

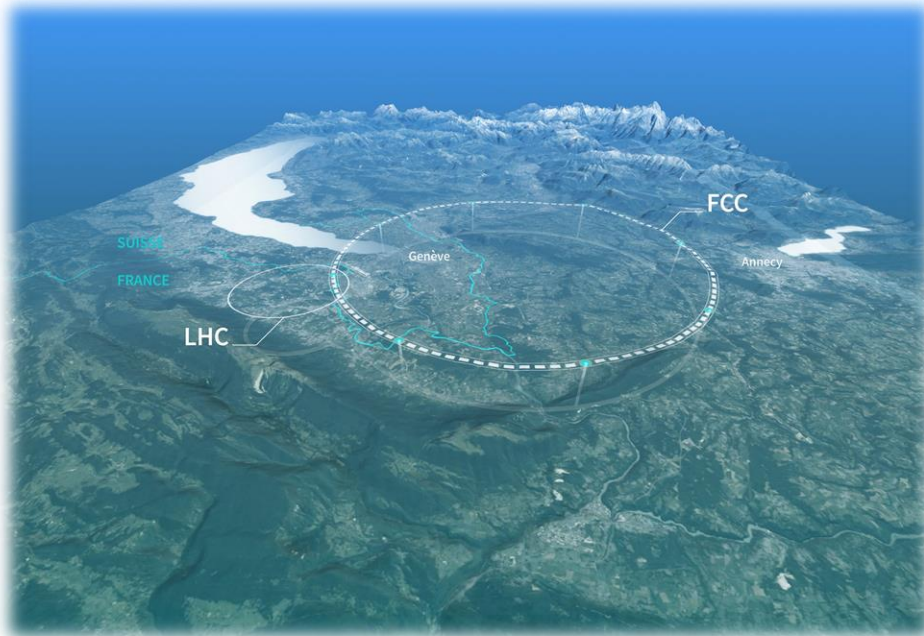
# A bright IDEA: $\mu$ -RWELL technology at the FCC

Graduate symposium

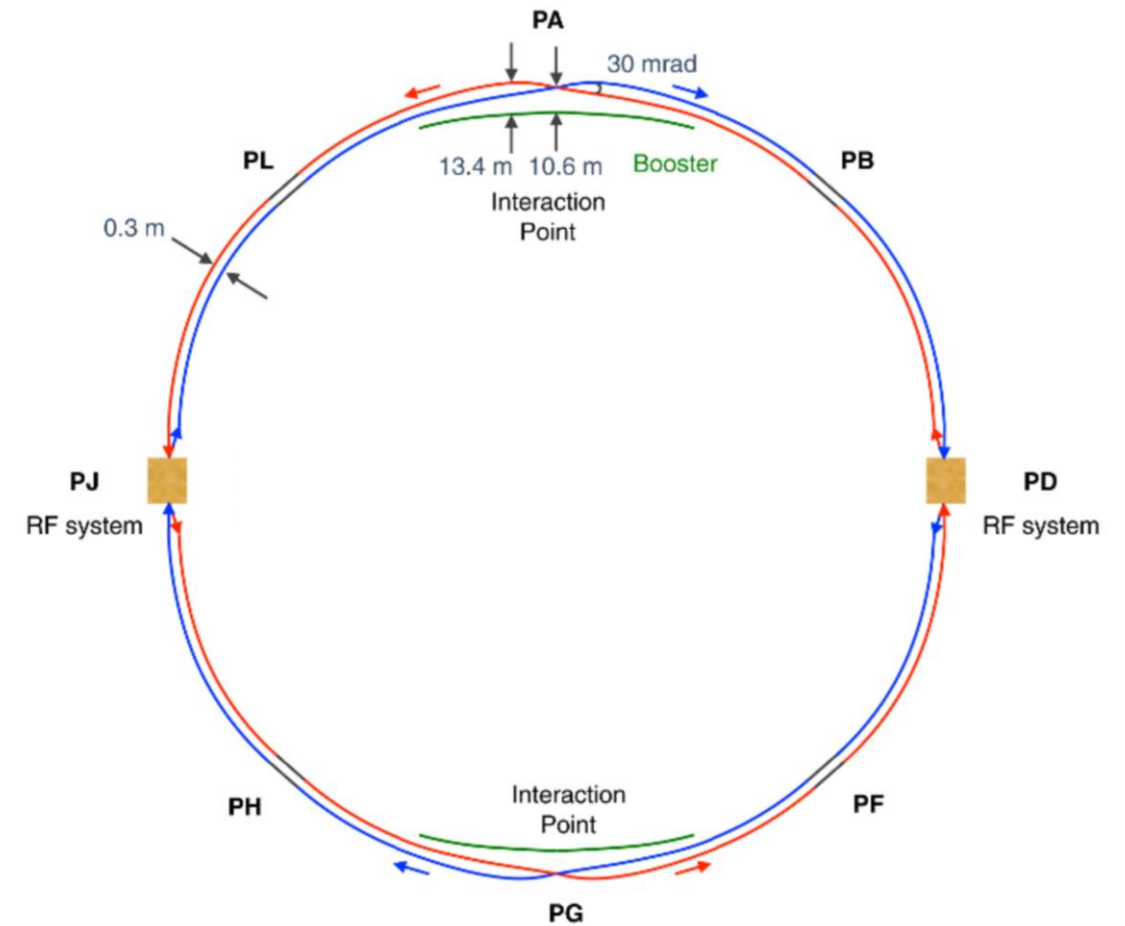
13<sup>th</sup> March 2024

Annabelle Brooks

# Lord of the Rings...



[1] A schematic map showing a possible location for the Future Circular Collider



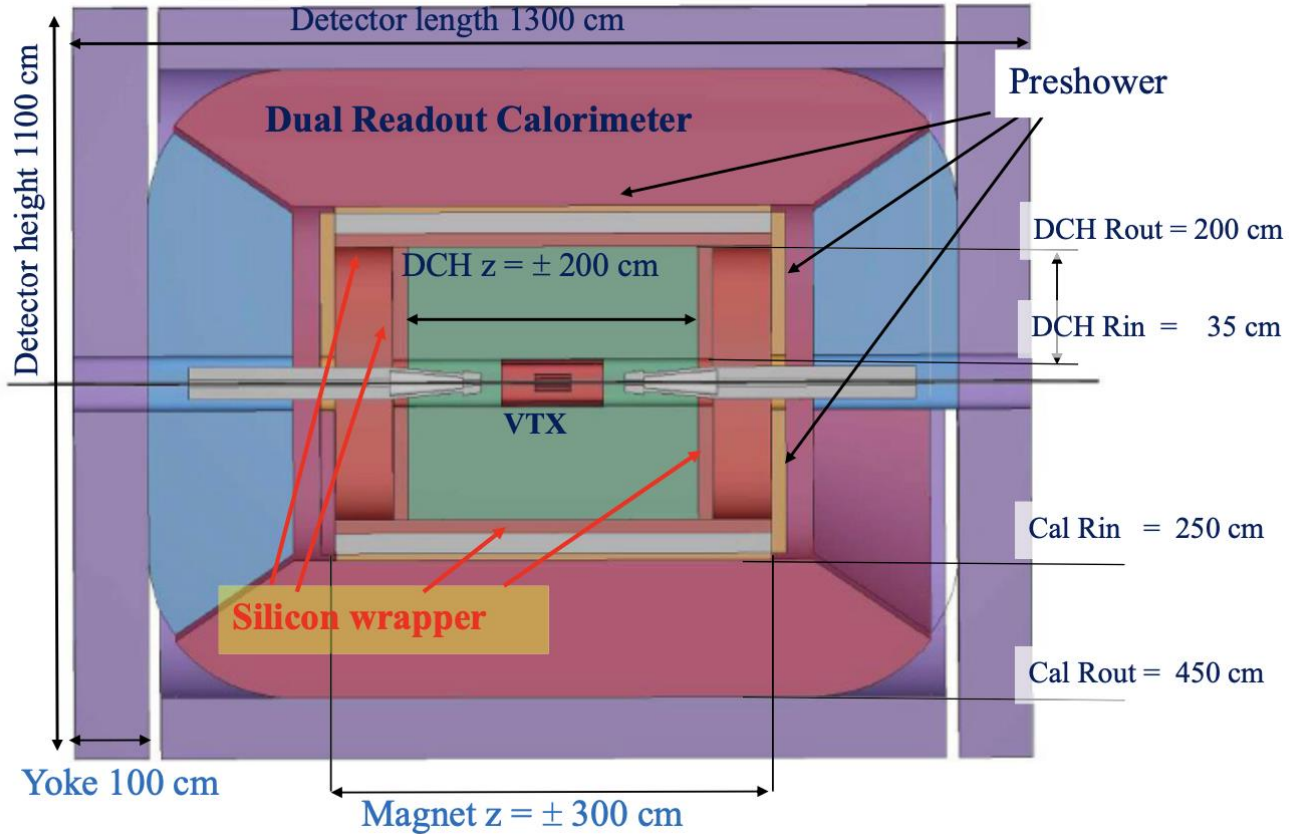
[2] Overall layout of the FCC-ee

[1] CERN

[2] FCC collaboration (2019)

# IDEA: a detector and a decent backronym

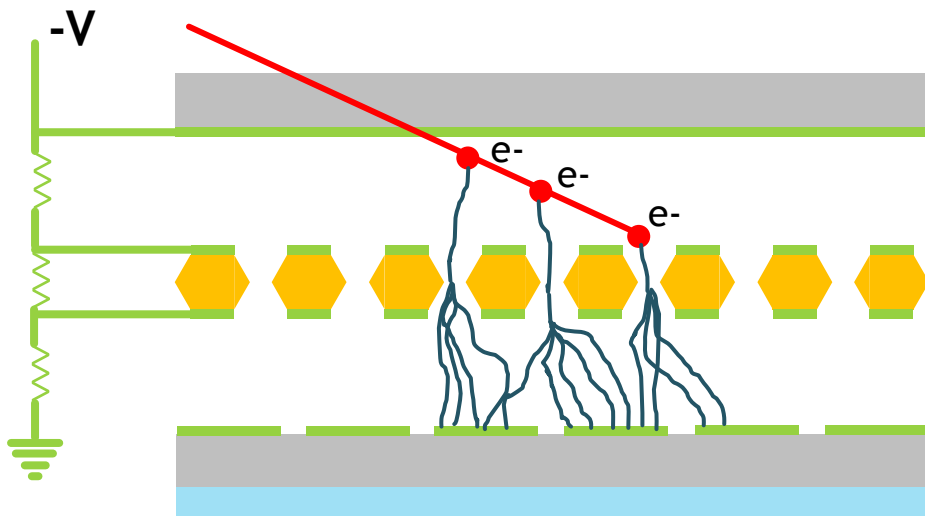
[2] Schematic layout of the IDEA detector



- Silicon pixel vertex detector (based on ALICE inner tracker system)
- DCH: large volume wire chamber
- Preshower detectors
- Dual readout calorimeter (optical fiber and SiPM)
- Muon chambers

# Gas electron multiplier (GEM)

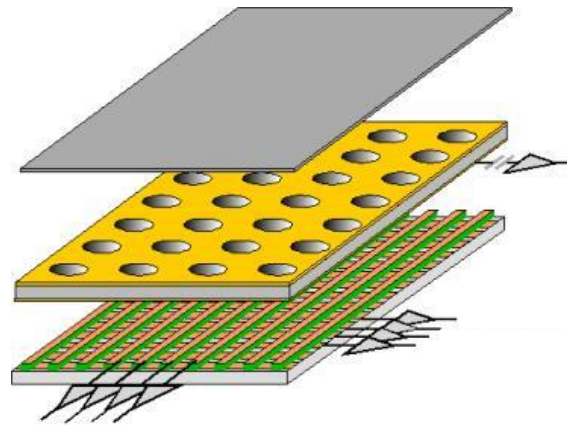
Gas detector working principle: ionisation and electron multiplication



[3] [gdd.web.cern.ch](http://gdd.web.cern.ch)

[4] [vanderby.web.cern.ch](http://vanderby.web.cern.ch)

[3] GEM detector layout

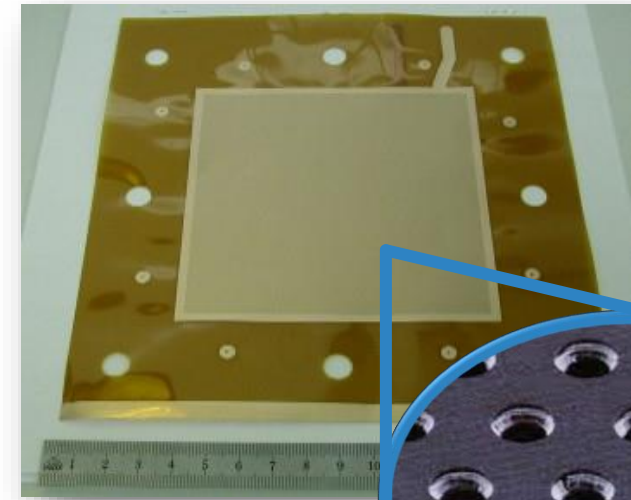


Drift cathode

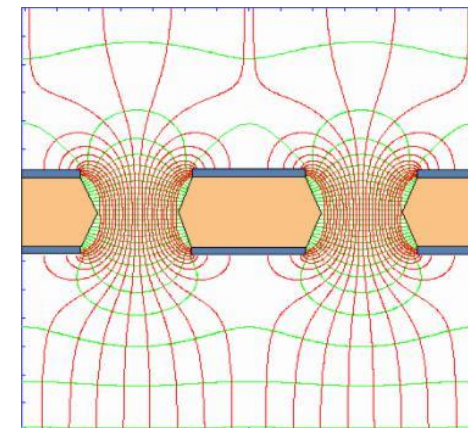
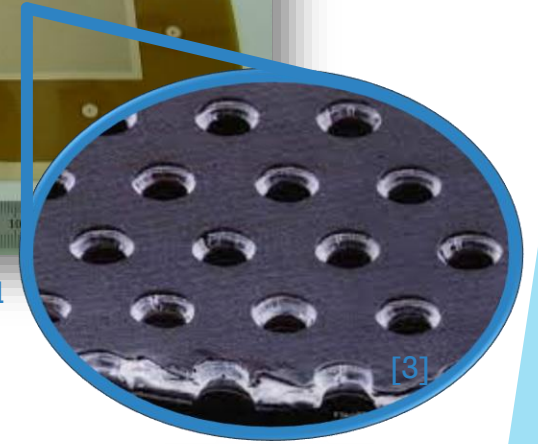
GEM foil

Readout strips

PCB



[4] GEM foil



[3] Electric field inside a GEM foil

# GEM detector wish list

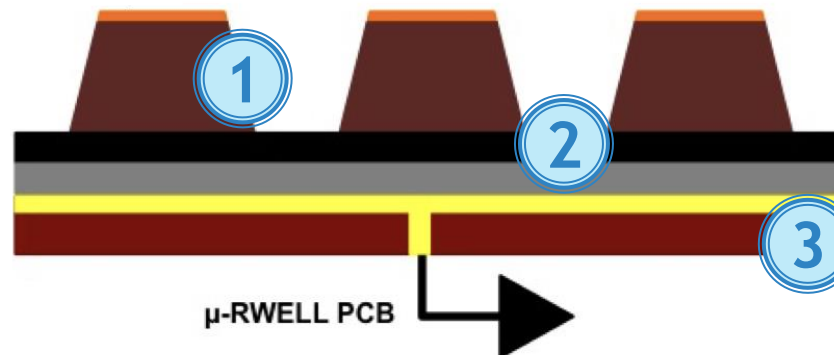
- robust against discharges
- large gains (up to  $10^4$ )
- compact structure
- easy to build
- cost effective
- suitable for mass production

# Enter: the $\mu$ -RWELL

[5] Sketch of the  $\mu$ -RWELL layout



**Drift cathode PCB**



# $\mu$ -RWELL at the FCC

- Spatial resolution of 50  $\mu\text{m}$
- Efficiency above 97-98%
- Rate capability up to 10  $\text{MHz}/\text{cm}^2$

## Preshower:

high spatial resolution to tag incoming particles

## Muon chambers:

area coverage of over  $4000\text{m}^2$  with a lower spatial resolution and a reduced number of channels

# Summary

- Two detector designs proposed for FCC-ee: CLD and IDEA
  - Need high resolution, large area gas detectors for the preshower and muon chambers
    - $\mu$ -WRELL is a natural choice, given its:
      - discharge suppression
      - simpler assembly procedure
      - mass production capabilities



The background features abstract, overlapping geometric shapes in various shades of blue, ranging from light sky blue to deep navy blue. These shapes are primarily triangles and polygons that create a sense of depth and movement, framing the central text.

Thanks for listening!

# References

- [1] <https://home.cern/science/accelerators/future-circular-collider>
- [2] FCC collaboration, 2019. FCC-ee: the lepton collider: future circular collider conceptual design report volume 2. *European Physical Journal Special Topics*, 228(2), pp.261-623.
- [3] <https://gdd.web.cern.ch/sites/default/files/oldGDD/www/gemgeneral.html>
- [4] <https://vanderby.web.cern.ch/dem/products/gem/>
- [5] Poli Lener, M., Morello, G., De Oliveira, R., Ochi, A., Felici, G., Bencivenni, G. and Gatta, M., 2019. SISSA: The micro-RWELL detector. PoS, p.019.
- [6] Farinelli, R., Amoroso, A., Balossino, I., Bencivenni, G., Bertani, M., Cafaro, V., Cibinetto, G., De Lucia, E., Dominici, D., Evangelisti, F. and Felici, G., 2023. The  $\mu$ -RWELL technology for the preshower and muon detectors of the IDEA detector. *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, 1048, p.167993.