

FDF 2025

Welcome to CERN

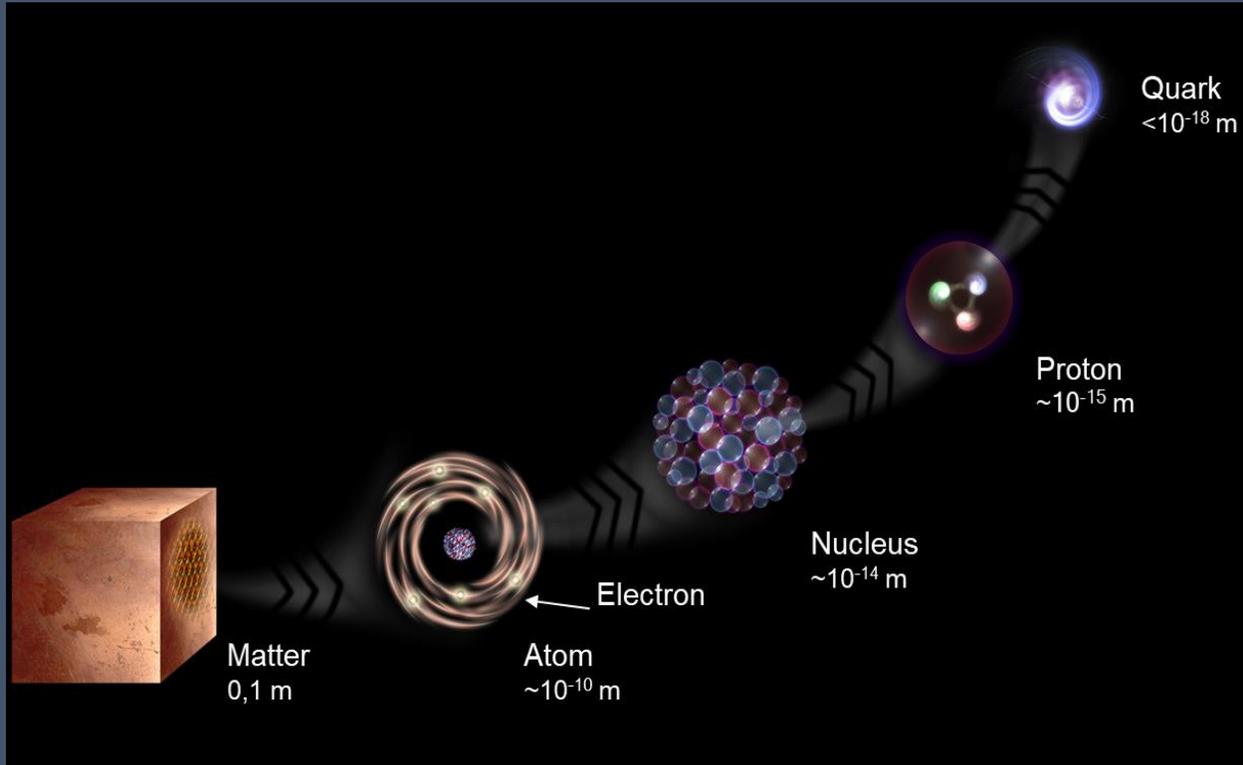


E. Gousiou

2025 05 20

CERN

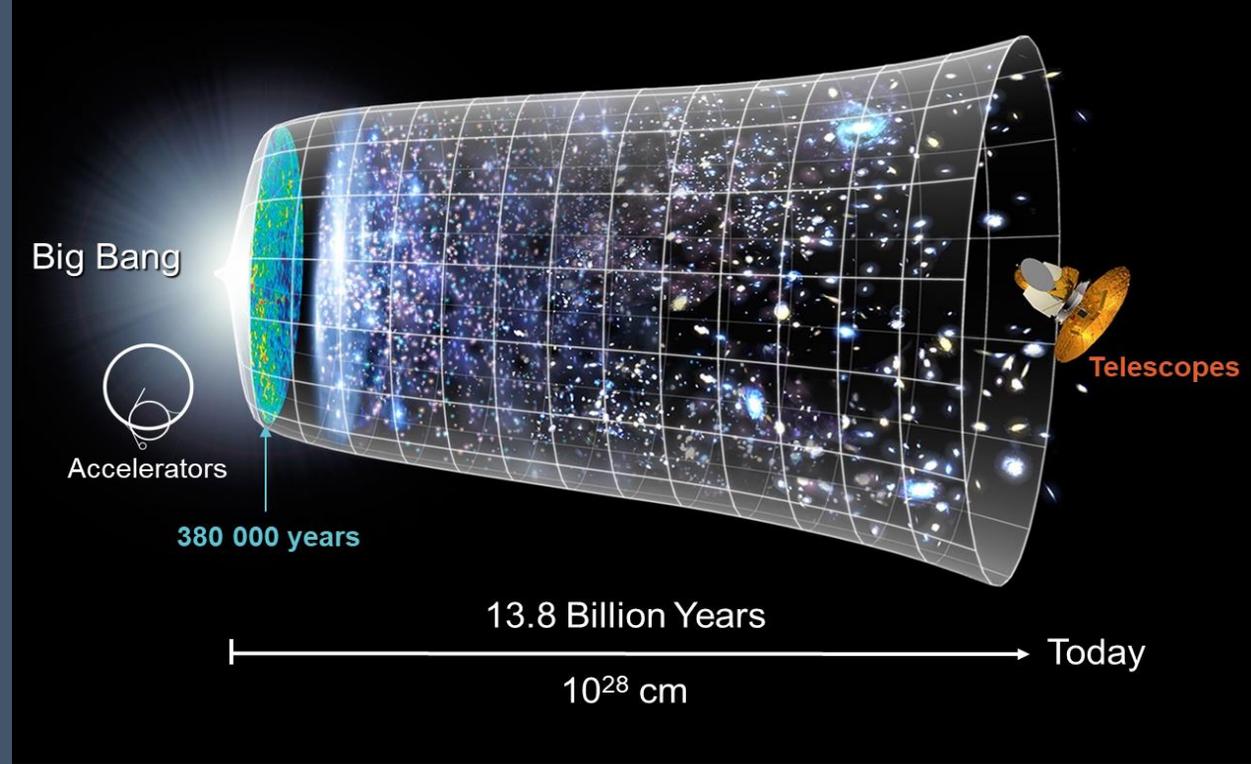
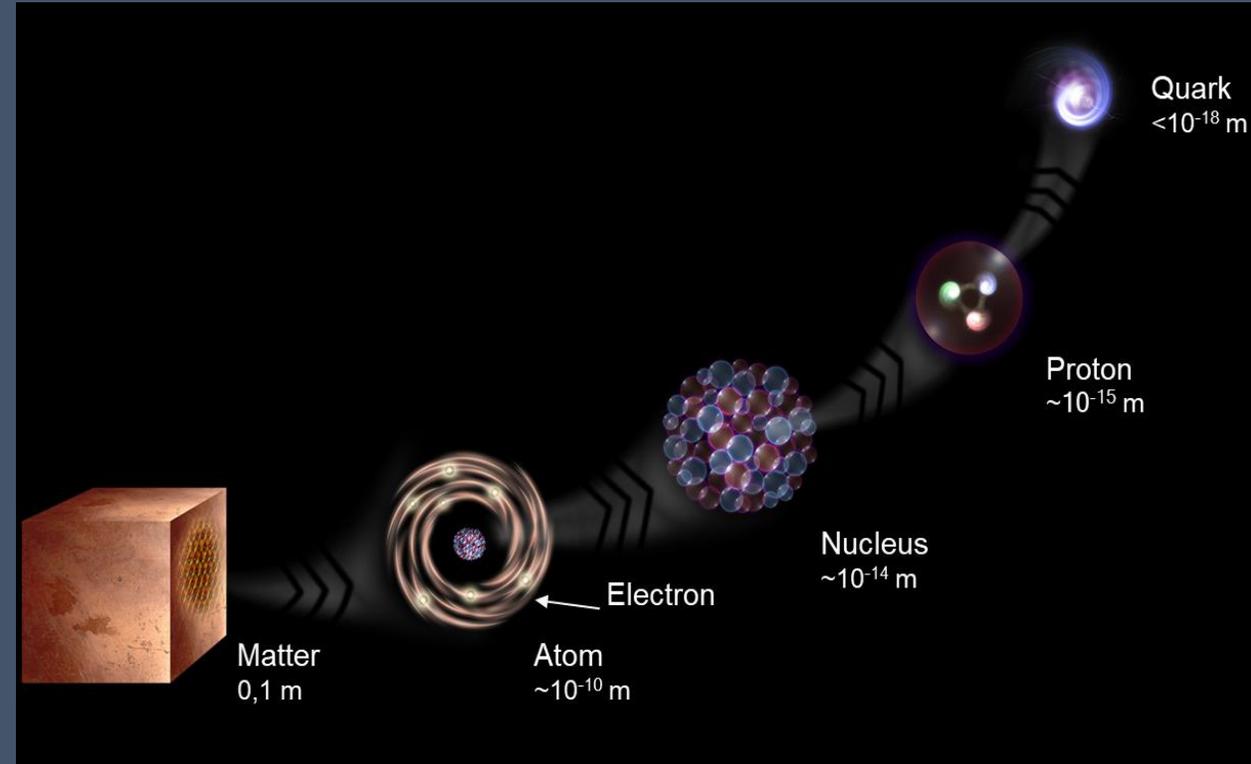
OUR MISSION



- Study of elementary building blocks of matter & forces that control their behaviour

CERN

OUR MISSION



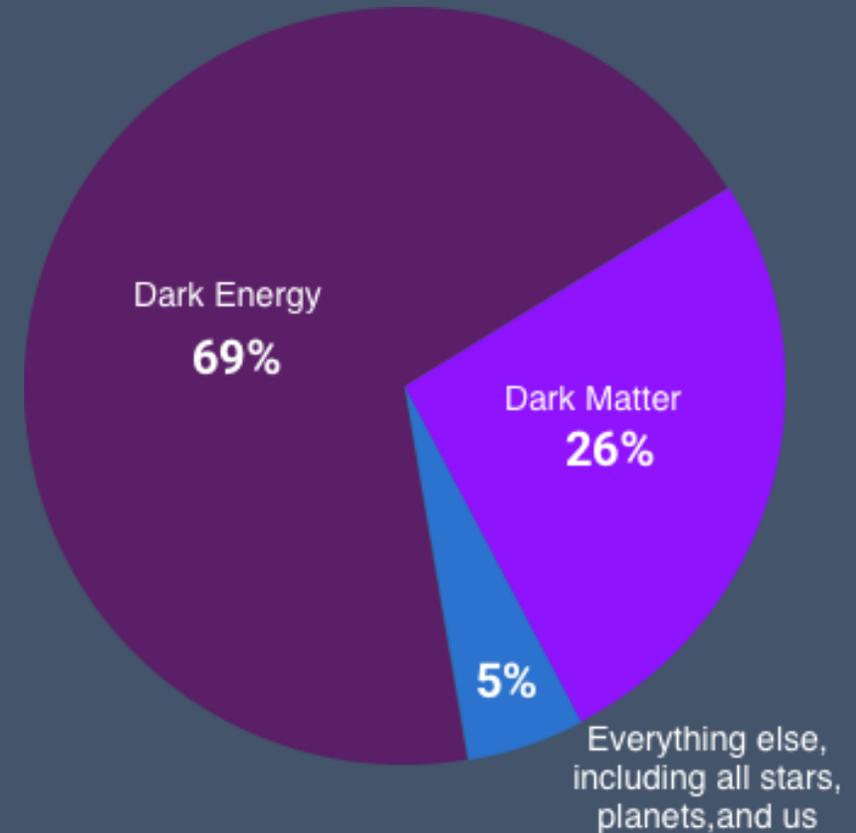
- Study of elementary building blocks of matter & forces that control their behaviour
- Reproduce the conditions a fraction of sec after the BIG BANG
 - To gain insight into the structure and evolution of the Universe
 - Telescopes also do that, but can arrive 380'000y after the BIG BANG

SOME QUESTIONS WE TRY TO ANSWER

Why is there a matter/ antimatter asymmetry?

What is dark matter?

What is dark energy?



Energy Distribution of the Universe

ACCELERATORS & DETECTORS

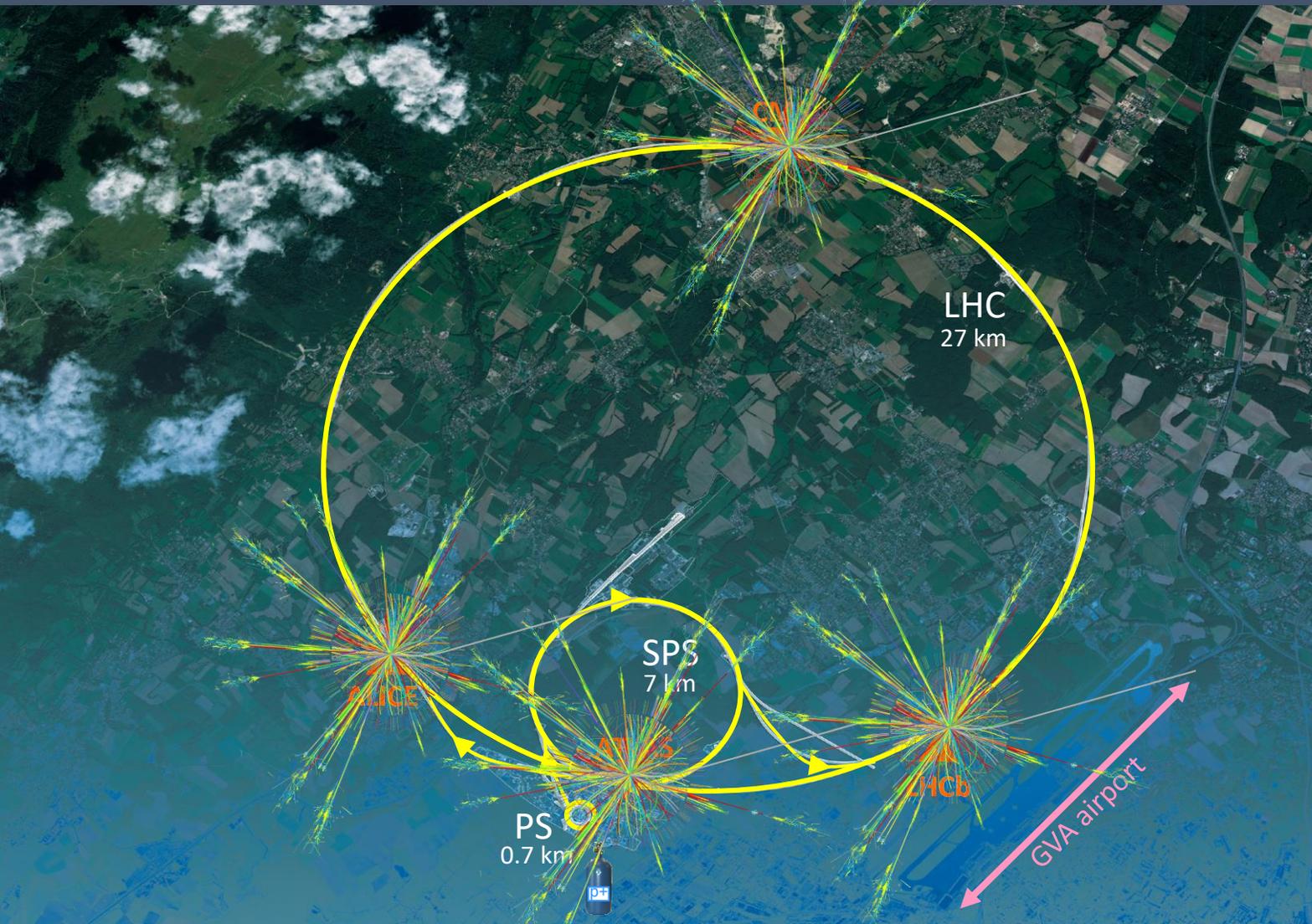
THE TOOLS TO EXPLORE THESE QUESTIONS



- 27 km circumference
- 100 m underground
- 2 beams of trillions of protons travelling at 0.999999991 times the speed of light in opposite directions
- Superconducting radiofrequency system to accelerate the beams
- NbTi Superconducting magnets operating at -271.3 °C to bend them in a circle
- Largest beam vacuum system worldwide
- Advanced powering, machine protection systems, beam diagnostics & control
- 4 Large experiments

ACCELERATORS & DETECTORS

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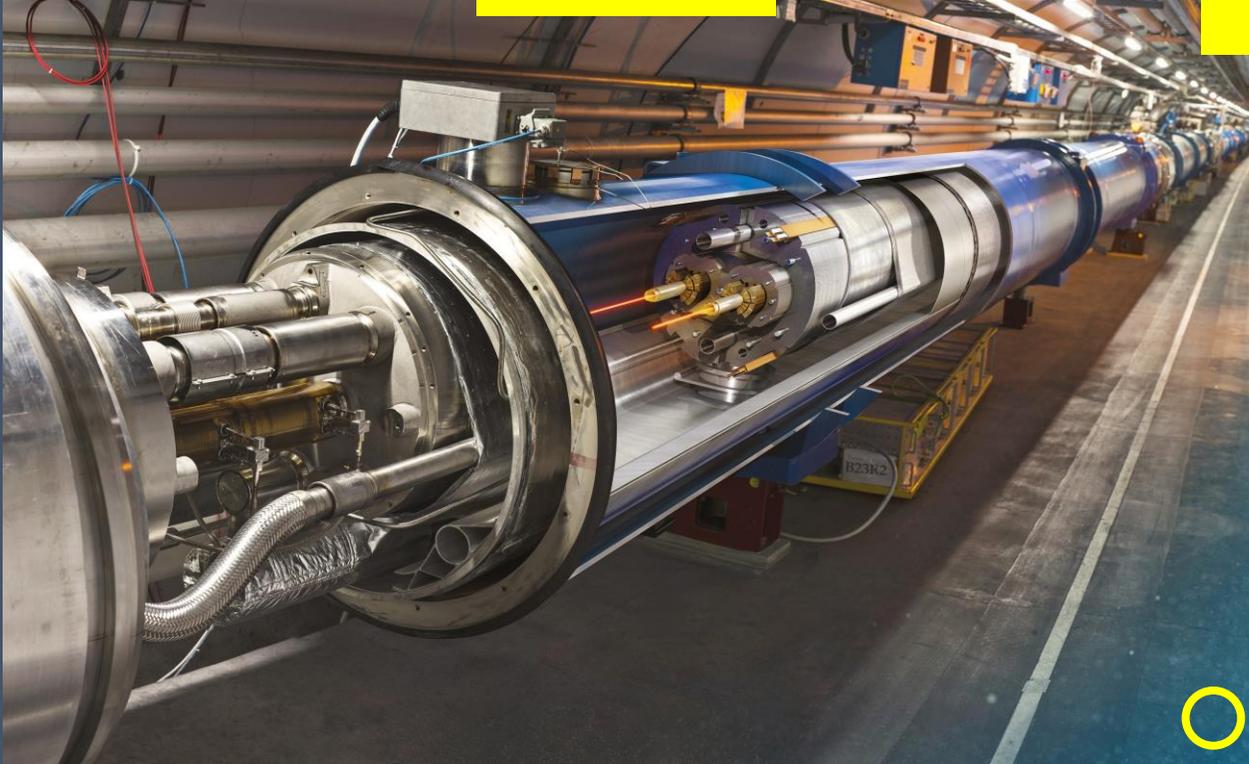
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ACCELERATORS & DETECTORS

ACCELERATORS

LHC

DETECTORS



CERN operates nine accelerators and two decelerators

ACCELERATORS & DETECTORS

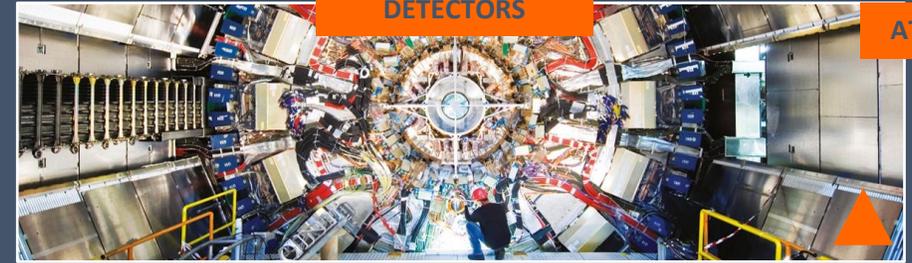
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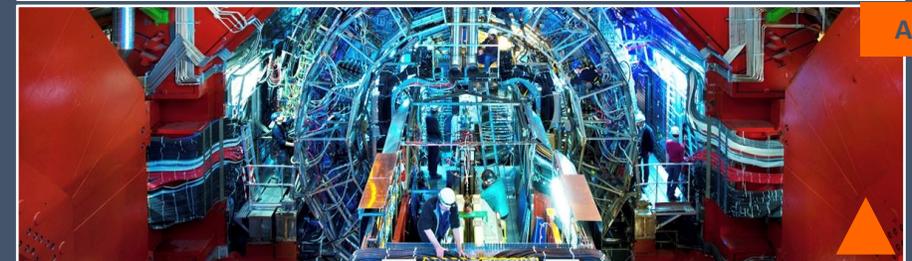
DETECTORS



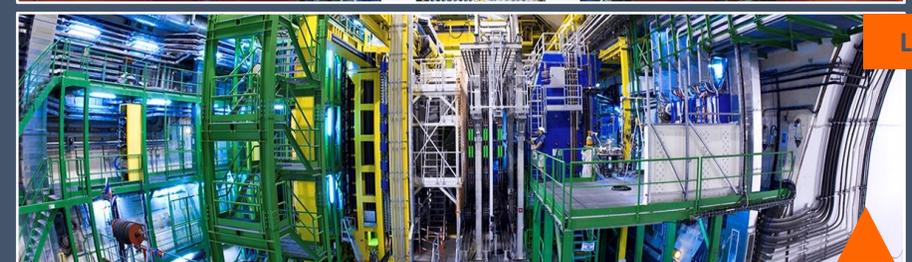
ATLAS



CMS



ALICE



LHCb

There are 5 more detectors at the LHC (9 in total)

ACCELERATORS & DETECTORS

ACCELERATORS

- Provide Beam
- Equipment groups: steer, focus, accelerate, structure, measure, inject and extract the beam
- **Control** of critical equipment

DETECTORS



ACCELERATORS & DETECTORS

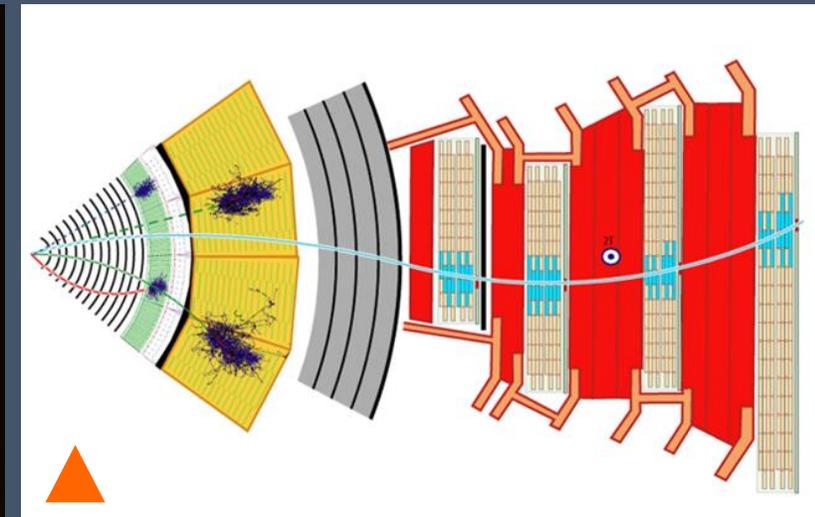
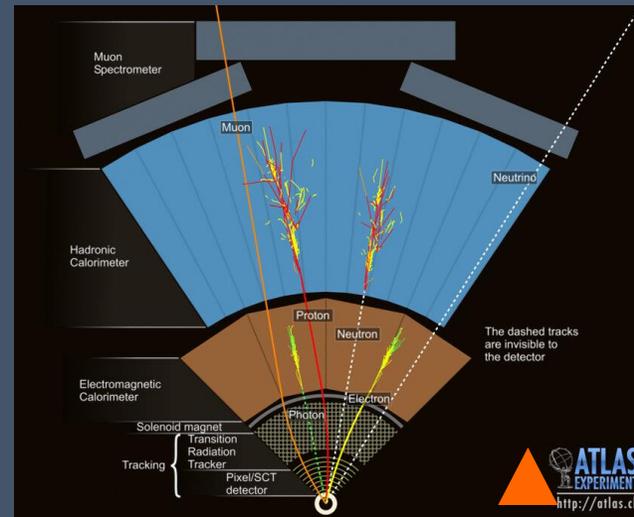
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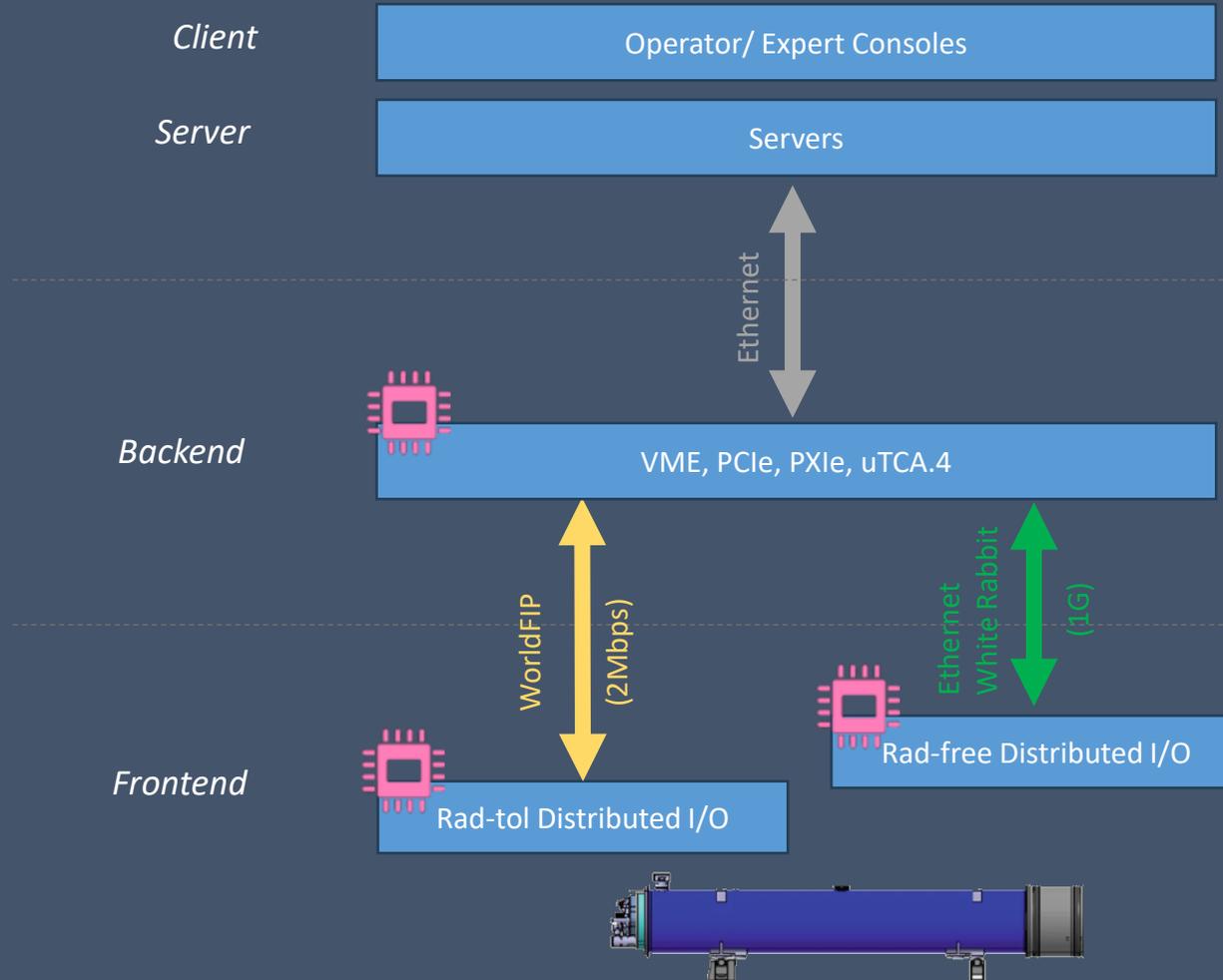
DETECTORS

- Reconstruct collision events
- Detector systems: Pixel detector, Calorimeter, Muon detector
- **Independently** designed



ACCELERATORS: FPGA DEVELOPMENT

Basic architecture focused on the upcoming Run4



- **FPGAs at the Front and Back-end**
- **Fieldbuses** bw Front and Back-end
- **Xilinx (ZU+), Rad-tol Microsemi**
- **VHDL for syn**

ACCELERATORS: FPGA DEVELOPMENT

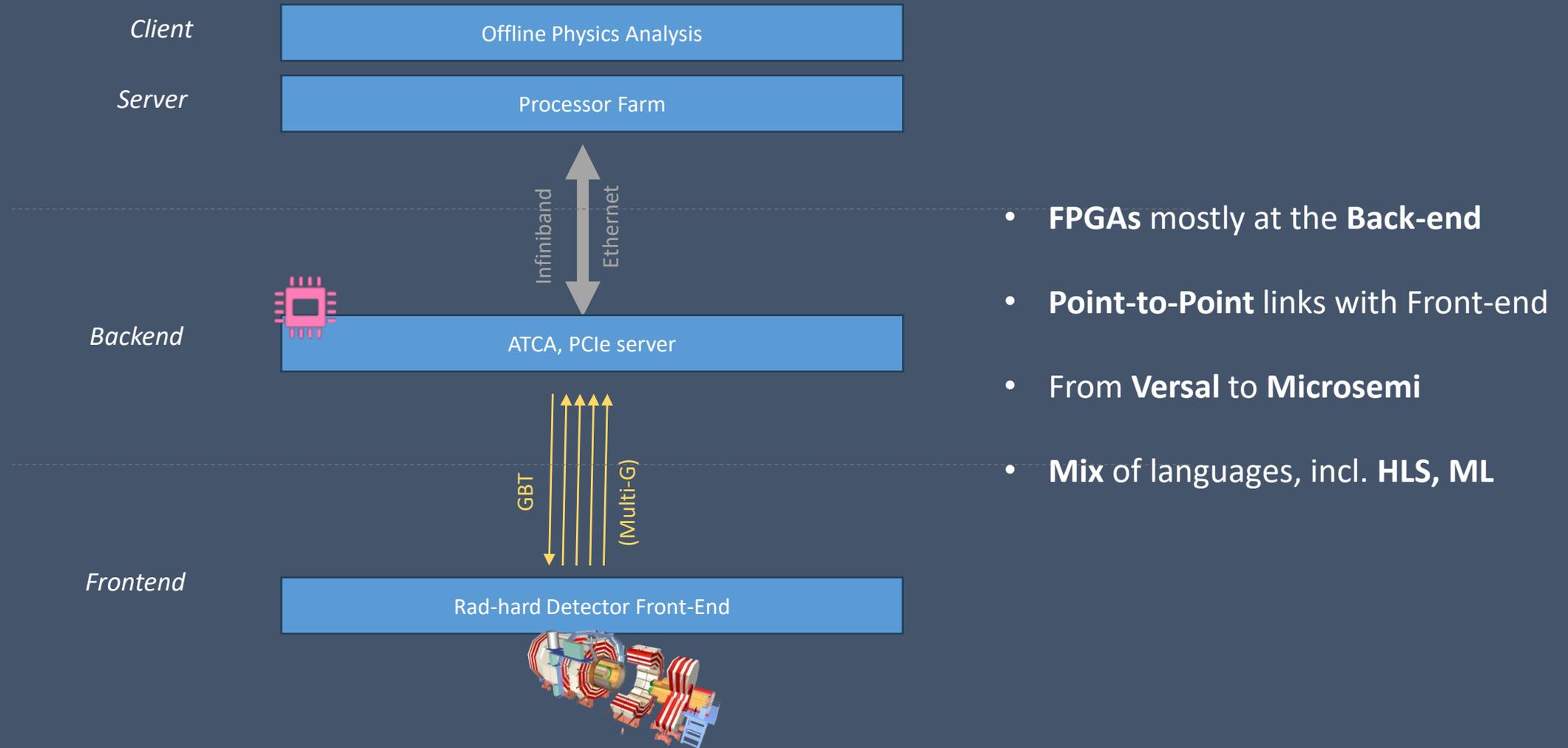
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DETECTORS: FPGA DEVELOPMENT

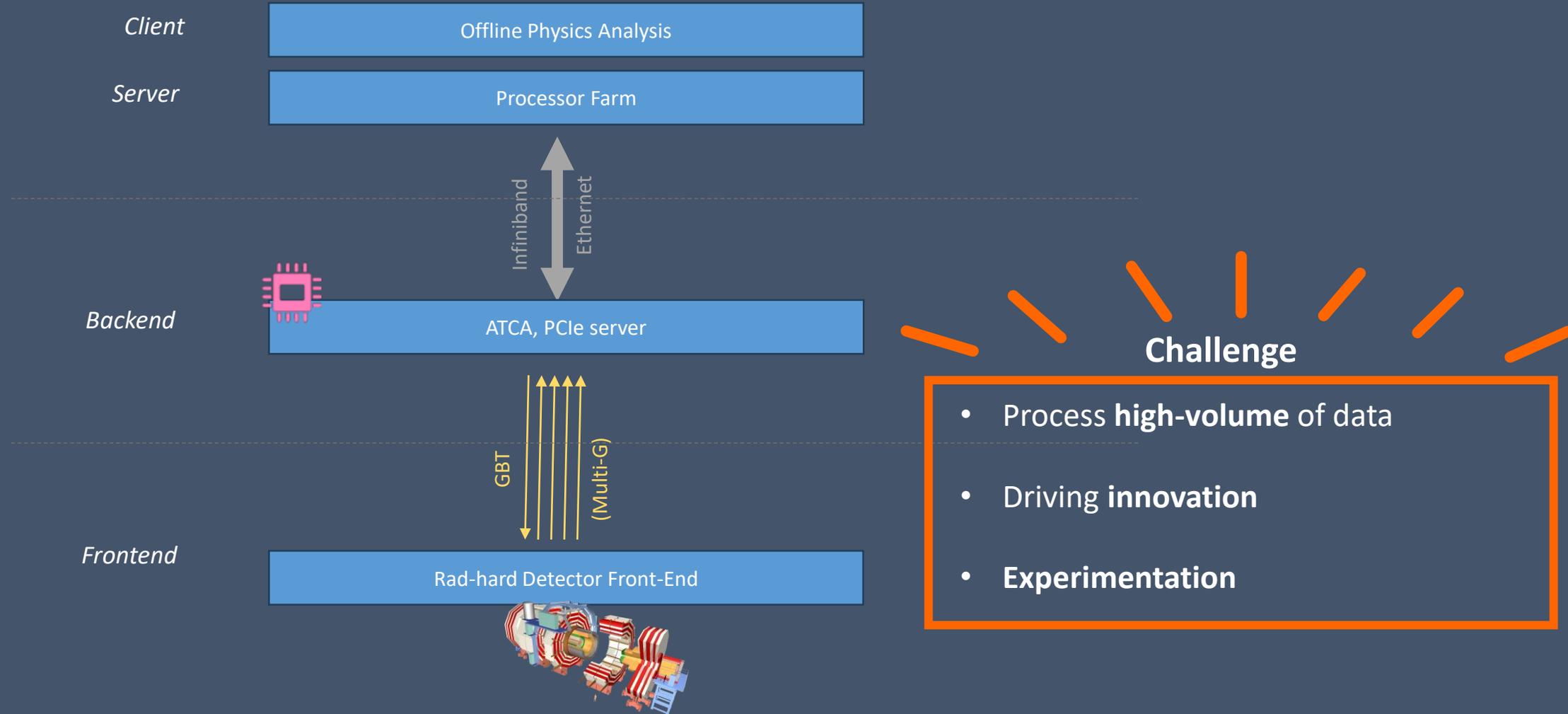
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DETECTORS: FPGA DEVELOPMENT

Basic architecture focused on the upcoming Run4





COMMON BUILDING BLOCKS FOR FPGA

Some Examples

Tools

- EDA Committee: Strategy for EDA toolkit



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Technologies

- SoC Interest Group
- Xilinx Ultrascale+ Transceivers
- Common gw libs under exploration



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Licensing

- Knowledge Transfer, Open Source Program Office
- CERN OHL for hw. gw



FUTURE FPGA CHALLENGES

A Preliminary Assessment

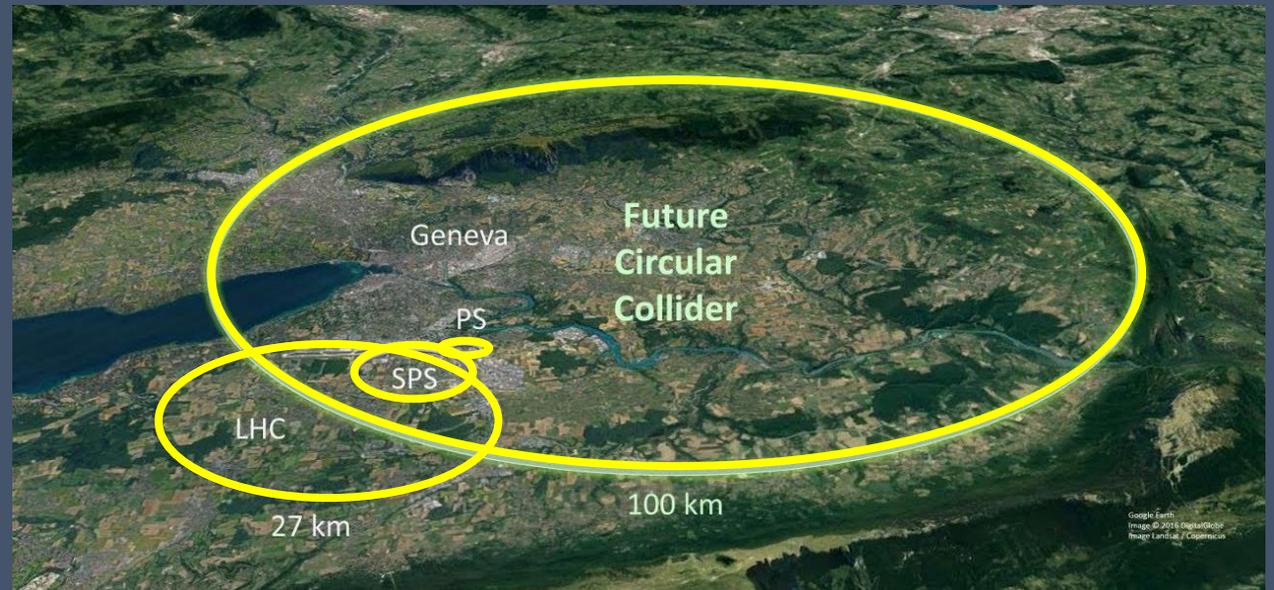
Today

2047?: FCCee

PREPARE FOR FUTURE MACHINES

Accelerators

- Rad-hard on the Front-end
- FPGAs on the Back-end
- Seamless redundancy
- High-speed links
- Higher synchronization precision, reaching the limits of FPGAs





FUTURE FPGA CHALLENGES

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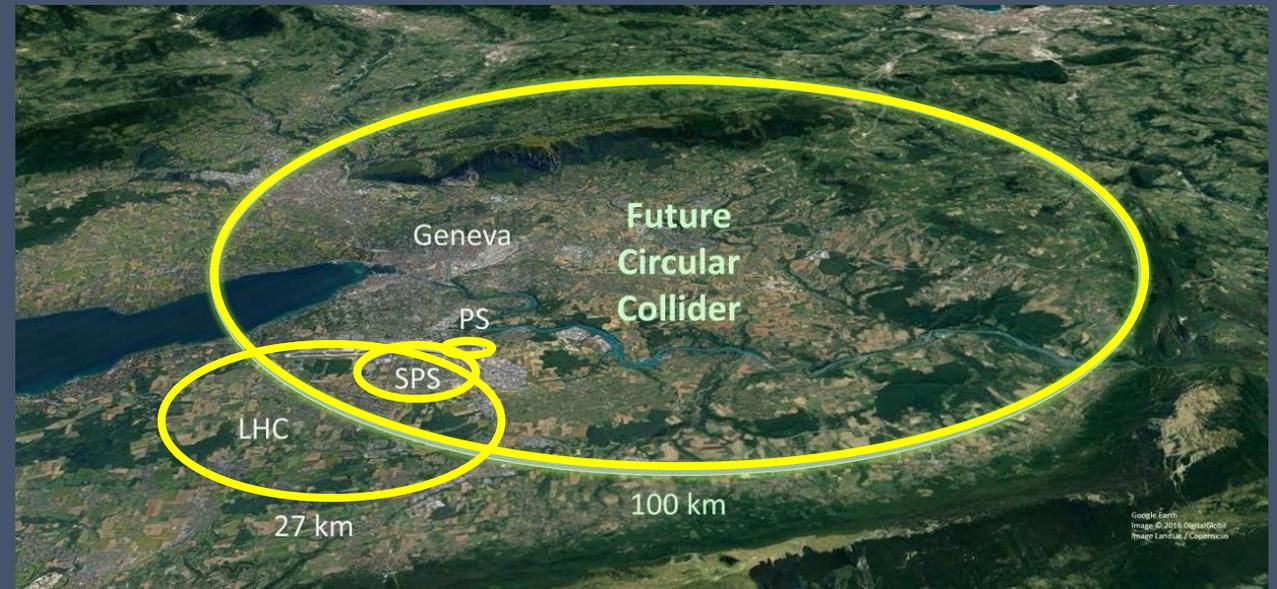


○ Accelerators

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▲ Detectors

- Sophie's talk right after!



LET'S GET STARTED!

A workshop to bring together FPGA

- Developers from
 - Accelerators
 - Detectors
 - Other Institutes
 - Industry
- Tools/Technologies providers

Focus on technical discussions

- Generous slots
- Coffee/Lunch/Dinner breaks

Encourage in-person participation

Community building

- Discourse, Seminars, Newsletter



- Firmware and Electronics Engineer - High Precision Timing
- FPGA Engineer
- Electronics Engineer
- Junior Labview Developer
- ..and more

BACKUP

White Rabbit: Ultimate Limits

[https://gitlab.com/ohwr/project/white-rabbit/-
/wikis/uploads/253cbfc17d2b43cd445b68348aee0374/Submitted_IEEE.pdf](https://gitlab.com/ohwr/project/white-rabbit/-/wikis/uploads/253cbfc17d2b43cd445b68348aee0374/Submitted_IEEE.pdf)

OPENINGS AT CERN

Jobs at CERN

Browse by:  Department

BE · 2 jobs

Junior Labview Developer (BE-CEM-MTA-2025-81-GRAE)

Entry Level

FPGA Engineer (BE-CEM-EDL-2025-65-GRAP)

Entry Level

EP · 1 job

Firmware and Electronics Engineer - High Precision Timing Distribution (...)

Not Applicable

SY · 3 jobs

Power Electronics Engineer (SY-EPC-LPC-2025-74-GRAE)

Entry Level

Electronics Technical Engineer (SY-RF-LL-2025-72-LD)

Not Applicable

Electronics Engineer (SY-RF-LL-2025-71-LD)

Not Applicable

TE · 1 job

Electronics Engineer (TE-CRG-IC-2025-61-GRAP)

Entry Level