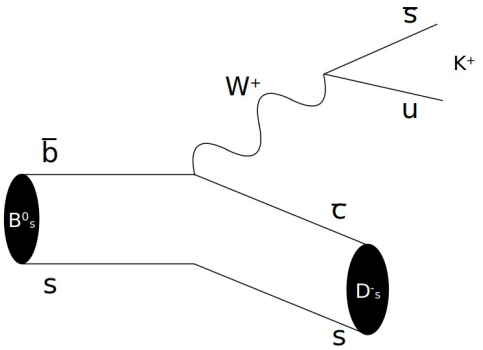
Time-dependent model adapted to a one-dimensional readout

IONIZATION
DETECTOR GAIN
ELECTRON DRIFT
RESISTIVE
INDUCTION
ELECTRONICS
RECONSTRUCTION
ANALYSIS

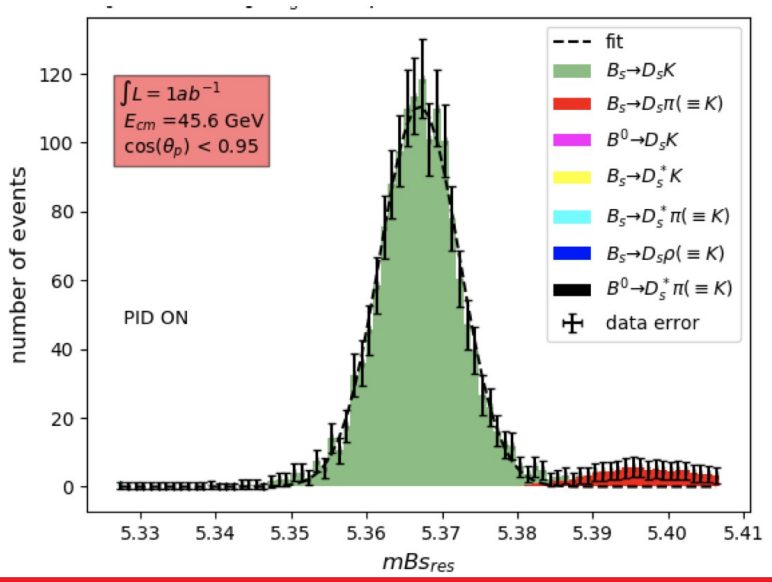


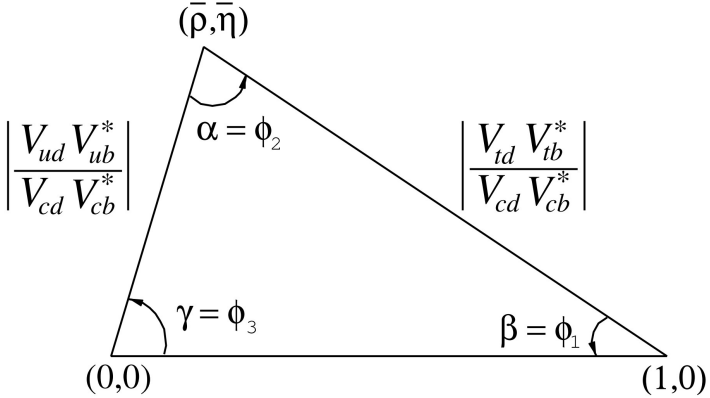
140-180 GeV/c muon and pion beam

Analysis and benchmark



$B^0_s \rightarrow D^{\pm}_s K^{\mp} \rightarrow (KK\pi^{\pm})\, K^{\mp}$





First FCC-Italy Workshop

Roma

21-22 marzo 2022

Scientific program committee

F. Bedeschi, M. Boscolo, P. Campana,
M. Cobal, C. Meroni, A. Nisati,
A. Quaranta, L. Rossi, R. Tenchini , A. Zoccoli

Workshop website: https://agenda.infn.it/e/FCC-Italy

https://agenda.infn.it/event/29752/

FUTURE CIRCULAR COLLIDER

INFN

About the thesis

Experimental Thesis

Detector operation and characterization in workshops and experimental area	Bachelor/Master

Software Thesis

Detector simulation with GEANT	Bachelor/Master
or	
Parametrized simulation of the detector w/ tuning	Bachelor/Master

Analysis Thesis

Benchmark channels for future studies in FCC	Master

You can apply also for the CERN Summer Student with FCC tasks connected to your thesis

Contact us!

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