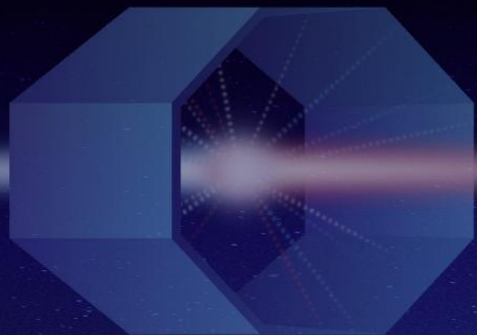




# INSTR 2026

October 12–16, 2026 Hefei | China

## Detector Concepts for FCC-ee

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*Chinese Academy of Sciences*

# European Strategy update



## The CERN Council decided to update the European Strategy for Particle Physics

22 May, 2026

**Released in May 2026**



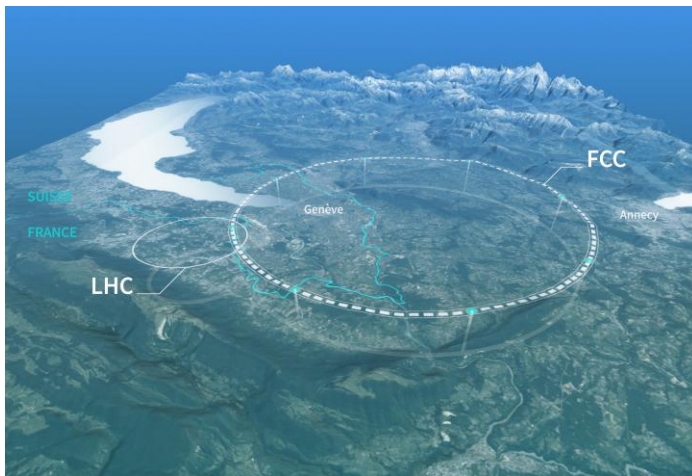
Artistic representation of the Future Circular Collider (FCC-ee) (Image: CERN)

# Preferred option: FCC-ee

- The electron–positron Future Circular Collider (FCC-ee) was recommended as the preferred option for the next flagship project at CERN
- Plan A: FCC-ee, 91 km, 91-365 GeV, 50 MW, 4 detectors
- Plan B: Descoped FCC-ee, 91-240 GeV, 30 MW, 2 detectors

At this stage, without knowing the reasons for which the FCC-ee would not be feasible, the other alternative options are not ranked. Paris SpHicas

[Talk at FCC week in June, 2026](#)

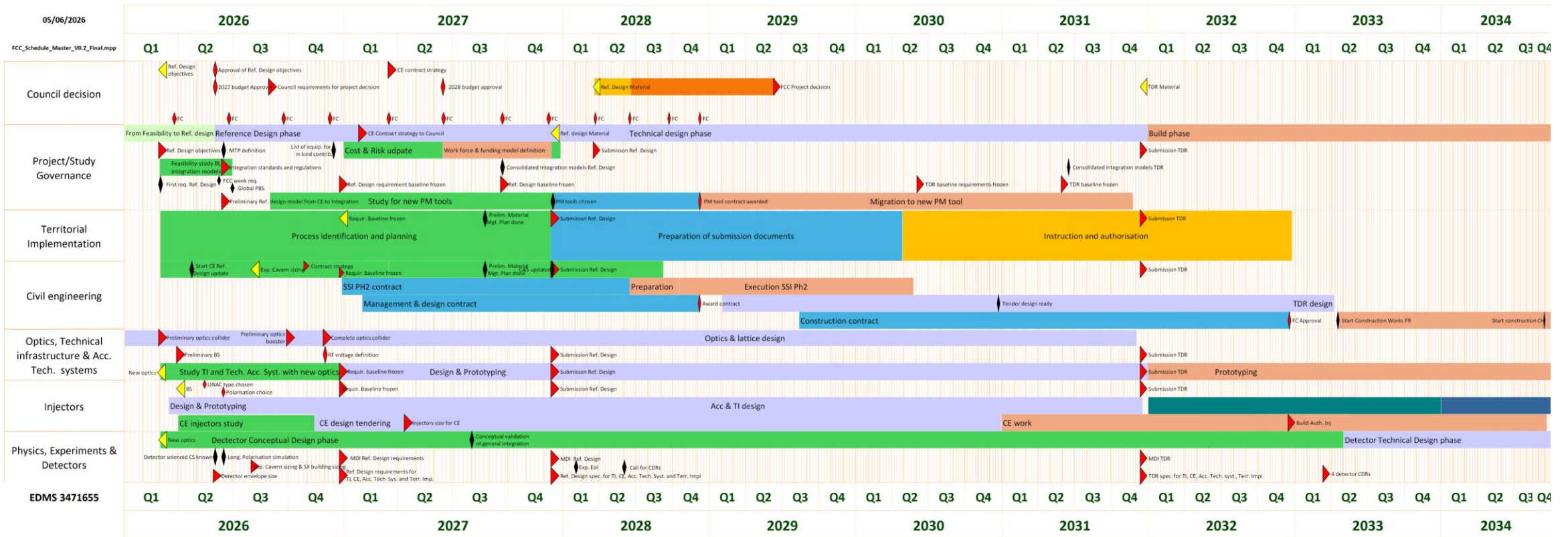


| Machine         | Precision Physics | BSM physics | Physics vs CEPC | Technical readiness | Constr. cost (BCHF) | Time scale | Path to $\geq 10$ TeV |
|-----------------|-------------------|-------------|-----------------|---------------------|---------------------|------------|-----------------------|
| FCC-ee          | 22                | 23          |                 |                     | 15.3                | 2046-2060  |                       |
| Descoped FCC-ee | 15                | 17          |                 |                     | 12.9                | 2046-2055  |                       |
| LCF550          | 15                | 17          |                 |                     | 14.8                | 2045-2065  |                       |
| CLIC1500        | 14                | 18          |                 |                     | 14.6                | 2045-2066  |                       |
| LCF250          | 10                | 16          |                 |                     | 9.4                 | 2045-2053  |                       |
| CLIC380         | 10                | 16          |                 |                     | 7.5                 | 2045-2054  |                       |
| LEP3            | 15                | 17          |                 |                     | 4.1                 | 2047-2062  |                       |
| LHeC            | 8                 | 7           |                 |                     | 2.1                 | 2044-2051  |                       |

**Plan A**  
**Plan B**

# FCC-ee timeline

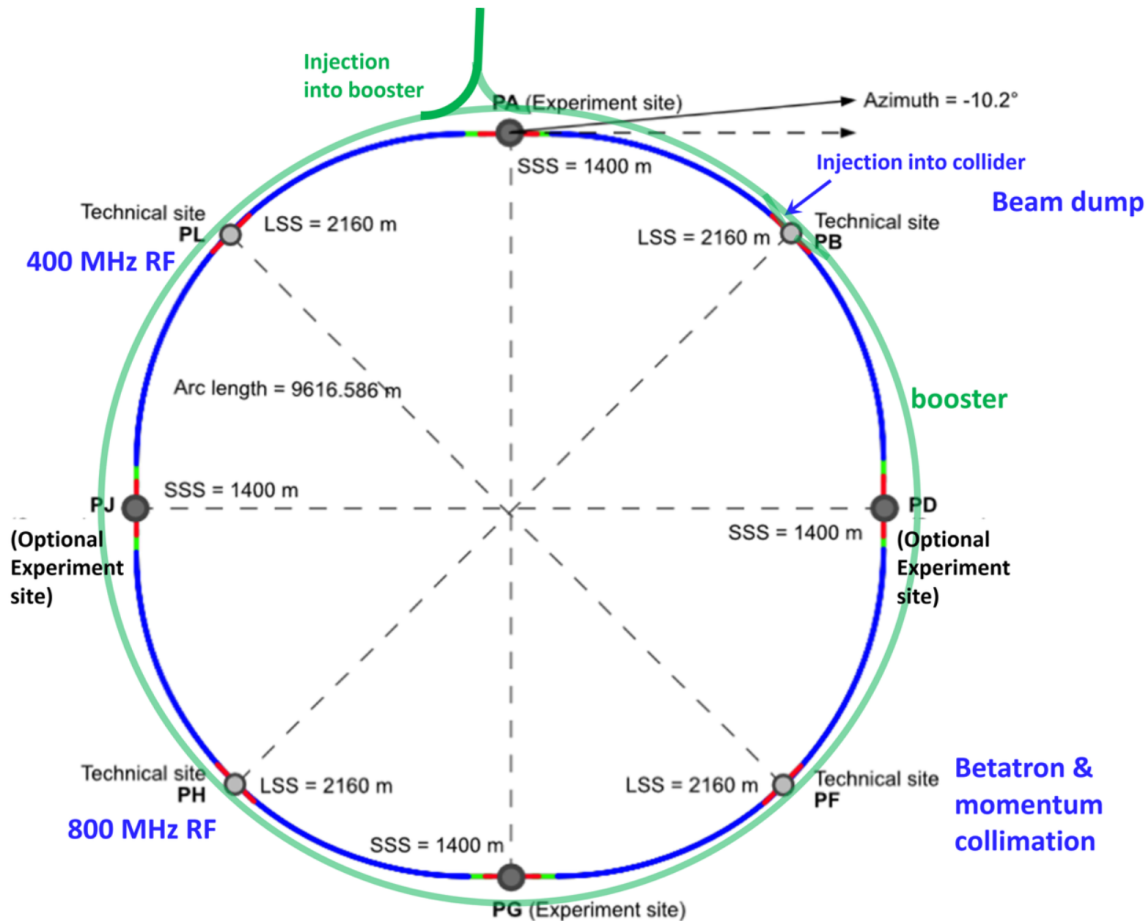
FCC Master schedule FCC-PM-PM-0004 v0.2



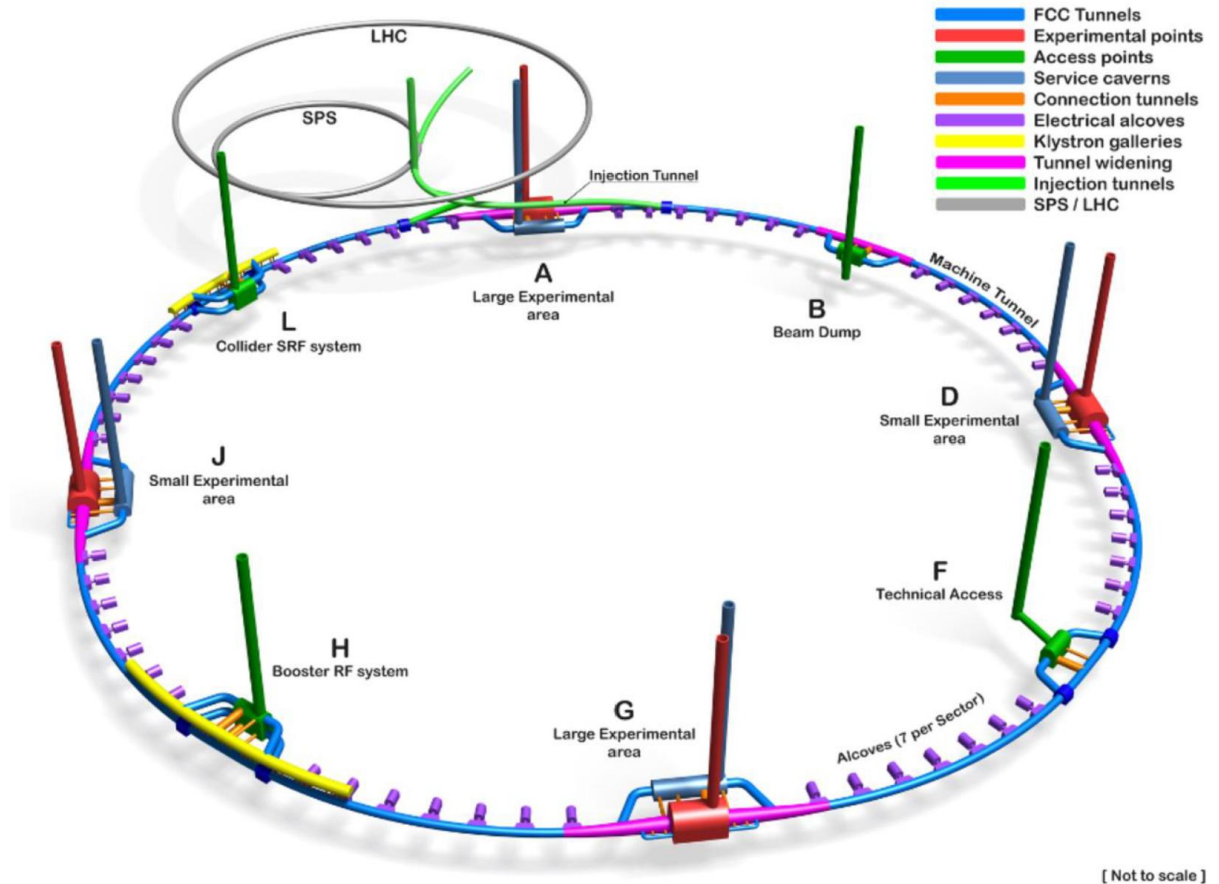
- Annual reports on the implementation of the Strategy
- Decision by CERN Council in 2028-2029
- Start Civil Engineering: 2033



# FCC-ee overview

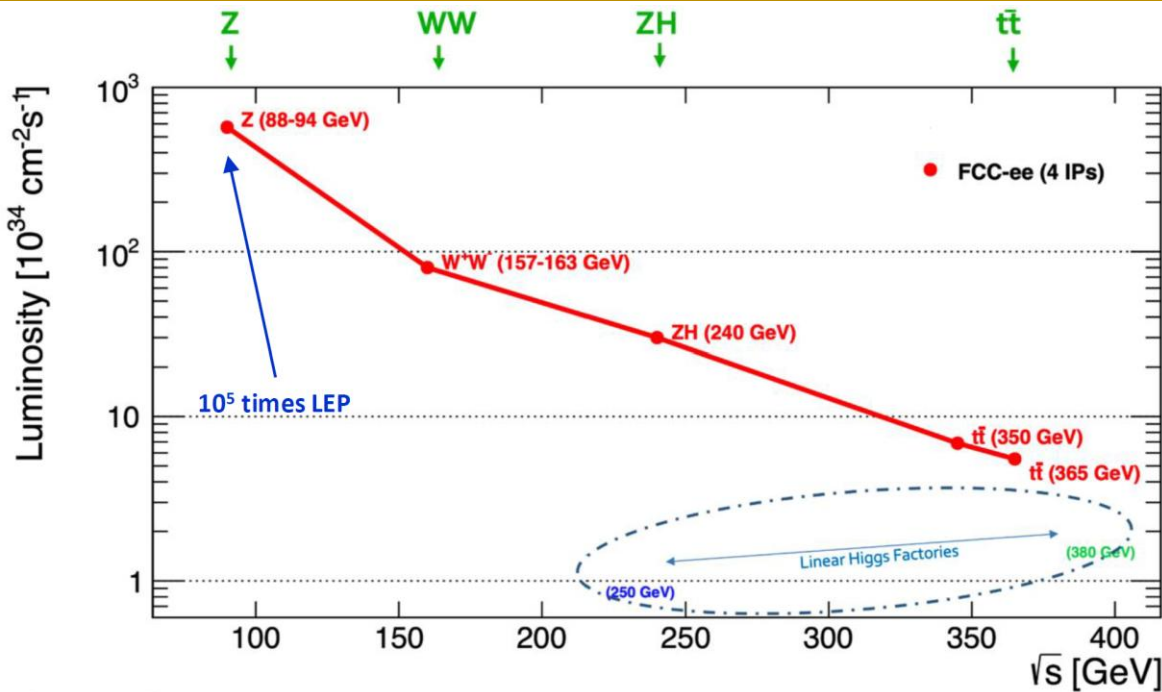


- Double ring e<sup>+</sup>e<sup>-</sup> collider, 91 km
- Large crossing angle 30 mrad, crab-waist optics
- Top-up injection from separate booster ring



- Four experimental areas: Diversity - control of overall systematic uncertainties; Higher statistics; Sustainability

# FCC-ee Luminosity and Conditions



● Experimentally, Z pole is the most challenging

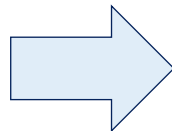
- Extremely large statistics
- Physics event rates of  $\sim 100$  kHz
- Bunch spacing at 25 ns  $\rightarrow$  “Continuous” beams
- However, no pileup, no underlying event
  - pileup of  $2.5 \times 10^{-3}$  at Z pole

| Running mode                           | $\sqrt{s}$<br>[GeV] | Luminosity /<br>IP<br>[ $10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ ] | Bunch<br>spacing<br>[ns] | Physics<br>$\sigma$<br>[pb] | Total $\sigma$<br>[pb] | Event<br>rate<br>[Hz] | Pile-up<br>$\mu$<br>( $10^{-6}$ ) | Run<br>time<br>[years] | Expected<br>sample                   | Physics<br>channel            |
|----------------------------------------|---------------------|--------------------------------------------------------------------|--------------------------|-----------------------------|------------------------|-----------------------|-----------------------------------|------------------------|--------------------------------------|-------------------------------|
| <b>Z pole</b>                          | <b>91.2</b>         | <b>140</b>                                                         | <b>25</b>                | <b>35,000</b>               | <b>70,000</b>          | <b>100,000</b>        | <b>2,500</b>                      | <b>4</b>               | <b><math>6 \times 10^{12}</math></b> | $e^+e^- \rightarrow Z$        |
| <b>WW threshold</b>                    | 160                 | 20                                                                 | 160                      | 10                          | 30                     | 6                     | 1                                 | <b>2</b>               | <b><math>2.4 \times 10^8</math></b>  | $e^+e^- \rightarrow W^+W^-$   |
| <b>ZH maximum</b>                      | 240                 | 7.5                                                                | 680                      | 0.2                         | 10                     | 0.5                   | 1                                 | <b>3</b>               | <b><math>2.3 \times 10^6</math></b>  | $e^+e^- \rightarrow ZH$       |
| <b><math>t\bar{t}</math> threshold</b> | 350–<br>365         | 1.5                                                                | 5,000                    | 0.5                         | 8                      | 0.1                   | 1                                 | <b>2</b>               | <b><math>2 \times 10^6</math></b>    | $e^+e^- \rightarrow t\bar{t}$ |
| <b>s-channel Higgs</b>                 | 125                 | —                                                                  | —                        | —                           | —                      | —                     | —                                 | 5?                     | <b><math>\sim 5,000</math></b>       | $e^+e^- \rightarrow H_{125}$  |

# Physics program → detector requirements

## Higgs factory

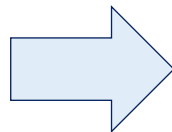
2.6M HZ events; precision Higgs couplings



- 3–4% jet energy resolution
- excellent recoil-mass / momentum resolution
- b/c flavour tagging

## EW & QCD

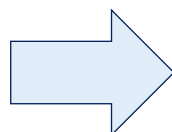
$6 \times 10^{12}$  Z and  $2 \times 10^8$  WW events



- $10^{-4}$ – $10^{-5}$  luminosity normalization
- Precise acceptance and angular measurement
- High-rate, lossless DAQ and long-term stability

## Heavy flavour

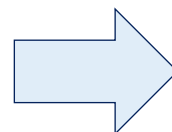
$10^{12}$  bb/cc and  $2 \times 10^{11}$   $\tau^+\tau^-$



- Few- $\mu$ m vertex and secondary-vertex resolution
- $\pi$ /K/p identification over a wide momentum range
- Low material and fine ECAL granularity

## BSM searches

Feebly coupled and long-lived particles

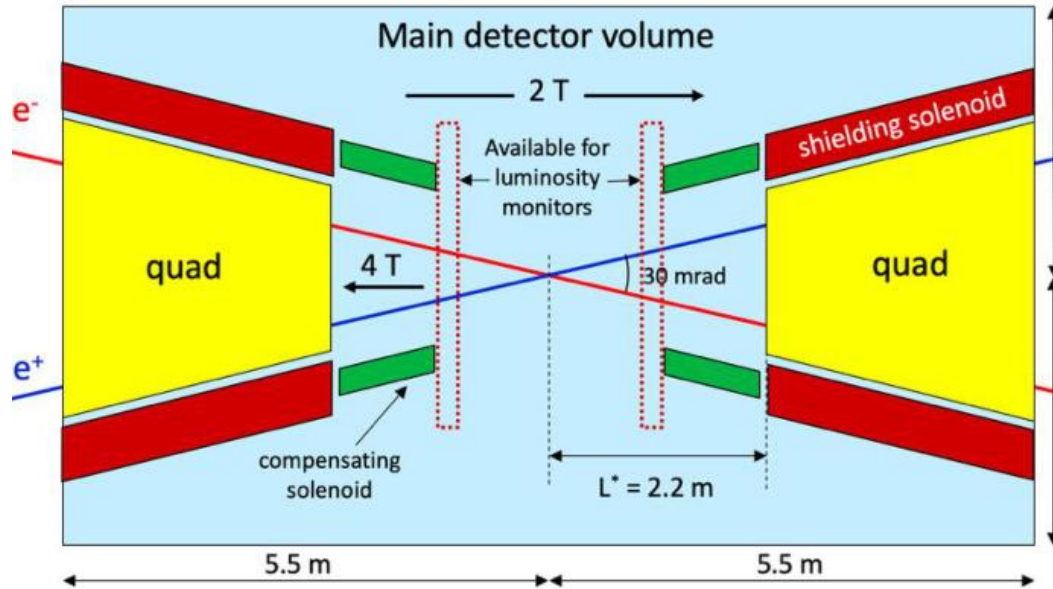


- Hermetic coverage and low detection thresholds
- Displaced-vertex / continuous tracking
- Precise timing and sensitivity to slow or delayed signals

**Key message: enormous statistics shift the challenge from discovery reach to systematic control.**

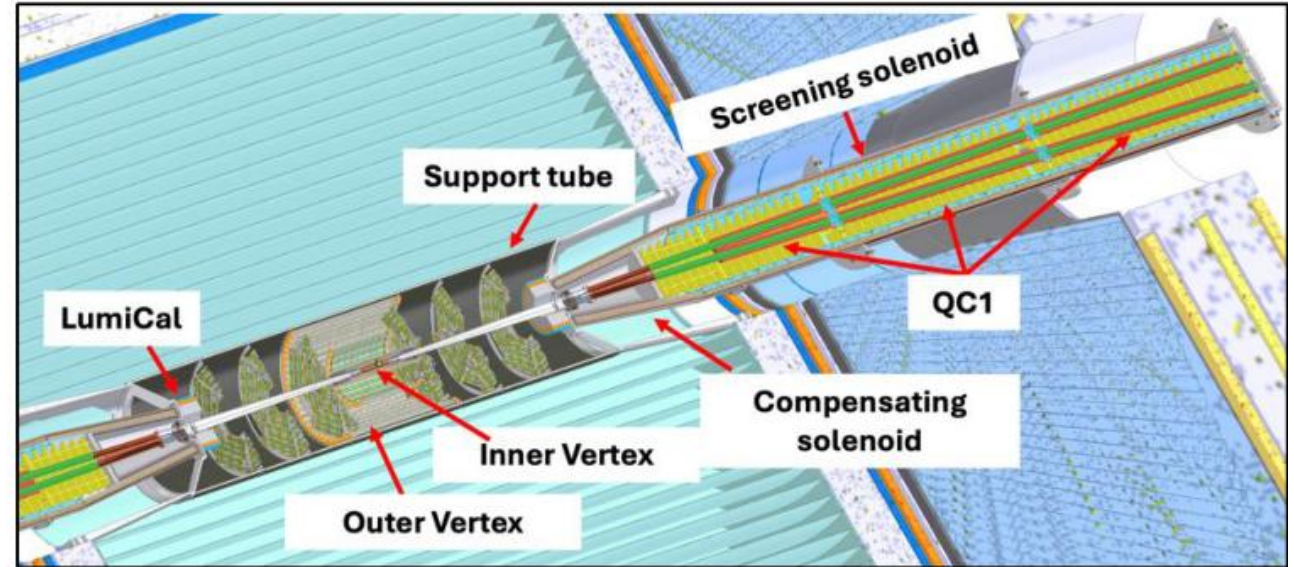
# Machine Detector Interface

Central part of detector volume – top view



- Invasive final focus system and large horizontal crossing angle ( $30\text{ mrad}$ )
- Large beam-induced backgrounds: cause significant detector occupancy; may influence detector technology choices, detector segmentation, and beam pipe radius

Example of MDI integration, IDEA Concept



- Detector magnetic field causes emittance blow-up affecting luminosity at the Z pole:  $2\text{ T}$  with local compensation  $\rightarrow 3\text{ T}$  with non-local compensation (significant work remains); The final choice for the magnetic field will impact the detector dimensions and performance

**Detector and accelerator optimization must proceed together**

# Detector overview

## Tracking and vertexing

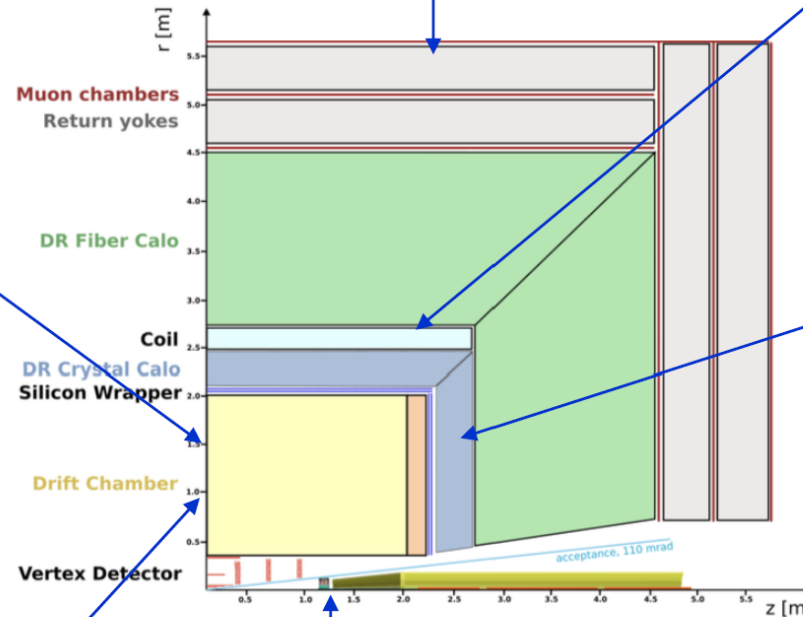
- As **lightweight** as possible
  - In the  $p_T$  range 0.1 - 50 GeV, resolution limited by multiple scattering;
  - Strong case for **gaseous** trackers
  - Also **light MAPS**
- Few micron VXD resolution** for flavour tagging and lifetime measurements
  - Thinned **MAPS** sensors
  - Few micron space point resolution
- Moderate radiation environments
- Nanosecond timing** for possible BXID (1 or 2 layers); **picosecond timing** only for possible ToF PID(**Si wrapper**)

## Particle Identification

- $\pi/K/p$  separation** for flavour, Higgs, and EW physics
  - Cluster counting in **gaseous** trackers
  - Compact, light **Cherenkov** detector
  - Time-of-flight** for  $p < 3$  GeV
- $\pi^0/\gamma$  separation, electron ID**
  - ECAL transv. and long. granularity

## Muon system

- Efficient and pure **muon ID** (tagging);
- 6-8  $\lambda_I$  HCAL as muon filter



## Luminometry and normalisation

- Requirement:  $\lesssim 10^{-4}$  absolute;  $\lesssim 10^{-5}$  relative
- Compact, extremely precise ( $\sim 1 \mu\text{m}$ )** LumiCal for small angle Bhabha scattering
- Precise endcap acceptance definition ( **$\sim 10 \mu\text{m}$** ) for di-photon final state

## Coil and B-field

- Field restricted to **3T** (previously **2T**) to avoid beam emittance blow up
- Coil positioned **inside or outside HCAL**
- Low temp. super conductivity; R&D needed for **HTS solution**

## Calorimetry

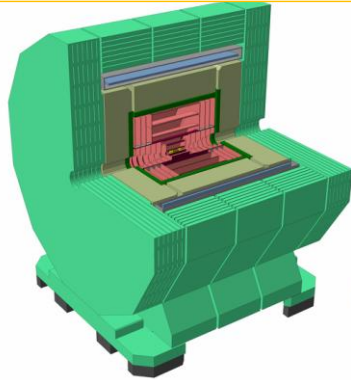
- Relatively low energy coverage:
  - 20-25  $X_0$ , 6-8  $\lambda_I$  suffices
- Jet energy resolution of 3-4 % @ 50 GeV
  - Particle flow** method: **high granularity**
  - possibly combined with **dual readout**
- ECAL** resolutions
  - high granularity; few %/ $\sqrt{E}$  for flavour phys.

## (T)DAQ

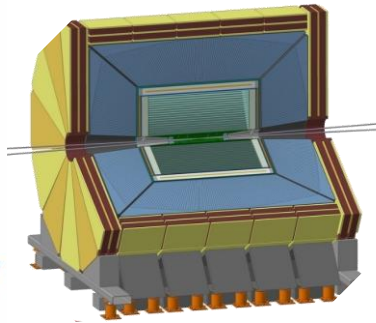
- Require “lossless” system with  $10^{-6}$  -  $10^{-5}$  normalisation precision between physics channels
- Two basic options: “**To TDAQ or to DAQ**”
  - Trigger system to activate complete detector readout – as at LEP & LHC
  - Streaming out of data from autonomous sub-detectors; off-detector event building based on time-stamping

# FCC-ee detector concepts overview

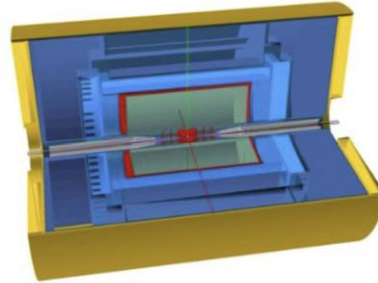
## A broad spectrum of complementary ideas



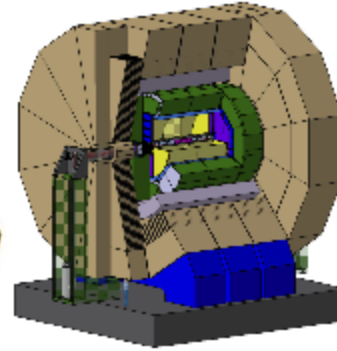
**CLD**



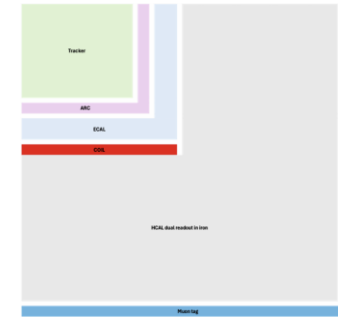
**IDEA**



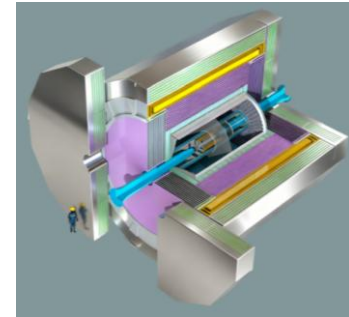
**ALLEGRO**



**ILD**



**ALFA**



**AGORA**

**Vertex Tracker**

Si

MAPS

MAPS

Si

MAPS

MAPS

Full Si

Drift Chamber  
+ Si strp

DCH / Straw / SciFi  
+ Si

TPC + Si strips

All MAPS

TPC + Si Pixel  
+ Si strips

**ECAL**

Si-W highly  
granular

Crystals w. DR

Noble Liquid (LAr)

Si-W highly  
granular

Grainita (crystal  
grains)

Crystals

**HCAL**

Scint. sampling

Fibre DR

TileCal  
(steel/scint.)

Scint. or RPC

DR + steel

Glass scint. + steel

**Muon**

RPC in iron yoke

$\mu$ RWELL

TBD

Scint. in iron yoke

TBD

Scint. in yoke

**PID**

RICH (option)

tracker dN/dx (+  
TOF)

tracker dN/dx (+  
TOF)

tracker dN/dx (+  
TOF)

Cherenkov ARC

tracker dN/dx (+  
TOF)

**Coil  
B-field**

Outside HCAL  
2T

Inside HCAL  
2T (3T HTS R&D)

Inside HCAL  
2T

Outside HCAL  
3.5 T  $\rightarrow$  2-3 T

Inside HCAL  
3T

Outside HCAL  
3T

# Vertex detector

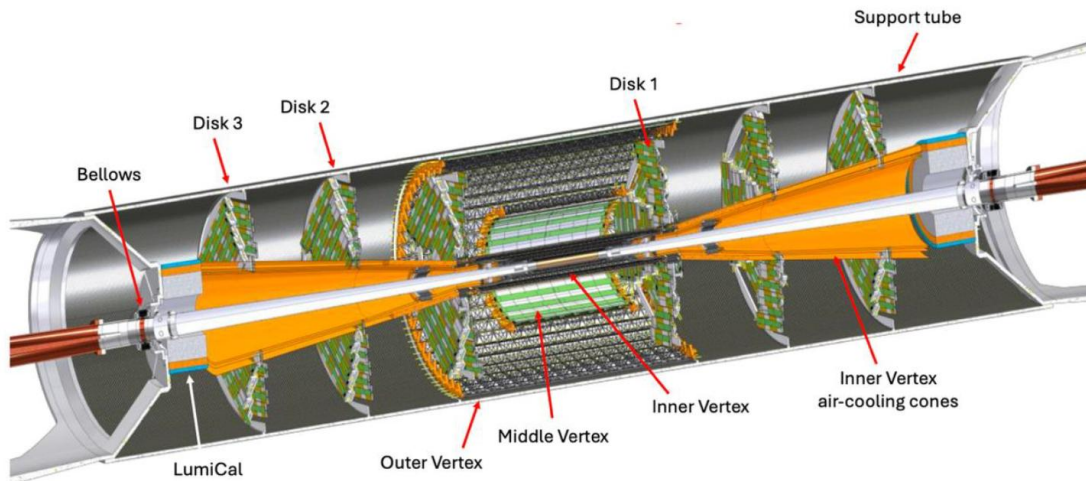
Vertex detector developments highly inspired by ALICE ITS2 and ITS3 designs

Workshop, Oct. 2025

- Based on thinned and stiched MAPS
- Ultra-low material, micron-level precision, low power, lightweight mechanics and cooling,  $\sim 13$  mm from IP

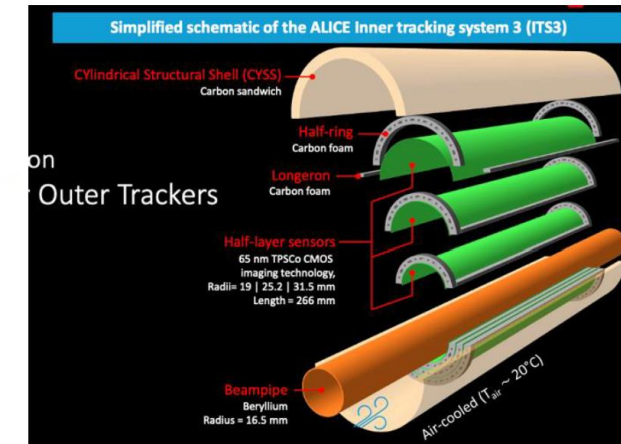
## IDEA Vertex Detector design study (INFN Pisa, Frascati)

- Fully integrated in MDI design
- All sensors are  $50\text{ }\mu\text{m}$  MAPS
- Three inner barrel layers:  $25 \times 25\text{ }\mu\text{m}^2$ ,  $50\text{ mW/cm}^2$ , air cooling
- Middel + outer barrel layers:  $150 \times 50\text{ }\mu\text{m}^2$ , water cooled
- Three disks in each direction: as middle/outer barrel layers
- Hit resolution:  $\sim 3\text{ }\mu\text{m}$ ; material:  $2.5\%$   $X_0$  at  $90^\circ$



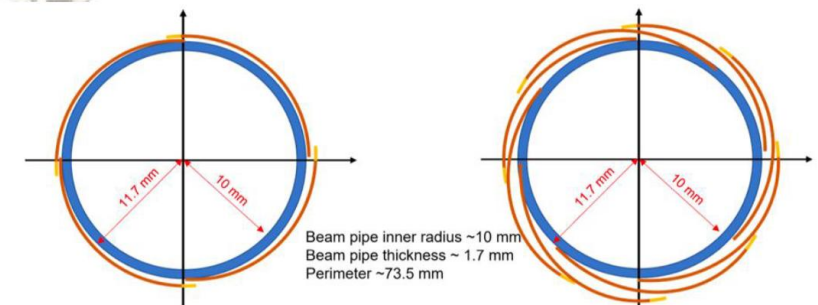
## Curved sensors “wrapping” around beam pipe

ALICE ITS3 with air cooling under development

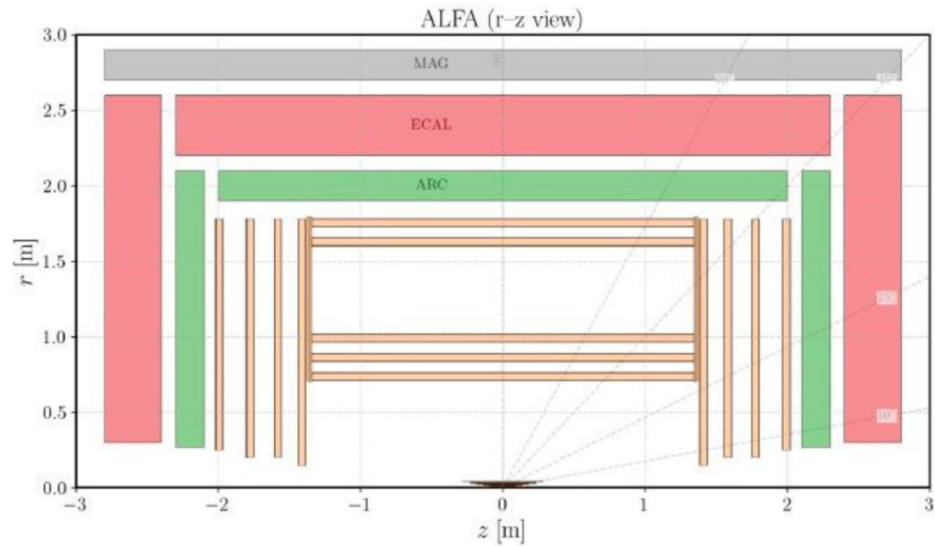


12-mm curvature reached

FCC-SEED



# Central tracker

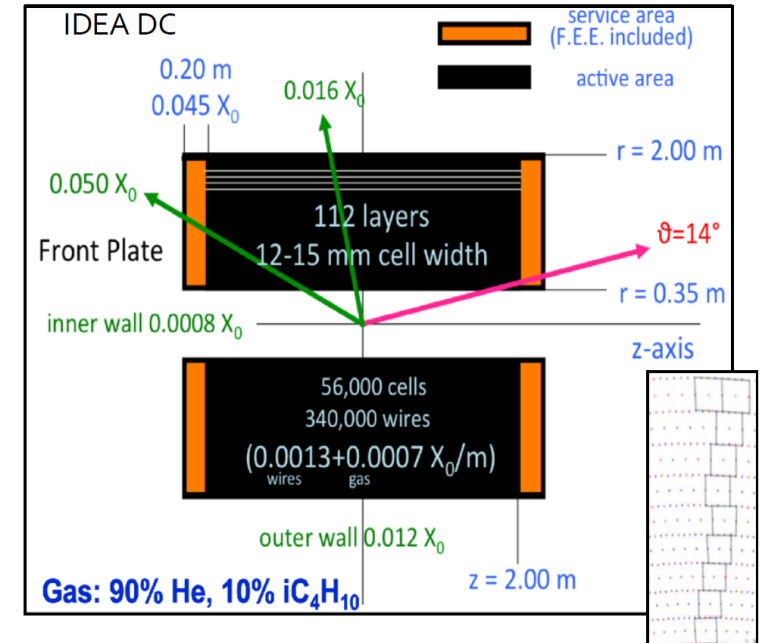


Full silicon

- CLD
- ALFA

Drift Chamber

- IDEA
- Allegro

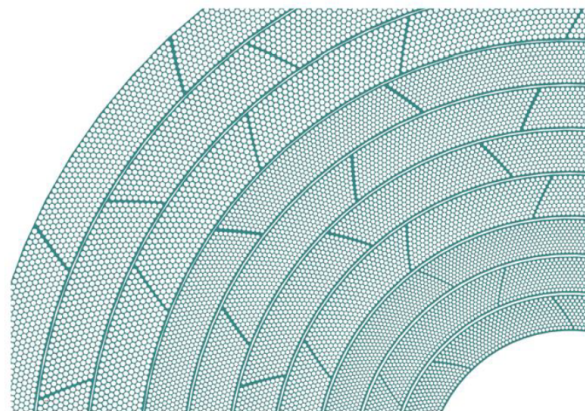


Straw Tracker (Allegro)

- Robust alternative to DCH?

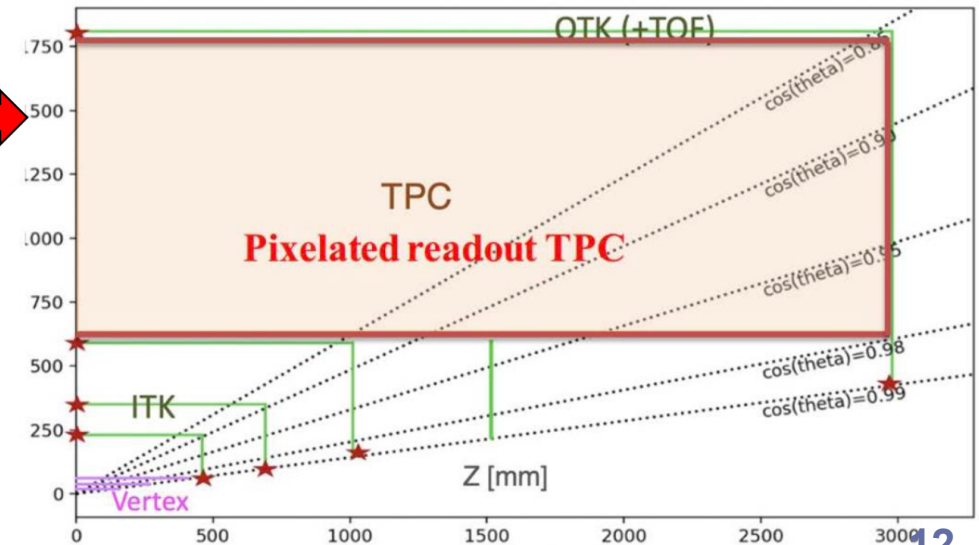
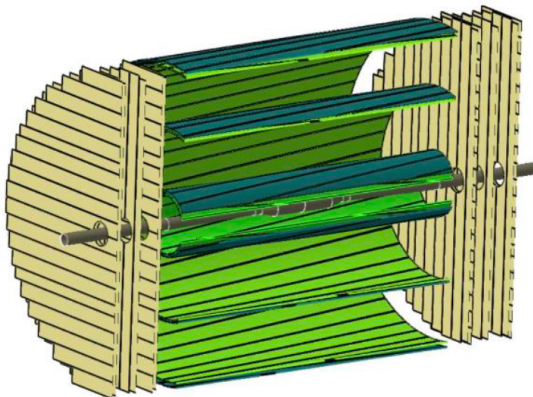
Time Projection Chamber

- ILD and AGORA



Scintillating Fibre (SciFi) Tracker

- Used in LHCb, studied for Allegro



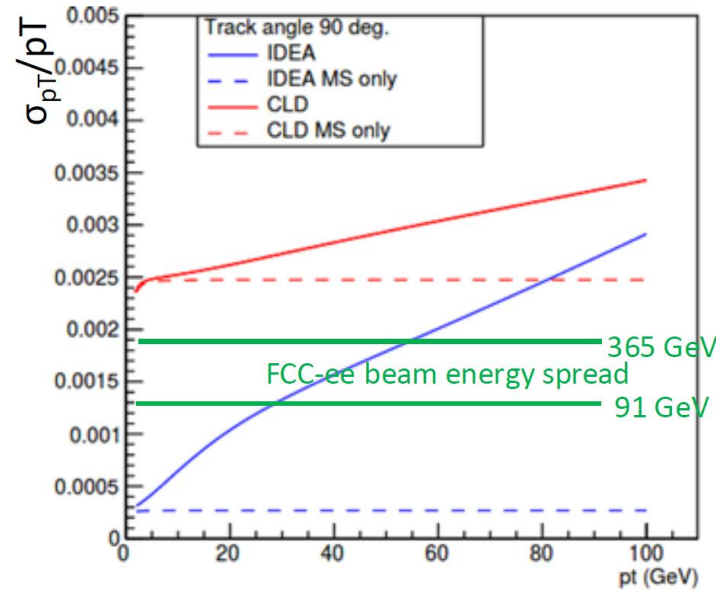
# Central tracker: Gaseous or Si

For FCC-ee energies, very light tracking systems are needed for the momentum resolution not to be limited by multiple scattering

$$\sigma(p_T)/p_T^2 = a \oplus \frac{b}{p \sin \theta}$$

mult.scat  
point  
resolution

Example: CLD vs. IDEA

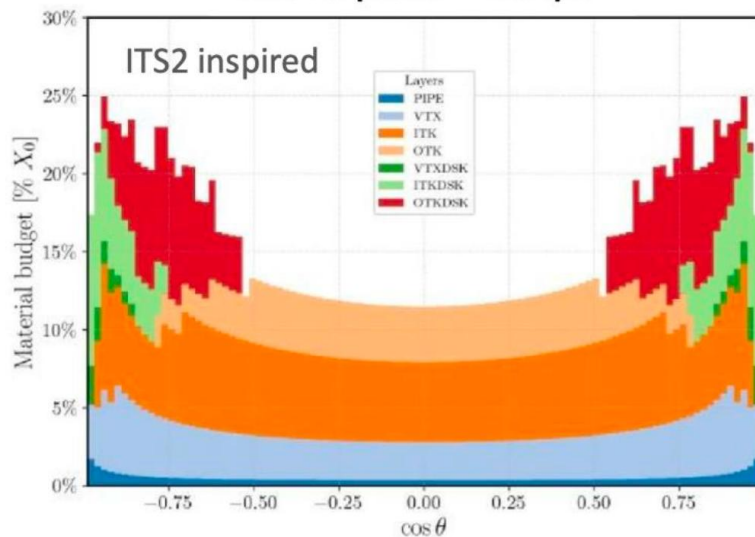


Strong case for gaseous trackers

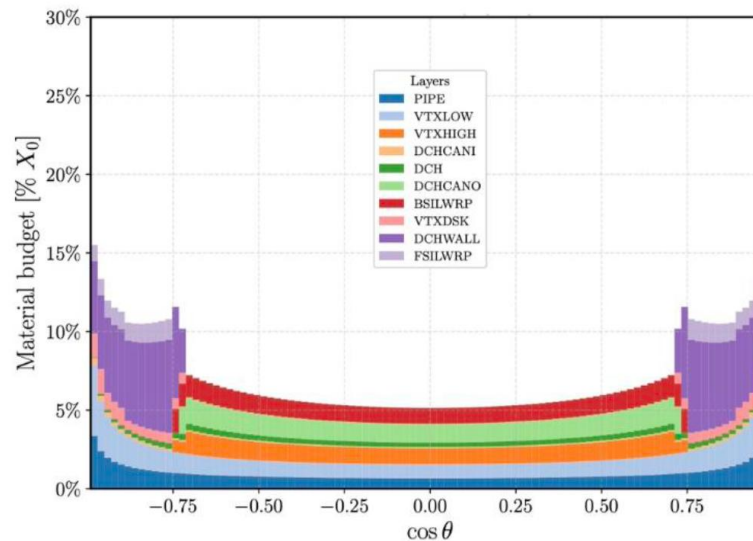
but also

New ALFA all-MAPS tracker concept with a very competitive material budget

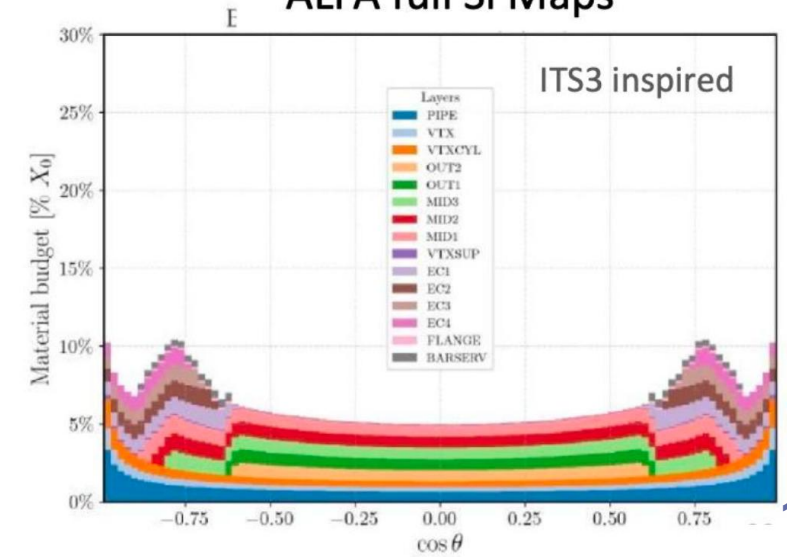
CLD Si pixel + strips



IDEA Drift Chamber + Si



ALFA full Si Maps



# Charged Particle Identification

**PID capabilities across a wide momentum range** is essential for flavour physics

◆ Drift Chamber and Straw Tracker promise  $>3\sigma$   $\pi/K$  separation up to  $\sim 35$  GeV based on **cluster counting,  $dN/dx$** . Similar performance from TPC.

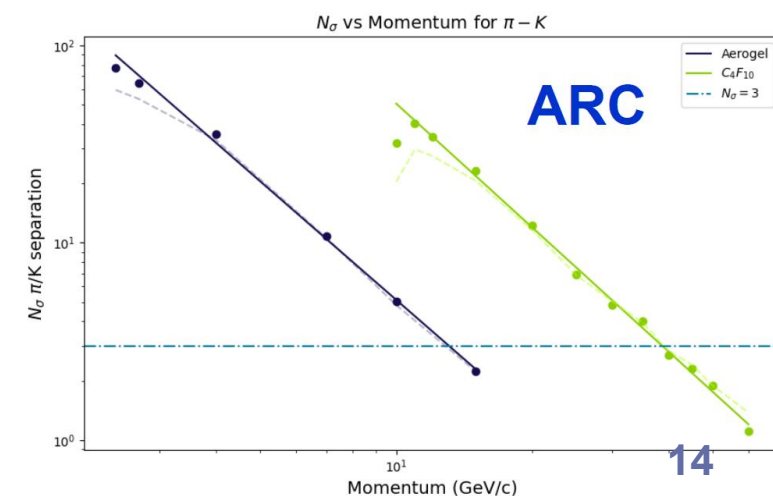
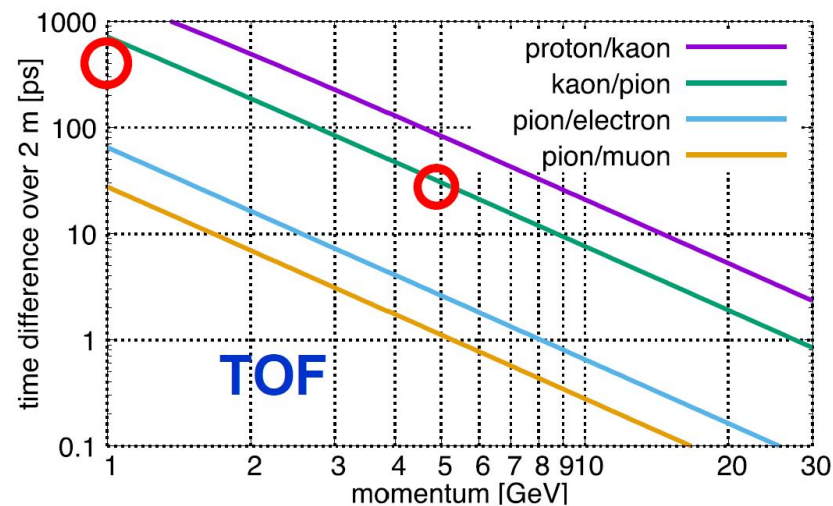
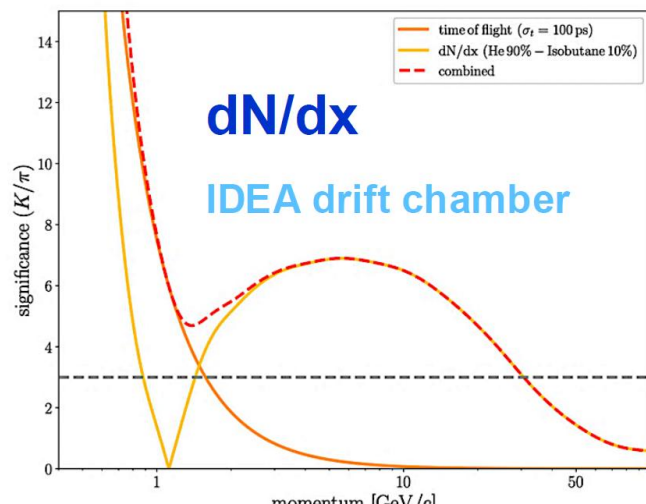
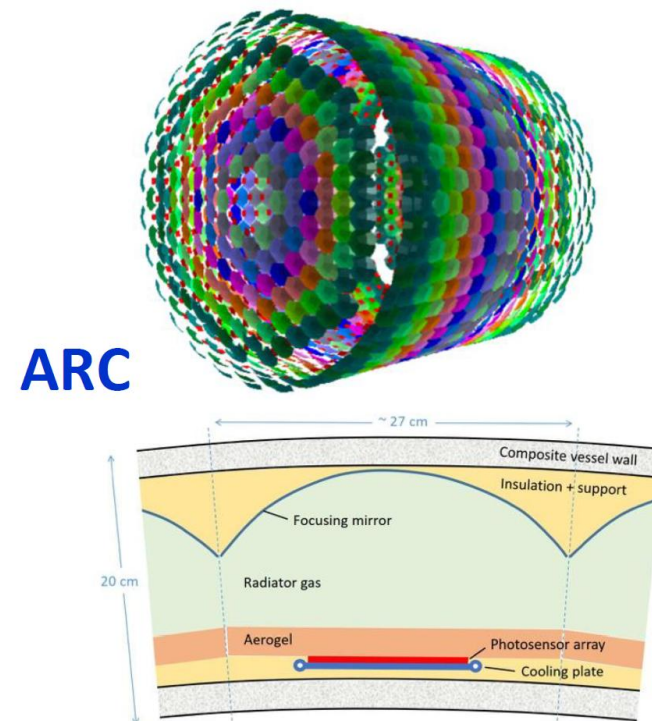
- ionisation cross-over window at 1 GeV, can be alleviated by unchallenging TOF measurement of  $\delta T \lesssim 100$  ps

◆ **Time of flight (TOF)** to cover cross-over window around 1 GeV

- With unchallenging time resolution of  $\sigma_t \sim 100$  ps
- With  $\sigma_t \sim 100$  ps, TOF alone could provide  $3\sigma$   $\pi/K$  separation up to  $\sim 5$  GeV (LGAD)

◆ **RICH counter** being investigated (for CLD and ALFA): **Array of RICH Cells – ARC**

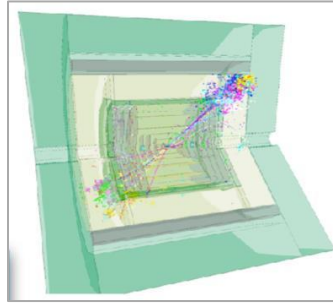
- Compact geometry (depth: 20 cm,  $0.1 X_0$ ) via use of SiPMs
- Aerogel + Gas ( $C_4F_{10}$  or pressurised Xe):  $3\sigma$   $\pi/K$  separation in 2.5 - 50 GeV range
- Below 2.5 GeV, no signal from K  $\Rightarrow$  veto mode separation



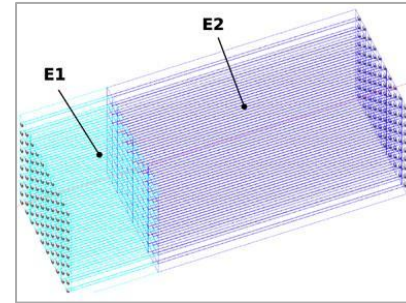
# Electromagnetic Calorimeter

## CALICE-style sandwich with embedded front-end electronics

- Tungsten-silicon ECAL;  
Extremely fine segmentation:  
(0.5 cm)<sup>3</sup>
- $\sigma(E)/E \simeq 16\%/\sqrt{E}$



Si-W sandwich (CLD / ILD)



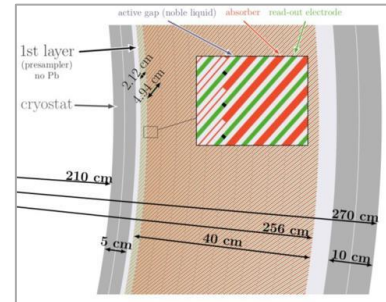
Crystal dual-readout (IDEA)

## Segmented crystals with Dual Readout

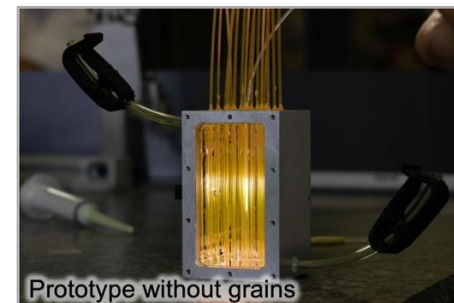
- Fine transverse segmentation, two longitudinal layers; SiPMs
- $\sigma(E)/E \simeq 3\%/\sqrt{E}$

## Noble Liquid ECAL

- Fine longitudinal sampling (w.r.t. ATLAS, 4 → 12 layers)
- Pb+LAr or denser W+LKr; cold (or warm) electronics
- $\sigma(E)/E \simeq 6-8\%/\sqrt{E}$



Noble-liquid LAr (ALLEGRO)



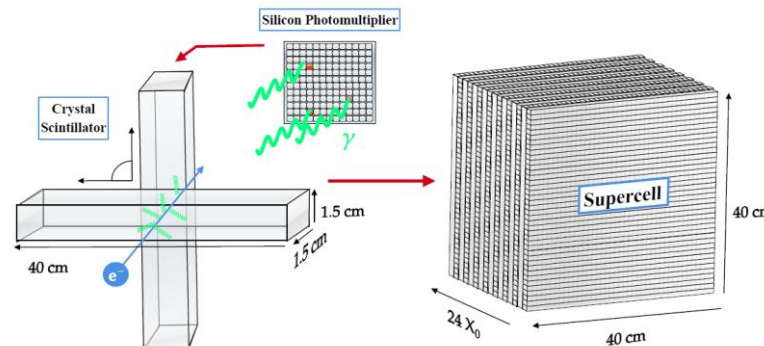
Grainita grains (ALFA)

## Grainita ECAL concept

- 1-mm crystal grains (ZnWO<sub>4</sub>) immersed in heavy transparent liquid
- Light emitted by crystal grains collected by WLS fibres spaced 7 mm
- $\sigma(E)/E \simeq 2\%/\sqrt{E}$

## Homogeneous crystal

- Long BGO crystal bars perpendicular arranged to achieve fine 3D granularity
- $\sigma(E)/E \simeq 2\%/\sqrt{E}$

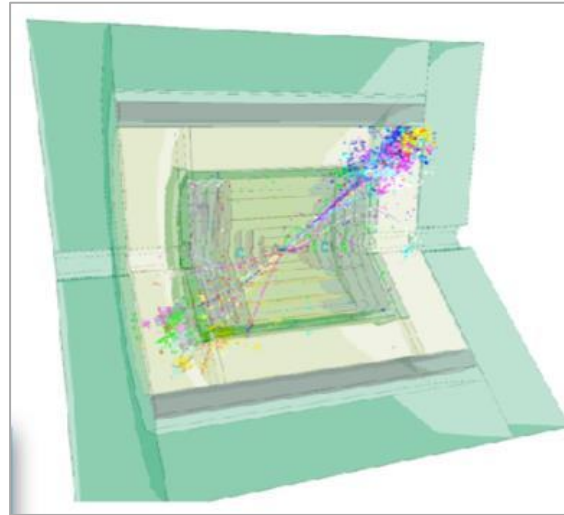


Homogeneous crystal (AGORA)

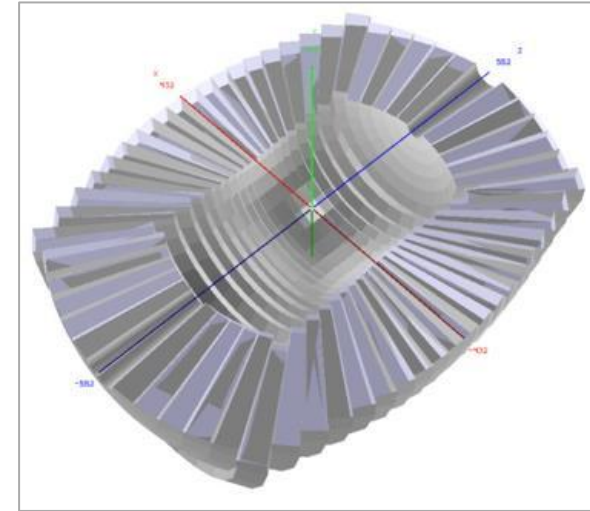
# Hadron Calorimeter

## High granularity sampling

- Steel-scintillator/RPC; SiPM-on-Tile; Fine segmentation:  $(2.5 \text{ cm})^3$
- $\sigma(E)/E \simeq 40\text{-}50\%/ \sqrt{E}$



Steel-scint (CLD / ILD)



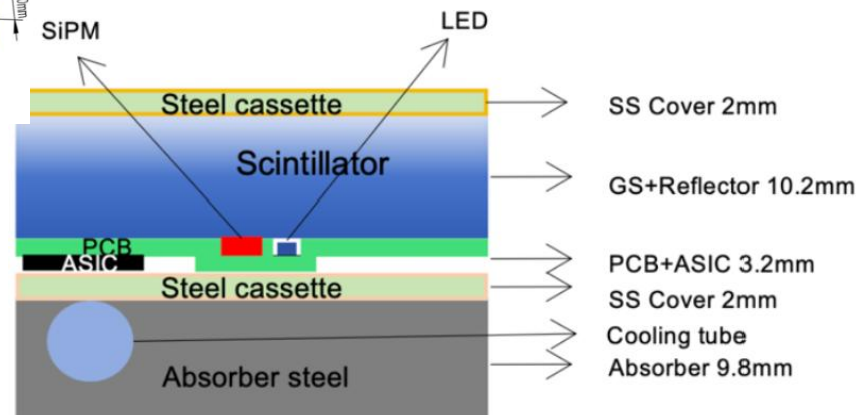
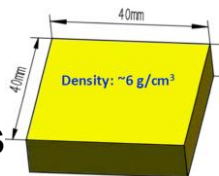
Fibre dual-readout (IDEA)

## Fibre-based DR calorimeter

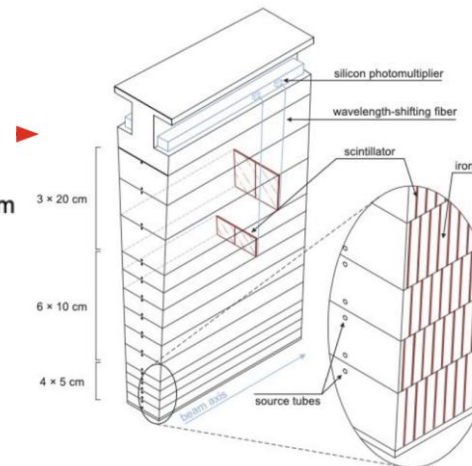
- scintillating fibres (sensitive to EM and hadron) + Cherenkov fibres (sensitive to EM)
- $\sigma(E)/E \simeq 30\%/ \sqrt{E}$

## Heavy glass scintillator

- Glass scintillator tiles  $(4 \times 4 \times 1 \text{ cm}^3)$  + steel
- 30% sampling ratio
- $\sigma(E)/E \simeq 30\%/ \sqrt{E}$



Glass scintillator HCAL (AGORA)



Scintillator tile (ALLEGRO)

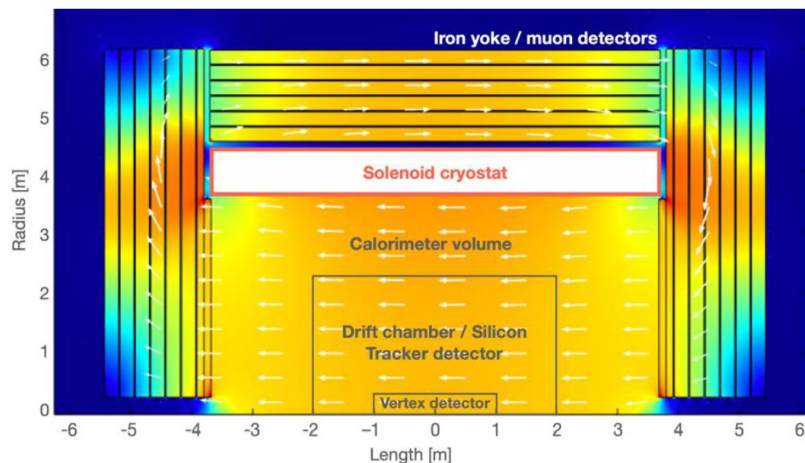
## Scintillator tile

- 13-mm absorber / 3-mm scintillator
- $\sigma(E)/E \simeq 40\text{-}50\%/ \sqrt{E}$

# Detector Magnet

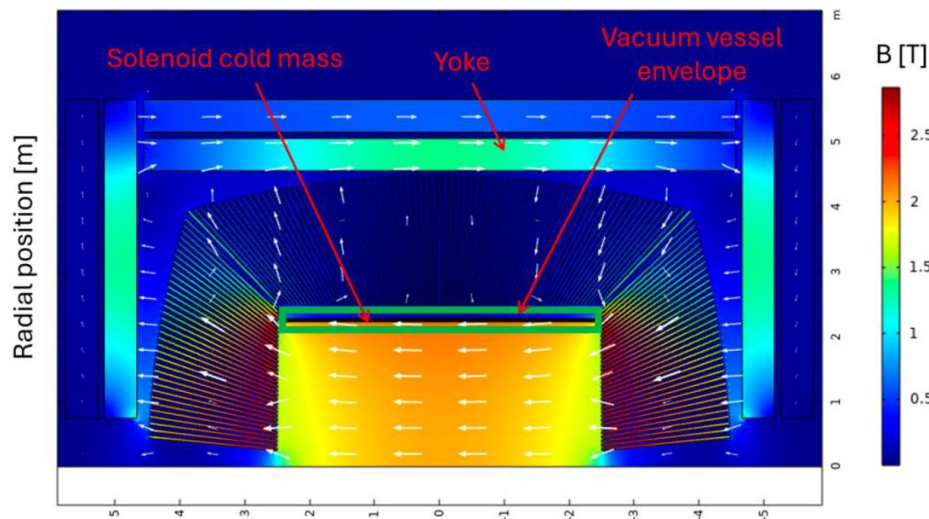
Two placement options being pursued

## Coil outside calorimeter system



CERN detector magnet group:  
Conceptual design of thin,  
ultra-light 2T solenoid

## Coil between ECAL and HCAL



Future common R&D efforts identified during recent Detector Solenoid workshop:

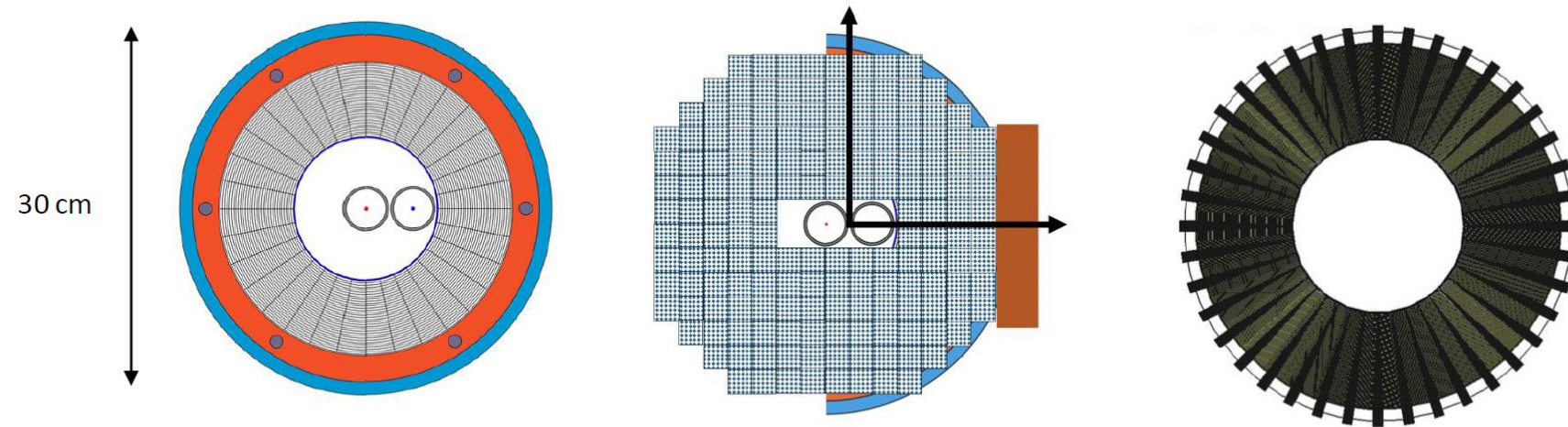
- ◆ Moving from 2T to 3T
- ◆ Explore HTS technology (ReBCO, Iron,  $\text{MgB}_2$ , ...)
- ◆ Quench protection
  - Design driver, especially for HTS
- ◆ Stabilised Aluminium conductor production
  - Potential bottleneck
- ◆ Single-piece coil vs. modular design
- ◆ Integrated design
  - Cryostat, cryogenic system, thermal shield, services
  - Minimise material if between ECAL and HCAL
- ◆ From CERN magnet group:
  - "Experience tells that development & construction of large superconducting coil takes  $\gtrsim$  a decade"*
  - Early design needed as input to general detector design
  - Need to identify labs with appropriate expertise

CLD, ILD, AGORA

IDEA, ALLEGRO, ALFA

# Machine detector interface

- ◆ Common luminometer developments, most likely compact SiW calorimeter
  - Cover polar angles from  $\sim 45$  to  $\sim 100$  mrad, about 1 m from interaction point
  - Micrometer geometrical tolerances for a  $10^{-4}$  precision on the luminosity measurement
  - Sensors: Si strips (à la FCAL), MAPS (à la ALFA), superconducting nanowires



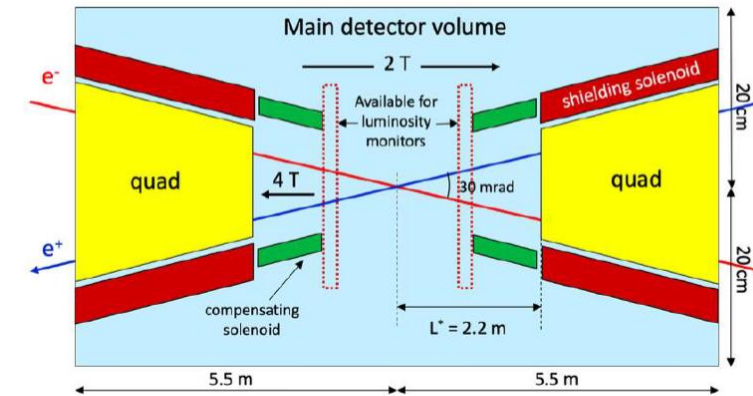
- Mechanical support & stability; alignment (2 LCAL, 100  $\mu\text{m}$ ), temperature stability (1  $^{\circ}\text{C}$ )

- ◆ R&D on lightweight (carbon-based?) beampipe, with adequate thermal management

- Material is not negligible in the current design

- ◆ More generally; detailed engineering of the interaction region (BP, VTX, LCAL)

- Support, extraction, maintenance, acceptance preservation (down to 100 mrad?)



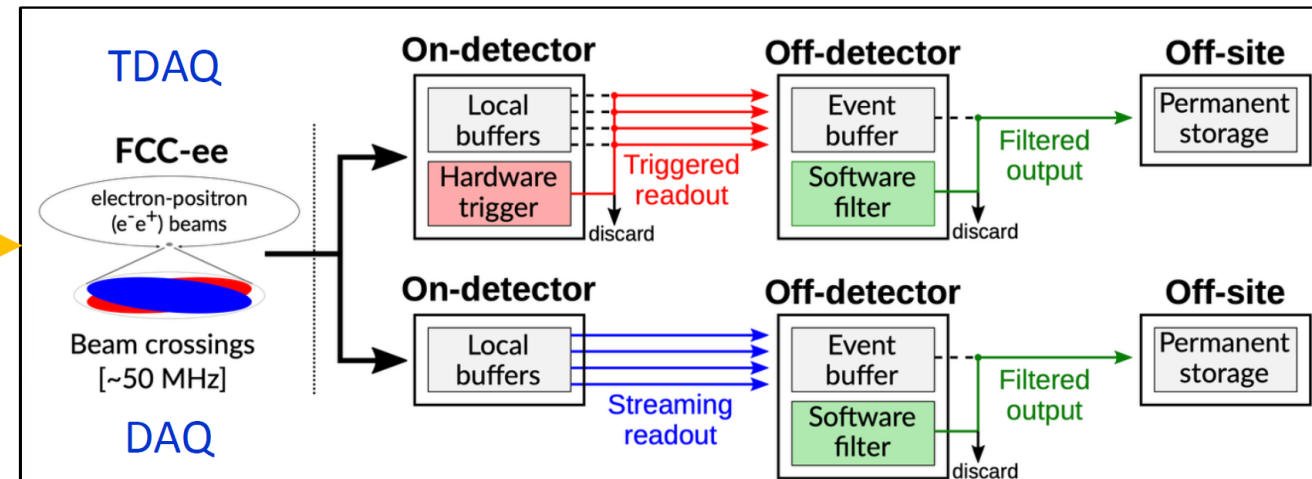
Recent Luminometer Workshop

# Data Acquisition System

## DAQ system goal

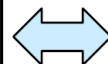
- Full efficiency for all SM annihilation physics events
  - Aiming at  $\mathcal{O}(10^{-6} - 10^{-5})$  relative normalisation between channels
- No loss of potential BSM signatures  
e.g., heavy (slow) particles decaying late, LLPs

“To TDAQ or to DAQ”  
Does FCC-ee need a trigger system?



## Trigger option (as at LEP and LHC)

- Which sub-detectors could trigger decision be based on?
- Need identical deadtime for all detector elements  
In particular LumiCal vs. rest
- High BX rate: Need for local **latency buffering** a la LHC?  
Material / power / cooling for on-detector buffering?



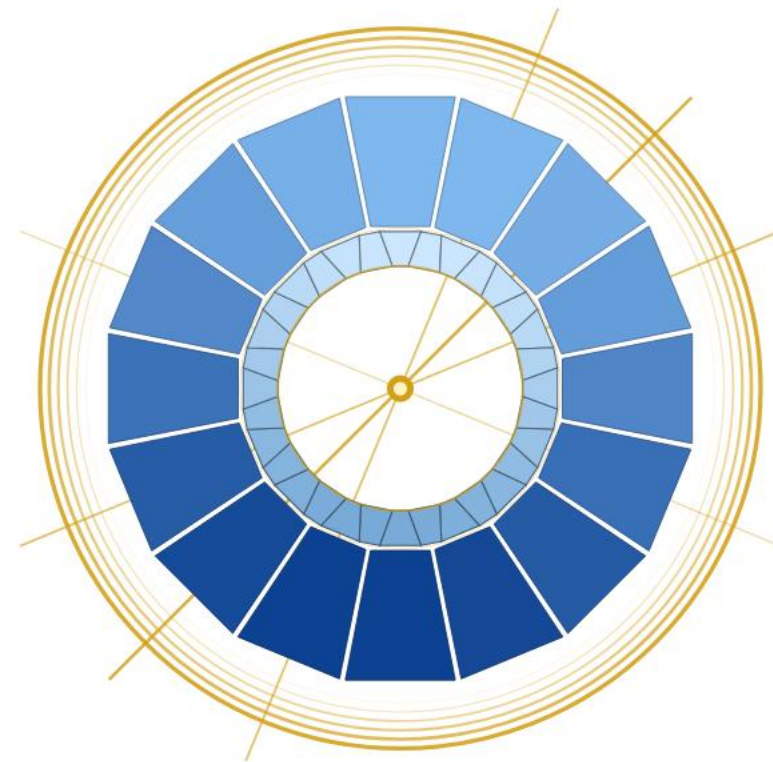
## No Trigger option (as being developed for EPIC @ EIC)

- **Free streaming** of *self-triggered* detector sensors
- Off-detector event building based on time-stamping (BXID) and topological combinations
- Potential enormous data rates out of sub-detectors  
Easily Tbit/sec from VXD alone. Technical feasibility? Power needs, 19?

# AGORA

## AGORA: Advanced Glass Optimized Research Apparatus

- The name AGORA describes a next-generation experiment at a lepton collider (CEPC/FCC-ee).
- The name emphasizes the unique **glass** calorimeter at the heart of the detector.
- The acronym AGORA is an English word that means "gathering place" or "assembly" and it intends to symbolize the international collaboration that we expect to flourish.
- AGORA is based on the CEPC reference detector and beyond it. It was proposed to FCC-ee in 2026.



# AGORA

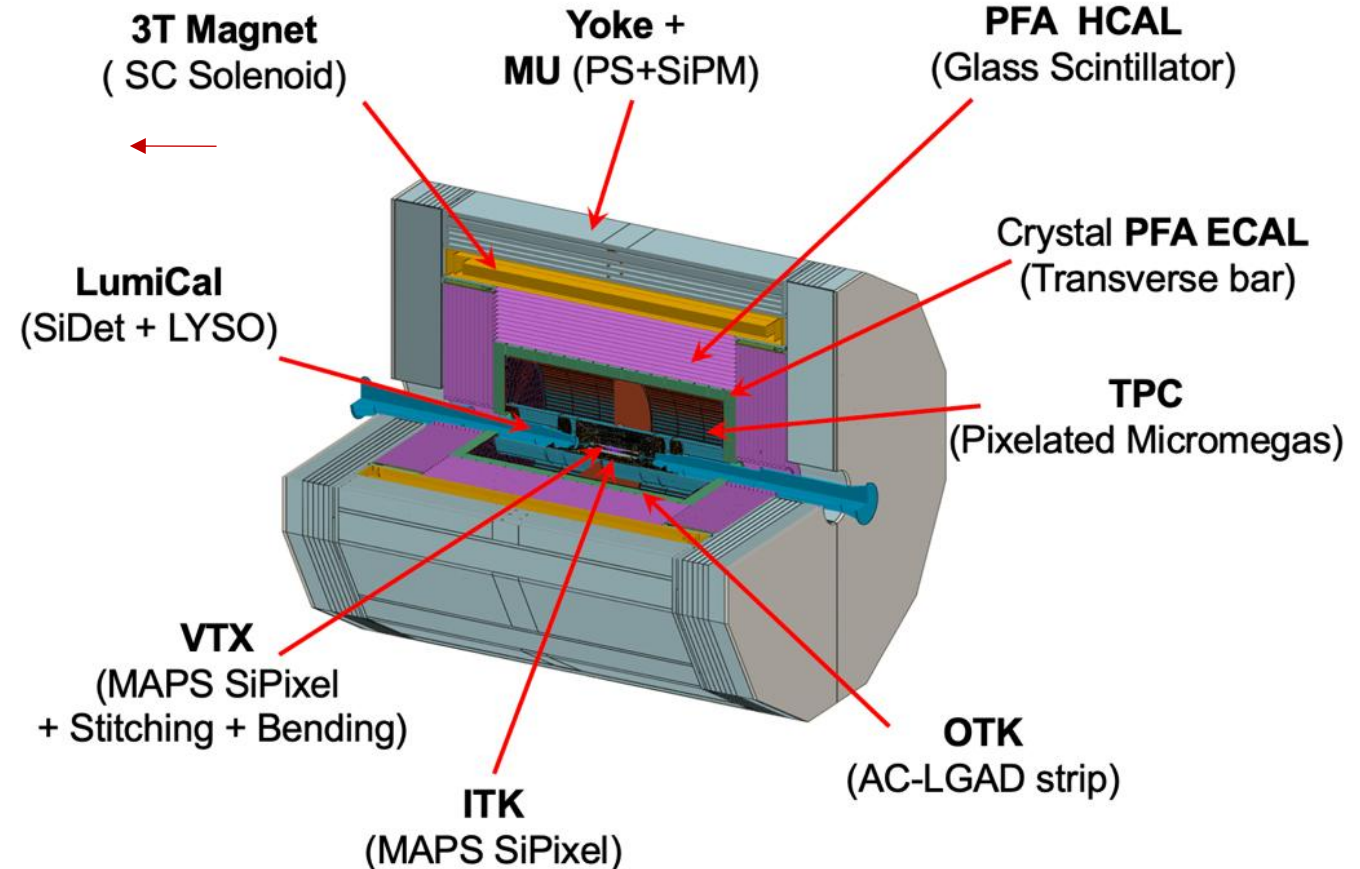
ADVANCED GLASS OPTIMIZED RESEARCH APPARATUS

# Overview of AGORA

| Sub-system           | Technologies                    |
|----------------------|---------------------------------|
| Beam pipe            | Beryllium, $\phi$ 20 mm         |
| LumiCal              | Silicon tracker + LYSO crystals |
| Vertex               | Si Pixels: CMOS MAPS+stitching  |
| Inner tracker (ITK)  | Si Pixels: CMOS MAPS 55-nm      |
| Gas detector         | TPC with high granularity       |
| Outer tracker (OTK)  | AC-LGAD $\rightarrow$ TOF       |
| ECAL                 | 4D transverse crystal bars      |
| HCal                 | Glass scintillator, SiPM + Fe   |
| Magnet               | LTS Solenoid                    |
| Muon                 | Plastic scintillator bars, SiPM |
| TDAQ                 | Conventional                    |
| Back-end electronics | Common                          |

- **Technical Design Report (TDR)**  
released in Oct. 2025, [arXiv:2510.05260](https://arxiv.org/abs/2510.05260)

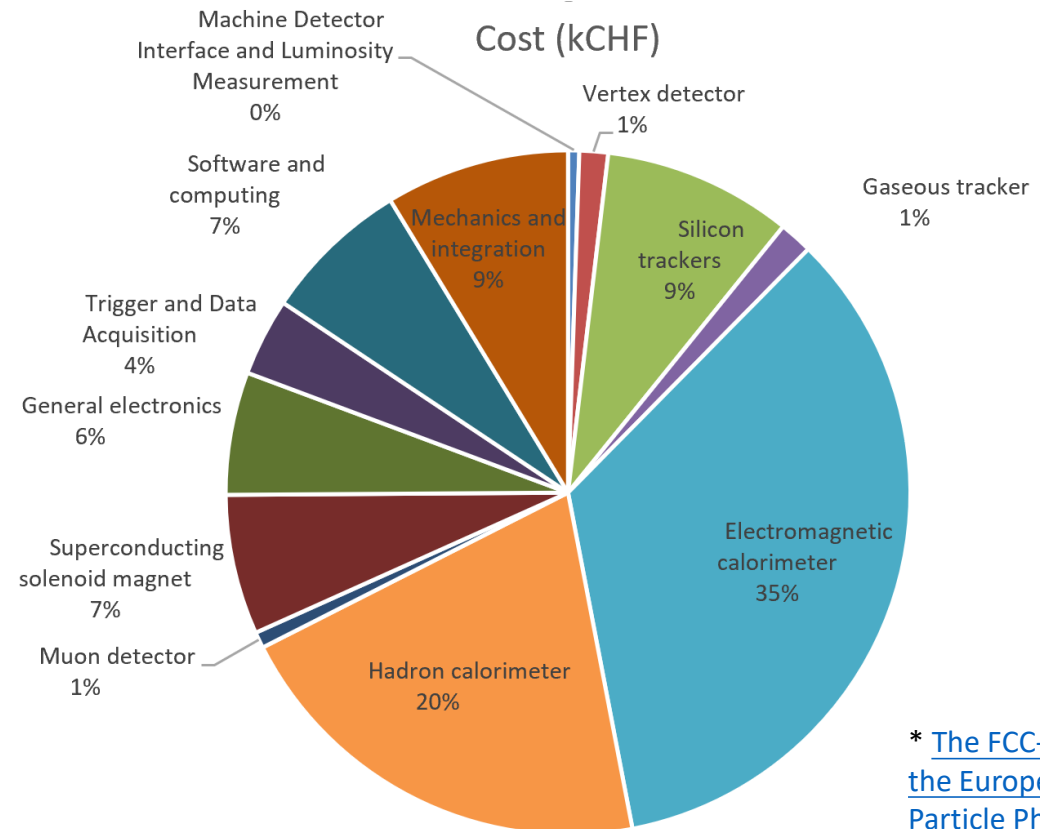
**$10 \times 10 \times 12 \text{ m}^3$ ,  $\sim 5000 \text{ ton}$**



# Cost of AGORA

| System                    | Cost (MCHF)  | Ratio         |
|---------------------------|--------------|---------------|
| MDI and Luminosity        | 1.8          | 0.5%          |
| Vertex detector           | 4.5          | 1.3%          |
| Silicon tracker           | 29.7         | 8.9%          |
| Time Projection Chamber   | 6.2          | 1.9%          |
| EM calorimeter            | 115.0        | 34.5%         |
| Hadron calorimeter        | 68.3         | 20.5%         |
| Muon detector             | 2.5          | 0.8%          |
| Detector Magnet System    | 22.0         | 6.6%          |
| Readout electronics       | 19.3         | 5.8%          |
| Trigger and DAQ           | 12.2         | 3.7%          |
| Software and computing    | 23.1         | 6.9%          |
| Mechanics and integration | 28.9         | 8.7%          |
| <b>Total</b>              | <b>333.3</b> | <b>100.0%</b> |

3% installation included; 8% contingency not included.

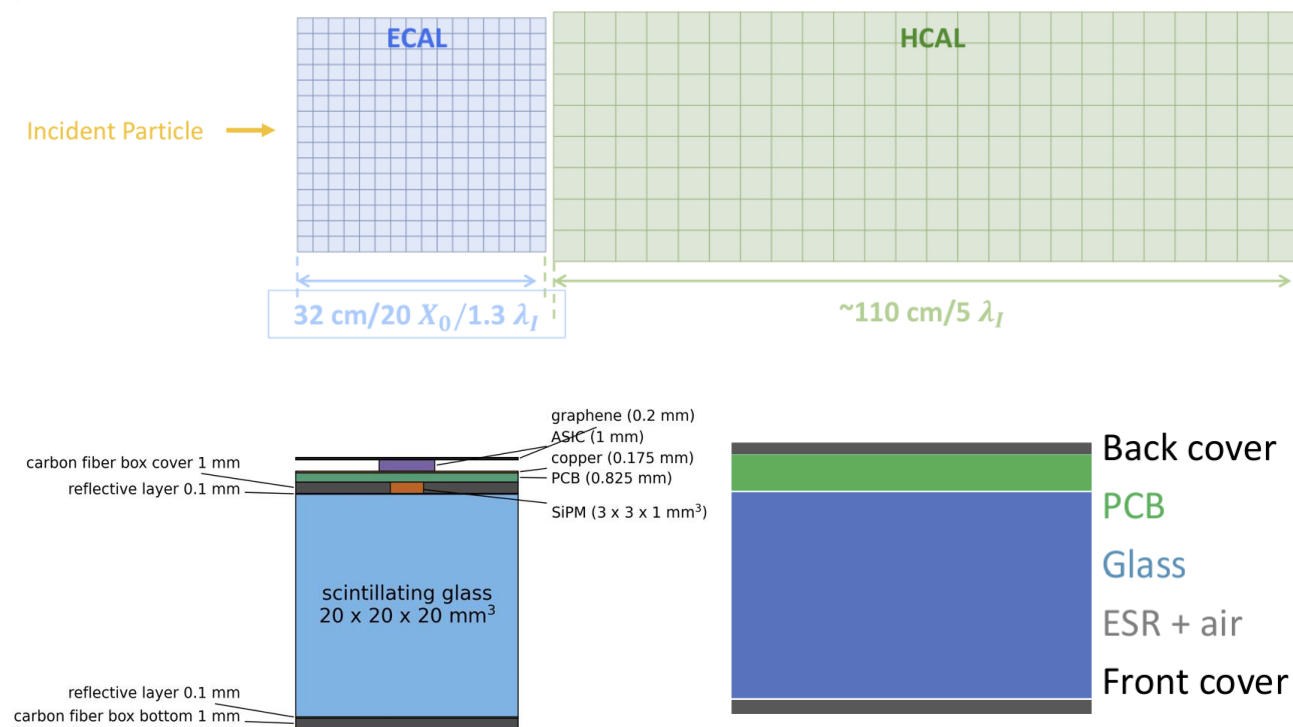


\* [The FCC-ee Contribution to the European Strategy for Particle Physics Update 2025](#)

**Cost compatible to the overall detector budgets in FCC-ee,  $1,300+290=1590$  MCHF\* for 4 detectors → 397.5 MCHF for 1 detector in average**

# New ideas in AGORA

An integrated design for ECAL and HCAL based on **glass scintillator (GS)**: trade-off between cost and physics



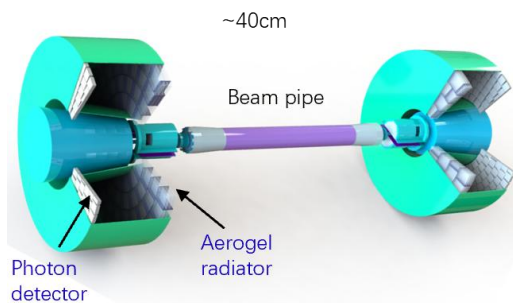
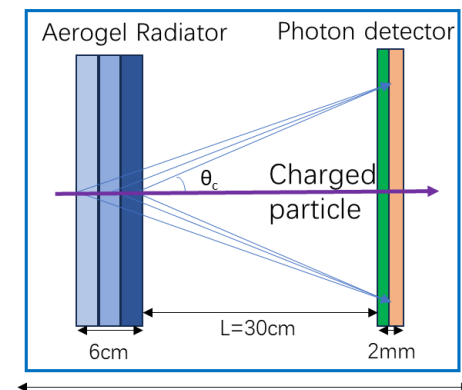
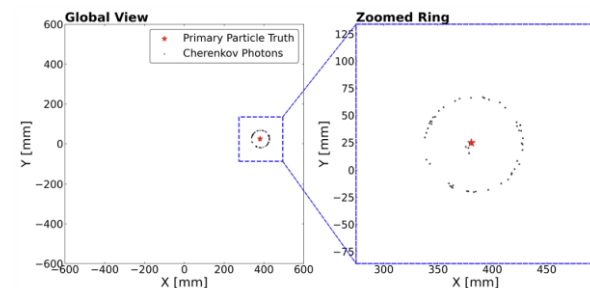
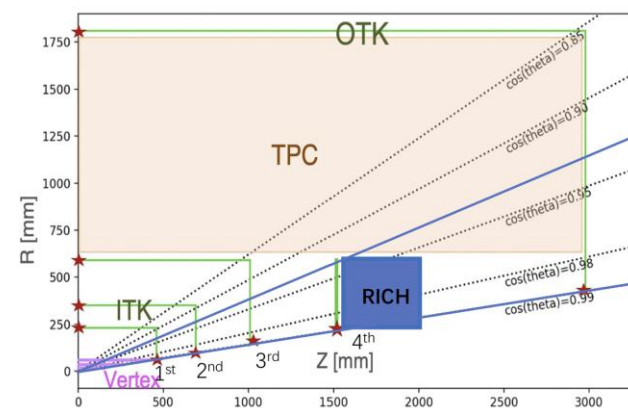
A unit of GS-ECAL  
 $\sigma(E)/E \simeq 3\%/\sqrt{E}$

A unit of GS-HCAL  
 $\sigma(E)/E \simeq 15\%/\sqrt{E}$

Talk by Yong Liu

A Ring-Imaging Cherenkov (**RICH**) detector in the forward region

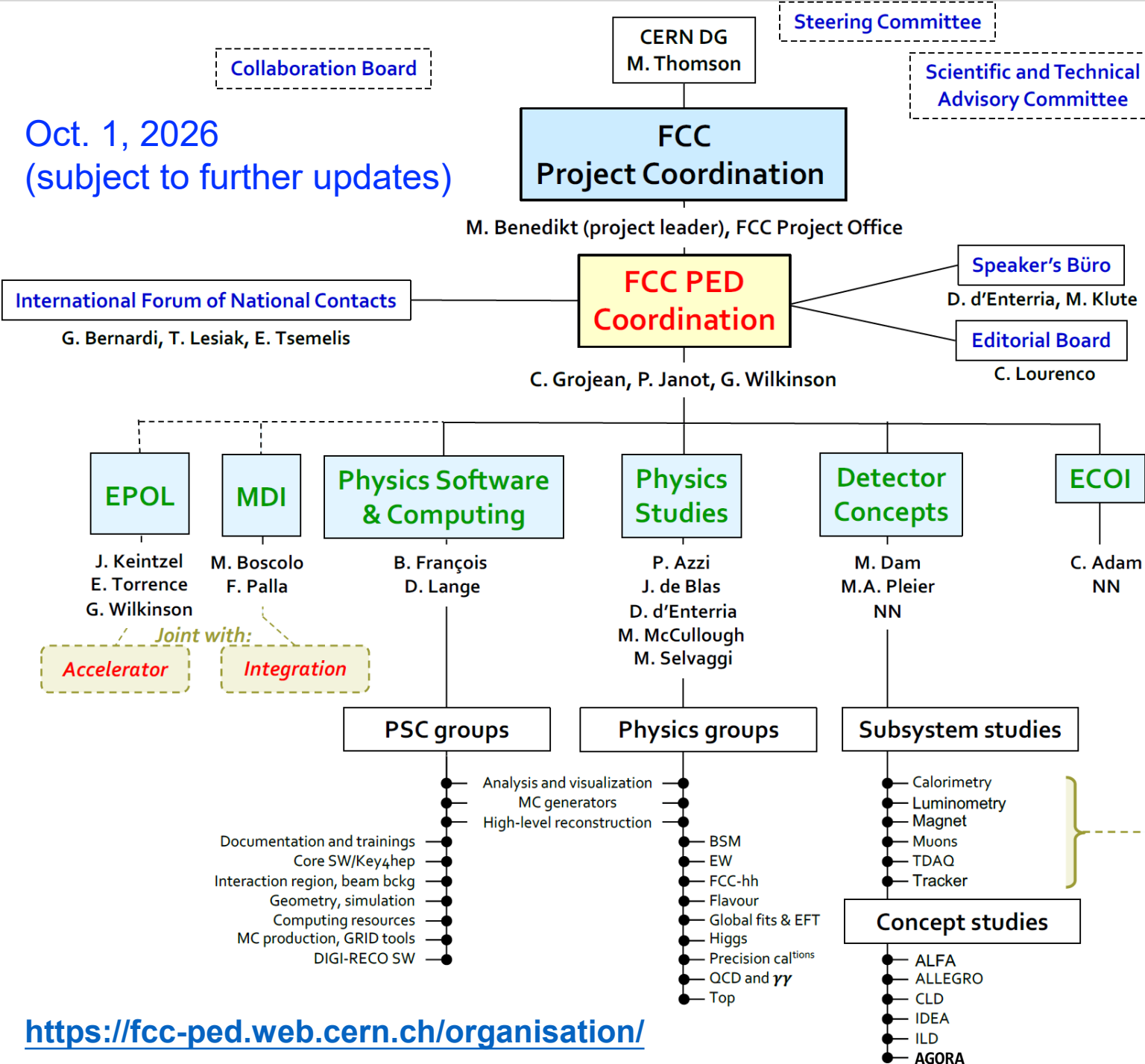
- To improve forward K/ $\pi$  separation
- Key technologies: aerogel radiators with low refractive index and radiation-hard SiPMs with low noise



Talk by Zhonghua Qin

# Organization

Oct. 1, 2026  
(subject to further updates)



## PED

(Physics, Experiments and Detectors) group is one of the pillars of the FCC project.

## 6 WPs

(with public call for nomination to identify coordinators – Call ongoing for Detector Concepts)

## 38 WGs

(with public call for nomination to identify conveners)

# Evolution of Detector Concepts Work Package

## In DRDs:

### RnD / technologies

- Gaseous Detectors (DRD1)
- Liquid Detectors (DRD2)
- Semiconductor Detectors (DRD3)
- Photodetectors & PID (DRD4)
- Quantum Sensors (DRD5)
- Calorimetry (DRD6)
- Electronics (DRD7)
- Mechanics (DRD8)

US R&D Collaborations (RDCs) focus on generic (non-targeted), interdisciplinary and blue sky R&D – will collaborate where possible.

**DRD renewal process  
ongoing, including re-focus  
wrt. EPPSU**

## In FCC Detector concepts:

### a) Generic system-level studies

(create structure as needed or organize workshops)

- Tracker (e.g. Si + straw tracker) & PID
- Calorimetry
- Muons
- TDAQ
- Luminometry
- Magnet

[Full mandate for the  
Detector Subsystem  
subgroup](#)

### b) Concept-specific studies

(using specific envelopes/support structures, or physics benchmarks)

- AGORA
- ALFA
- Allegro
- CLD
- IDEA
- ILD

[Full mandate for the  
Detector Concept Study  
subgroup](#)

Non-exclusive membership, need to preserve synergies and unity of the community!



# Regular meetings

## FCC Physics, Experiments and Detectors (PED)

|                                                                  |         |       |
|------------------------------------------------------------------|---------|-------|
| FCC PED Coordination meetings                                    | 97 个事件  | 🛡️ ➡️ |
| FCC PED monthly general meetings                                 | 64 个事件  | ➡️    |
| FCC Physics programme and performance                            | 388 个事件 | ➡️    |
| FCC Detector Concepts                                            | 149 个事件 | ➡️    |
| FCC Software and Computing                                       | 588 个事件 | ➡️    |
| FCC-ee Machine-Detector Interface                                | 98 个事件  | ➡️    |
| FCC-ee Beam Energy Calibration, Polarisation, Monochromatisation | 86 个事件  | ➡️    |
| FCC International Forum of National Contacts                     | 6 个事件   | ➡️    |
| FCC National Institute Meetings                                  | 526 个事件 | ➡️    |
| FCC Conceptual Design Study (Archive)                            | 379 个事件 | ➡️    |
| FCC PED Speaker's Büro                                           | 14 个事件  | ➡️    |
| FCC PED Topical Workshops                                        | 11 个事件  | ➡️    |
| FCC PED Education, Communication, Outreach, Inreach              | 61 个事件  | ➡️    |

<https://indico.cern.ch/category/5251/>

## Detector Subsystems

|               |           |    |
|---------------|-----------|----|
| Calorimetry   | empty     | ➡️ |
| Luminometry   | 1 event   | ➡️ |
| Magnet        | 1 event   | ➡️ |
| Muon          | 4 events  | ➡️ |
| TDAQ          | 28 events | ➡️ |
| Tracker & PID | 31 events | ➡️ |

<https://indico.cern.ch/category/20278/>

## Concept Studies

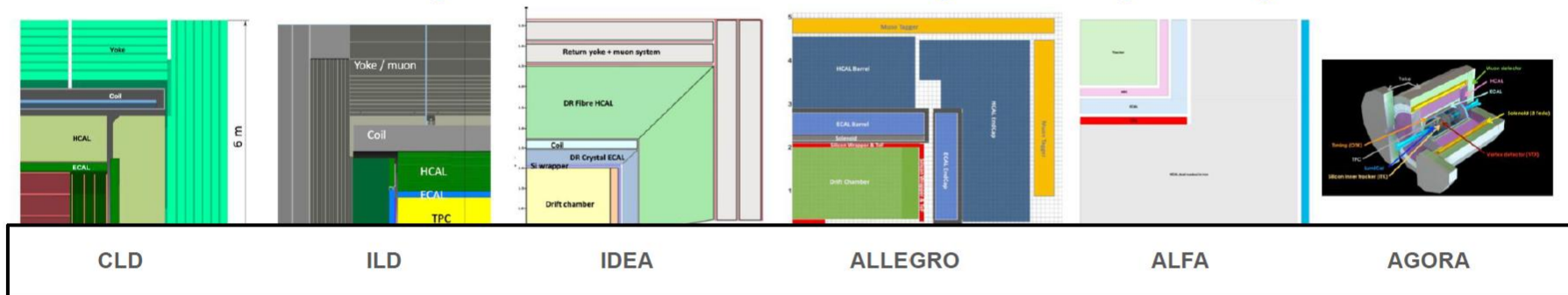
|         |           |    |
|---------|-----------|----|
| AGORA   | 15 events | ➡️ |
| ALFA    | 10 events | ➡️ |
| ALLEGRO | 10 events | ➡️ |
| CLD     | empty     | ➡️ |
| IDEA    | 2 events  | ➡️ |
| ILD     | 1 event   | ➡️ |

<https://indico.cern.ch/category/20285/>

# The Reference Design Phase seen from PED



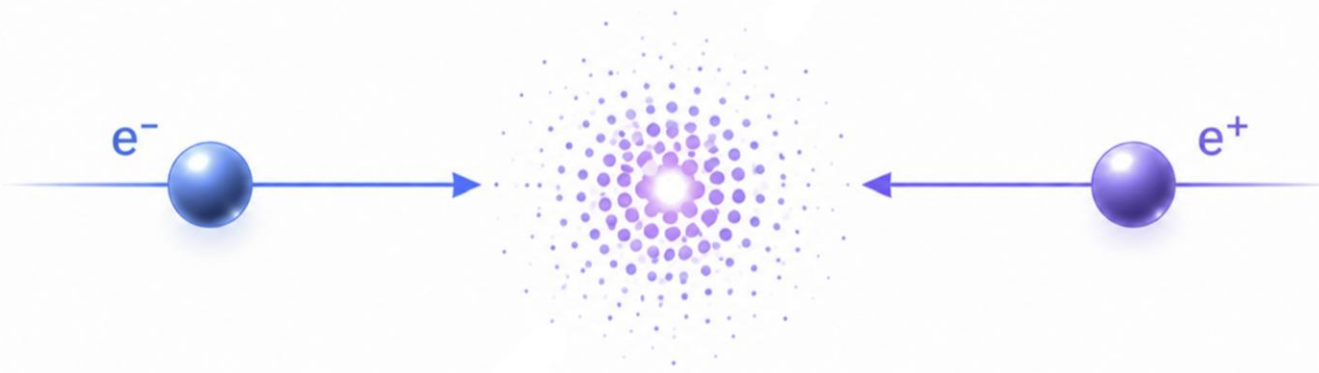
- Six detector concepts are studied today — hopefully more coming!



- Expression of interests will be called **AFTER** the approval (but prepared now)
- **Collaboration forming (merging, etc.): Evian-like series of workshop in 2029-30**
  - From 6+ detector concepts to four collaboration and four Letters of Intent in ~2030
- Detector CDRs in 2033-34; TDRs in 2036-37; Detectors ready in 2045-46.

# Summary

- Extremely rich physics program → formidable detector challenge
  - Very high rates; very high precision; advanced detectors called for
- Aiming for 4 experiments → 6 concepts being pursued
- Evolving organization of Detector Studies effort
  - Detector (sensor) R&D concentrated inside DRD collaborations
  - Detector sub-groups for coordination of sub-detector efforts
  - Detector concept study groups for development of specific concept
- Ample room for new ideas and technologies



## References

- **News from PED coordination**  
@ first FCC PED General Meeting Oct. 1, 2026
- **FCC-ee Detector Concepts**  
@ ILD Meeting CERN Sep. 14, 2026
- **Talks from each detector concept**  
@ FCC week Jun. 8-12, 2026