

# FDF 2024

# Welcome to CERN

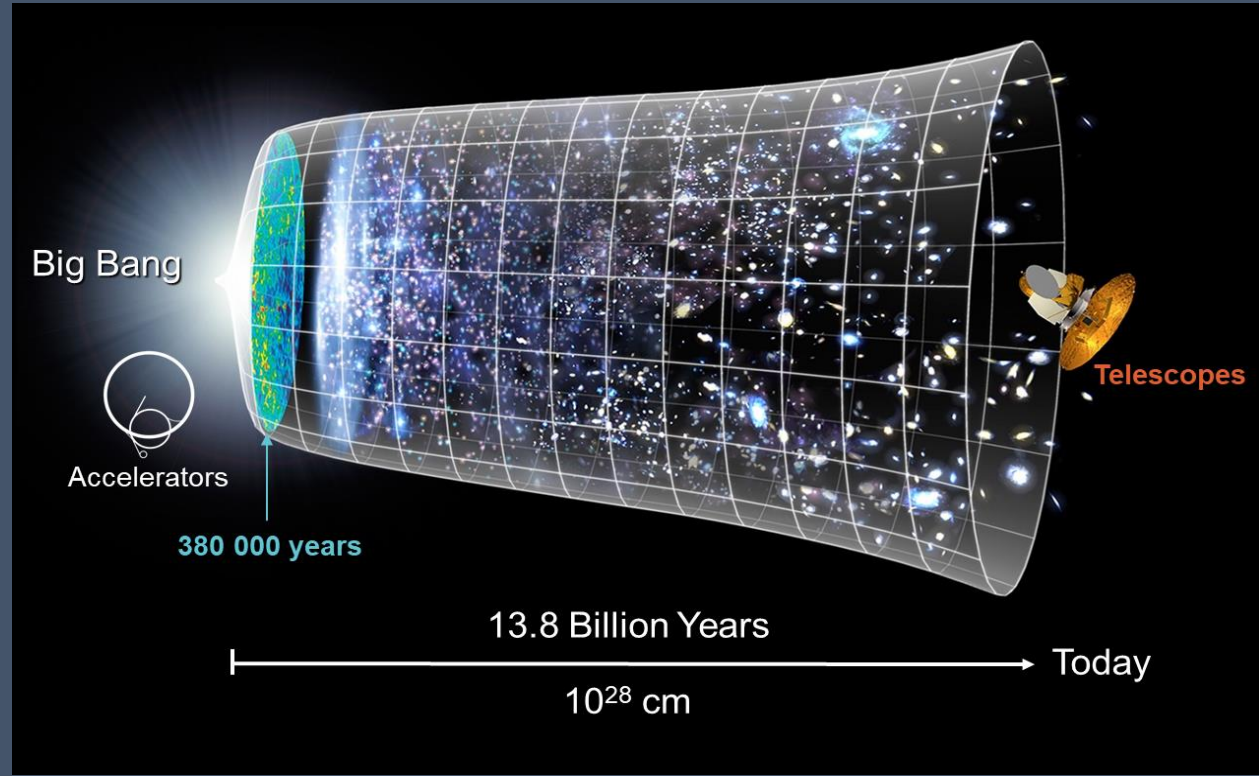
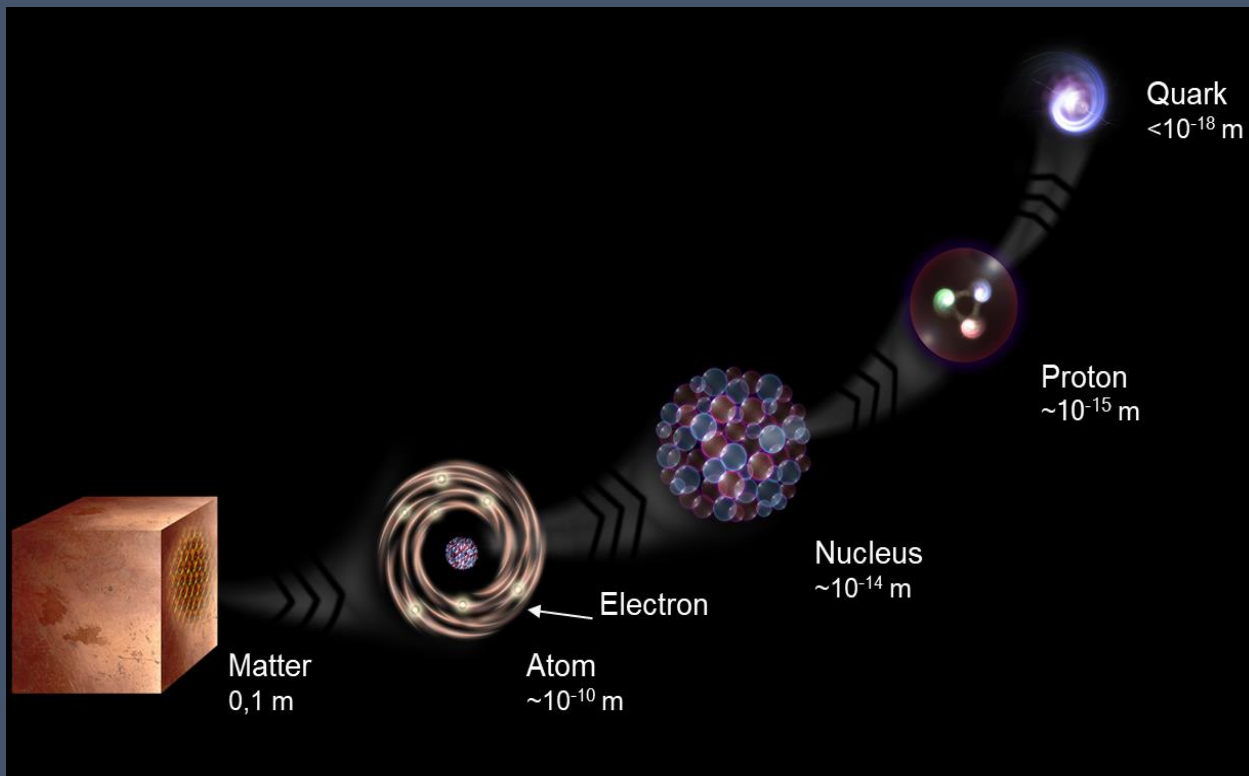


E. Gousiou

2024 06 11

# CERN

## OUR MISSION



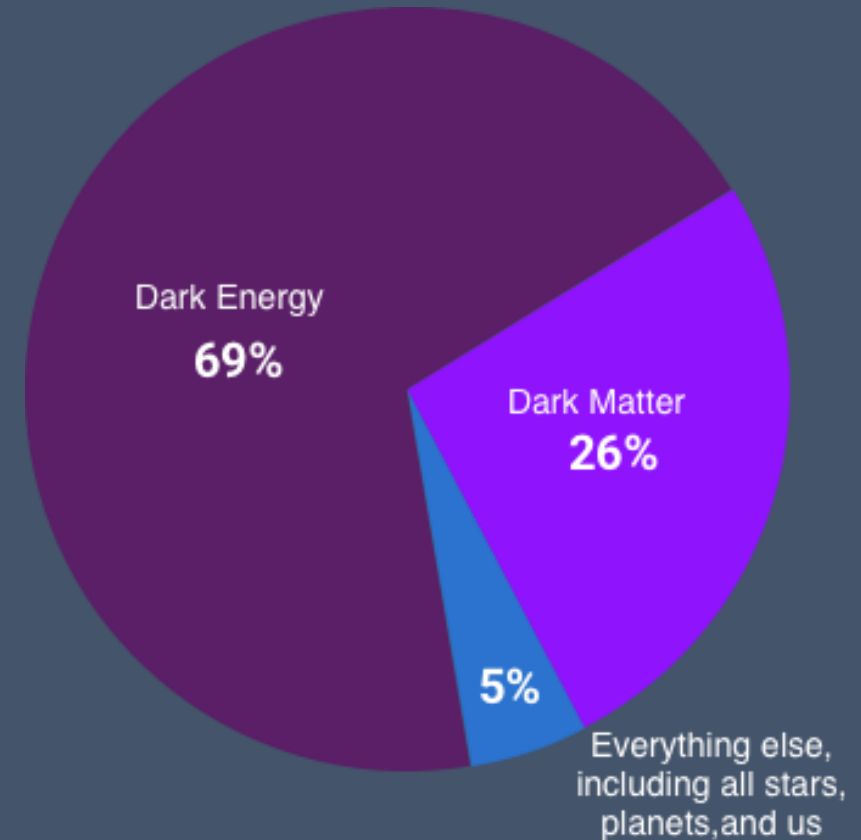
- Study of elementary building blocks of matter & forces that control their behaviour
- Reproduce the conditions a fraction of sec after the BIG Bang, to gain insight into the structure and evolution of the Universe
  - Telescopes also do that, but can arrive 380'000y after the Big Bang

# SOME QUESTIONS WE TRY TO ANSWER

What is dark matter?

What is dark energy?

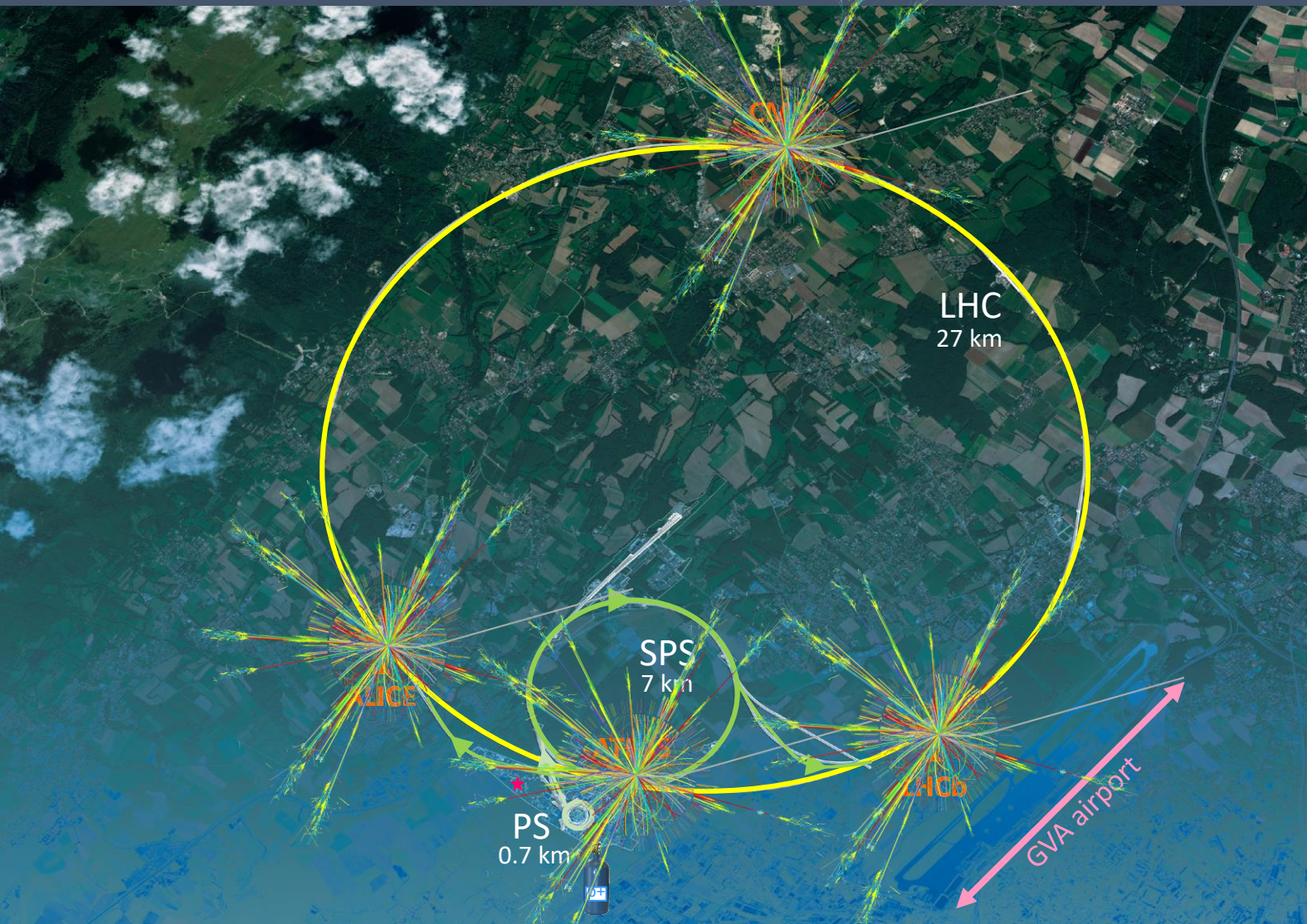
Why is there a matter/ antimatter asymmetry?



*Energy Distribution of the Universe*

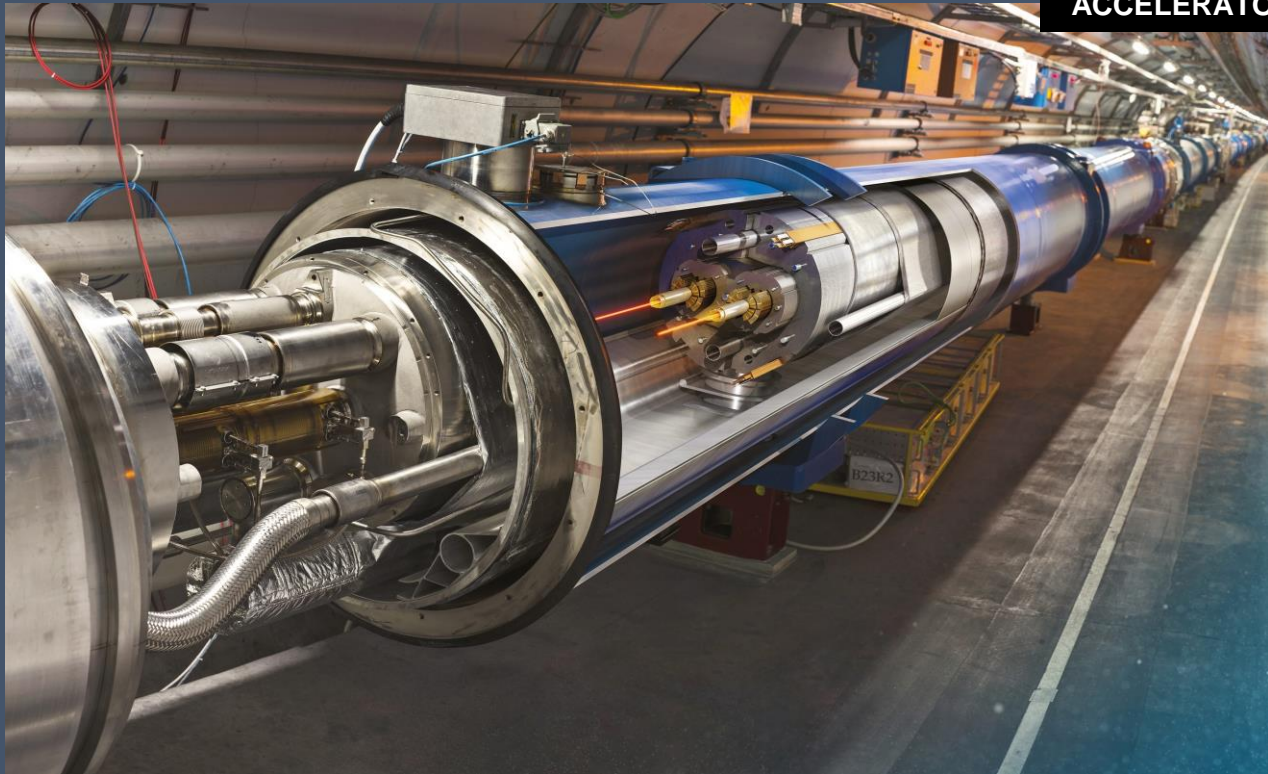
# ACCELERATORS & DETECTORS

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  $-271.3\text{ }^{\circ}\text{C}$  to bend them in a circle
- Largest beam vacuum system worldwide
- Advanced powering, machine protection systems, beam diagnostics & control
- 4 Large experiments

# ACCELERATORS & DETECTORS



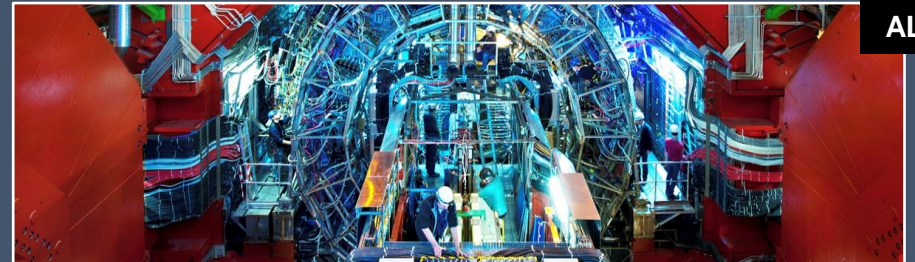
ACCELERATORS



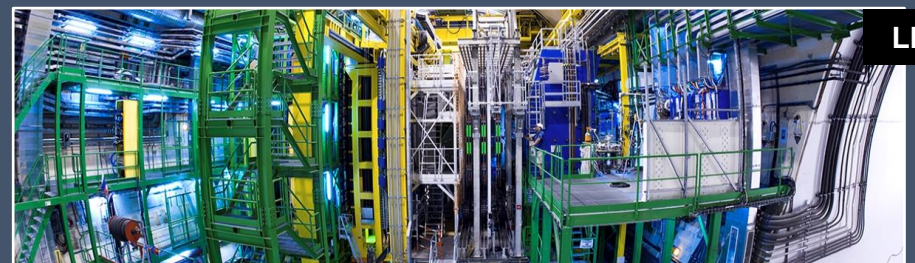
ATLAS



CMS



ALICE



LHCb

# ACCELERATORS & DETECTORS

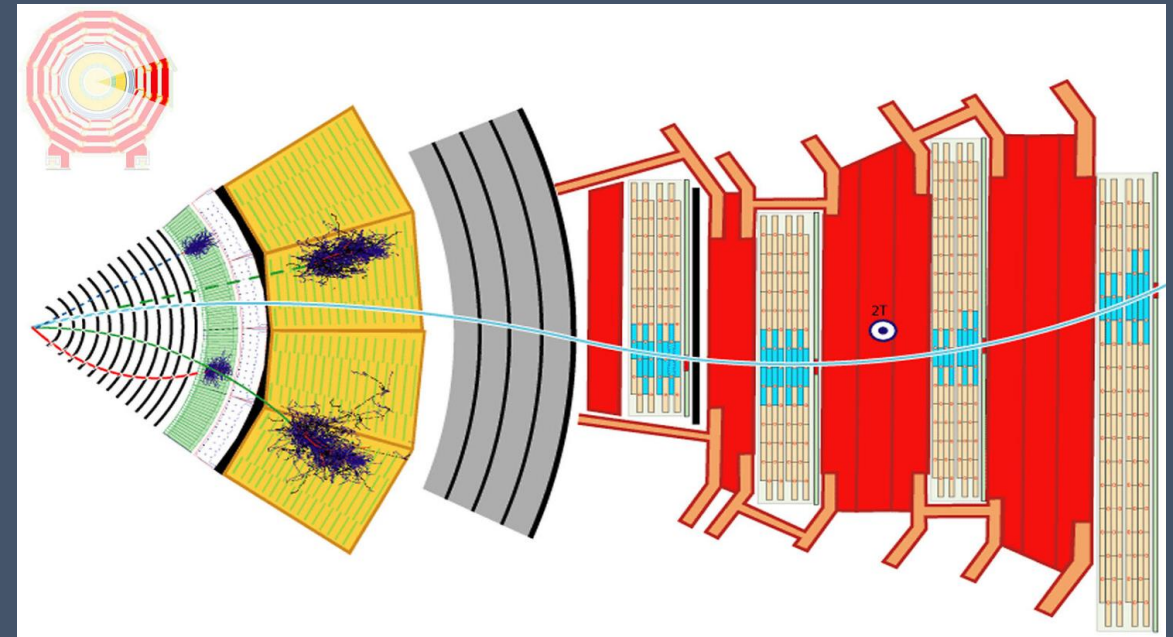
## ACCELERATORS

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



## DETECTORS

- Reconstruct collision events
- Detector systems: Pixel detector, Calorimeter, Muon detector
- Triggering & Data **acquisition**



# FPGA DEVELOPMENT

Basic data focused on the upcoming Run4

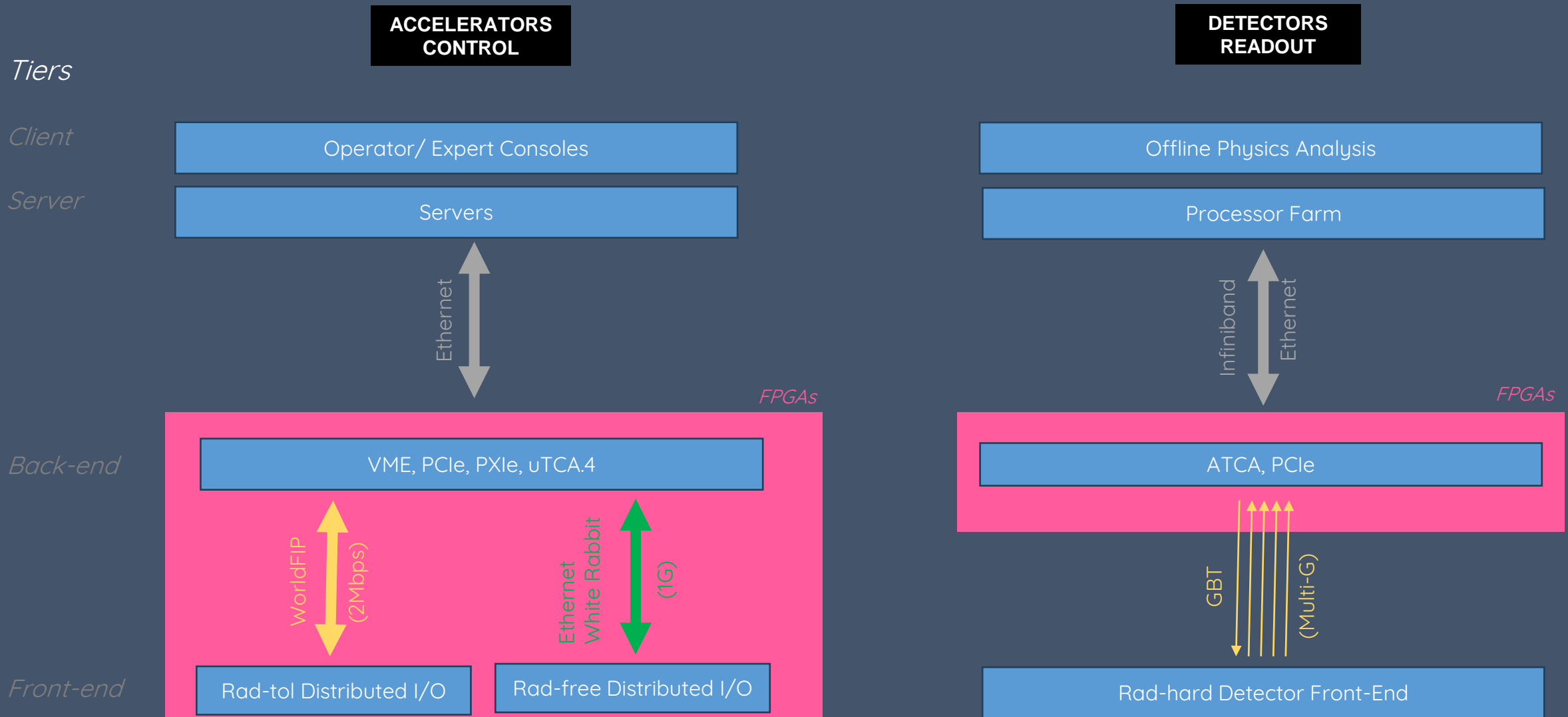
## ACCELERATORS

- Community: ~100 electronics engineers, on-site
- Mostly VHDL
- Xilinx (ZU+), Rad-tol Microsemi
- Hosted systems: VME, PCIe, PXIe, uTCA.4
- Fieldbuses
- Reliability, Ease of repair -> Standardisation
  - Centrally supported solutions from front-end hardware to all sw layers
  - Accelerator Sector Electronics-Forum

## DETECTORS

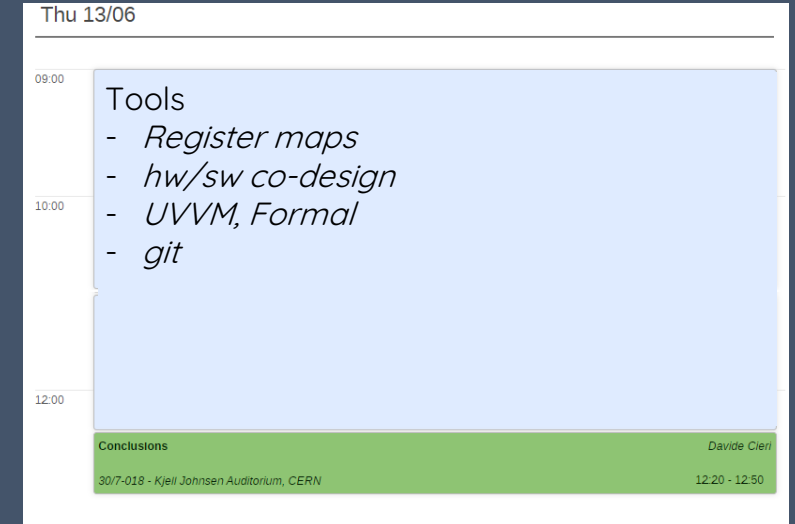
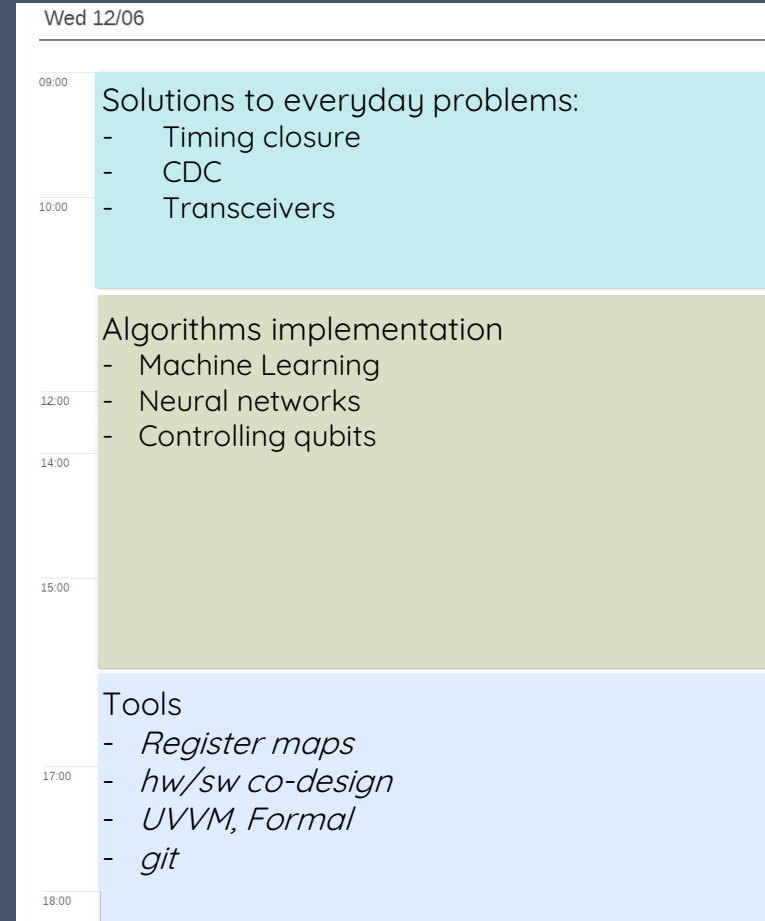
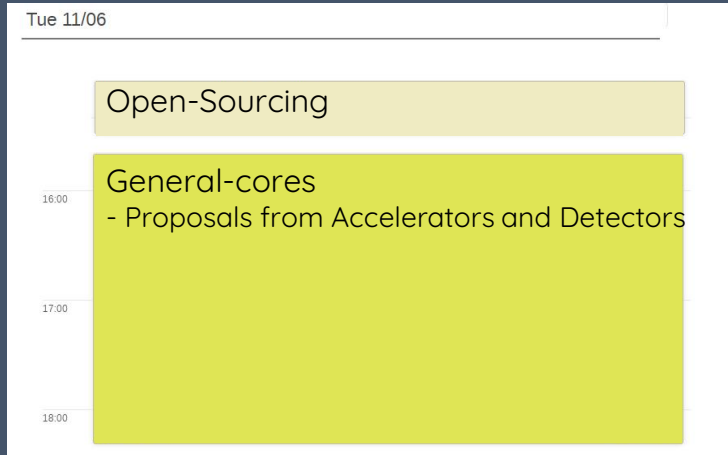
- Community: 100s electronics engineers & physicists, distributed in Institutes
- Mix of languages, incl. HLS, ML techniques
- Hosted systems: ATCA
- Full range from Versal to Microsemi
- Point-to-point links
- Experimentation with different approaches
  - Setting the trends

# BASIC ARCHITECTURE





# FDF2024



A workshop to bring together

- FPGA developers from
  - Accelerator
  - Detectors
  - Industry
- Tools providers

# LET'S GET STARTED!

- Focus on technical discussions
  - Generous slots
  - Coffee/Lunch/Dinner breaks
- Encourage in-person participation
- Community building
  - Discourse, Seminars, Newsletter

BACKUP