

The mystery of the Higgs boson

The discovery of the Higgs boson in 2012 completed the Standard Model of particle physics

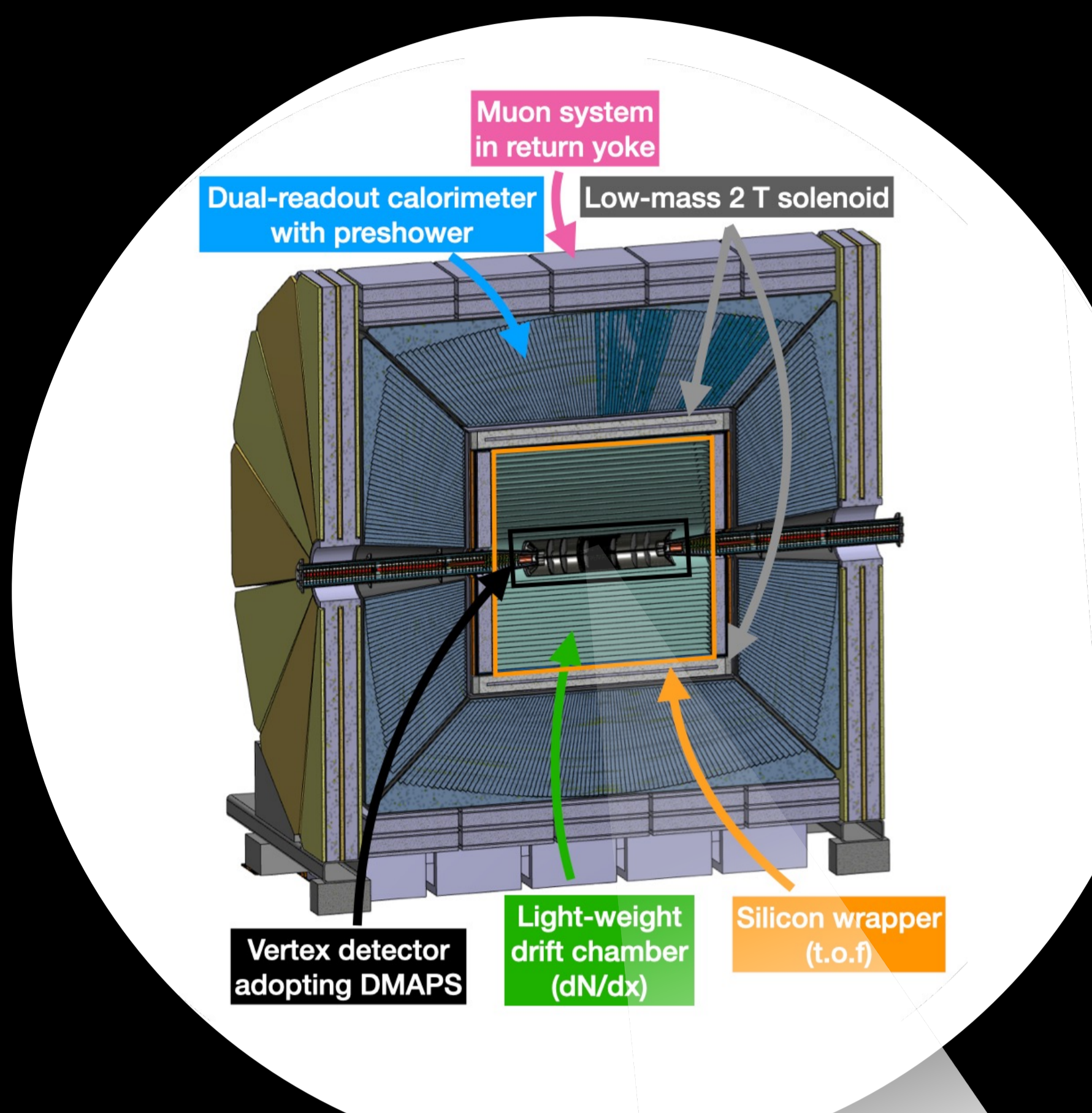
- Many open questions unaddressed
- Almost all related to the Higgs

→ Studying the Higgs boson is of highest importance for the post-LHC era

The Future Circular Collider (FCC)

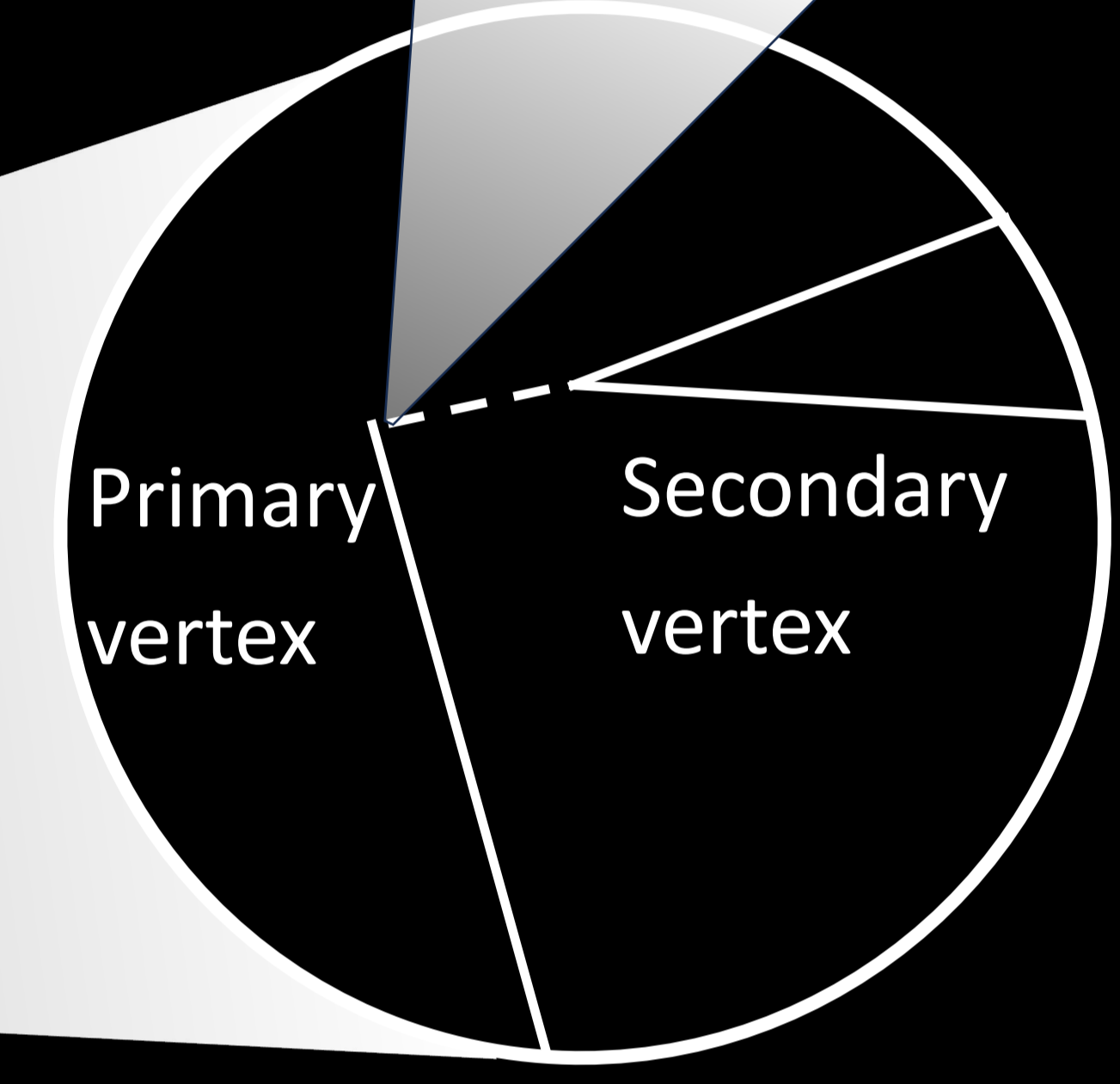
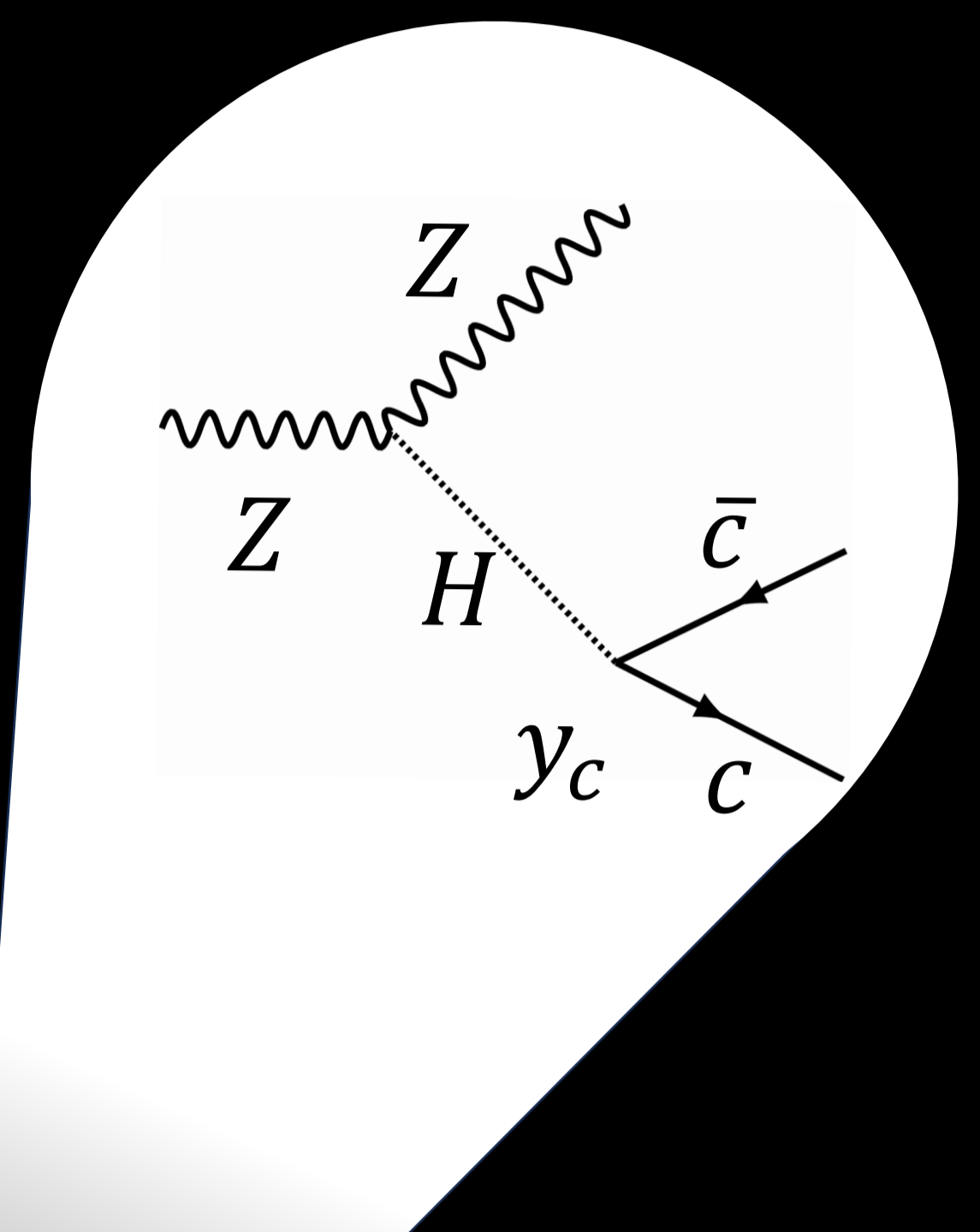
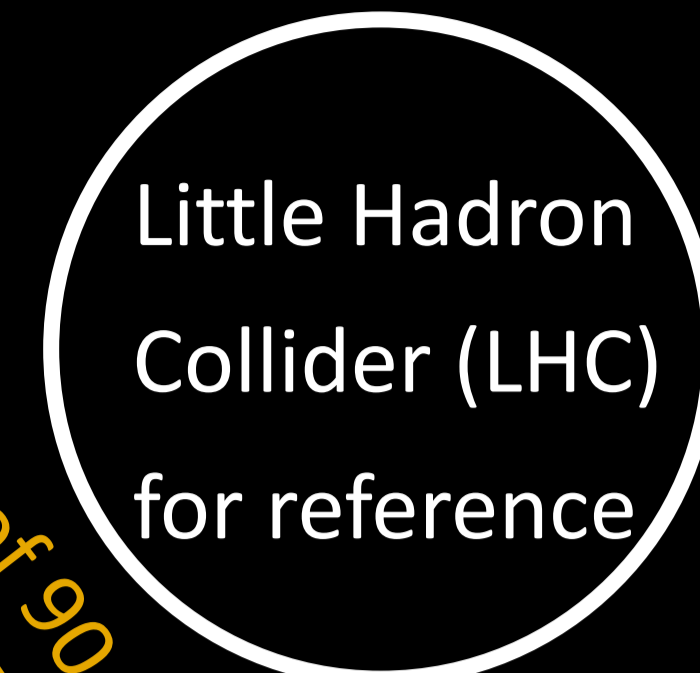
Particle collider for the rest of the 21st century

- FCC-ee for intense e^+e^- collisions between 91 and 365 GeV
- Later: FCC-hh to collide hadrons with energies of 80 – 116 TeV



IDEA detector concept

IDEA vertex detector (scale 1:1)



Physics at the FCC-ee

- All SM particles in huge quantities
- Clean experimental conditions (leptons not subject to QCD)

→ $6 \cdot 10^{12}$ Z and $2.4 \cdot 10^8$ W bosons, indirect sensitivity to new particles of 10-70 TeV

→ Two million *precious* Higgs bosons to probe a non-zero Higgs self-coupling λ_3

→ Establish Higgs coupling to charm (y_c) and maybe strange quarks

Experiments: Need to match tiny statistical uncertainties with systematics down to $10^{-4} - 10^{-5}$

Vertex detectors

- At the centre of all future collider experiments

→ Flavour tagging, particle lifetime measurements, flavour physics

Vertexing performance depends on:

- Spatial resolution of the sensors
- Amount of material of detector

Our group develops monolithic active pixel sensors for FCC-ee vertex detectors and simulates the performance of the latter

Jet flavour tagging

Process of mapping measured *jet* to its originating quark or gluon.

- Clean experimental conditions
- Sophisticated ML algorithms

→ Performant charm tagging

→ Strange tagging feasible

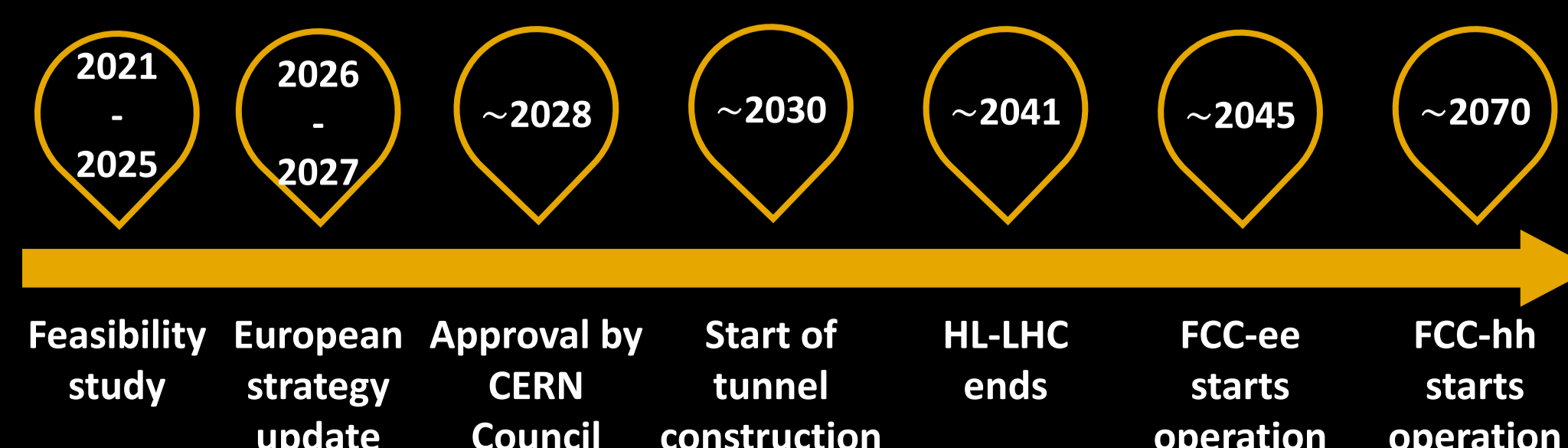
Our group has developed a flavour tagger for FCC-ee

Opportunities working on the FCC at UZH

Unique opportunity for you to shape the future of particle physics. Some possible BSc. or MSc. thesis topics are:

- Characterisation of pixel sensors for FCC-ee vertex detectors
- Study of FCC-ee physics potential using simulated data
- Tracking and vertexing algorithms for FCC-ee

→ *Speak friend and enter our FCC group!*



All we have to decide is what to do with the time that is given us.