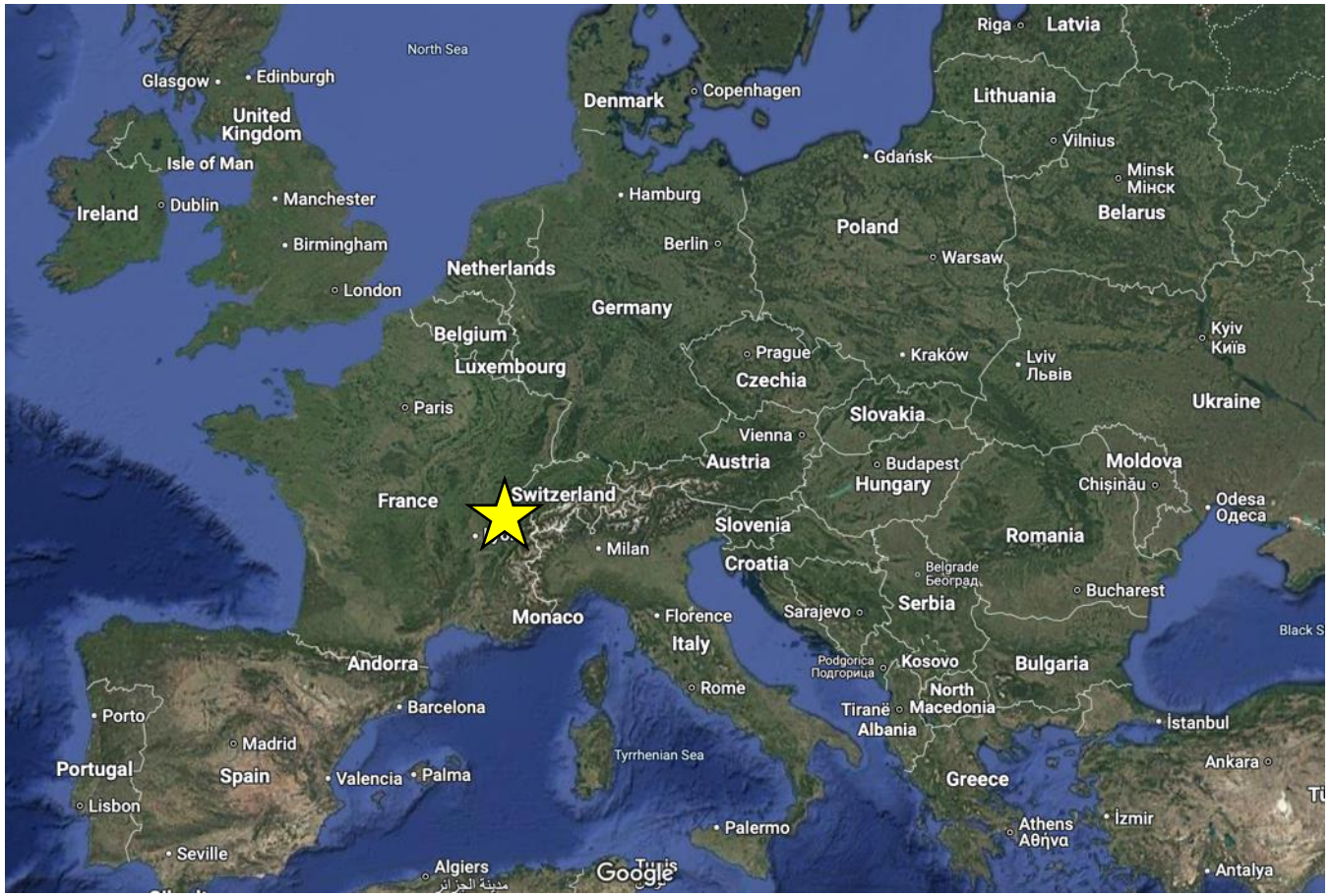
# A brief intro to CERN: European Centre for Particle Physics

Dave Barney, CERN



# CERN basics


## Smash things together and see what happens!

**Accelerators**: smash things together (protons, electrons, heavy ions e.g. Pb)
**Detectors**: see what happens

## CERN as institute (around 2300 employees):

- is responsible for developing, providing and operating the accelerators
- hosts the experiments (=detectors + collaborations)
- takes part in the experiments

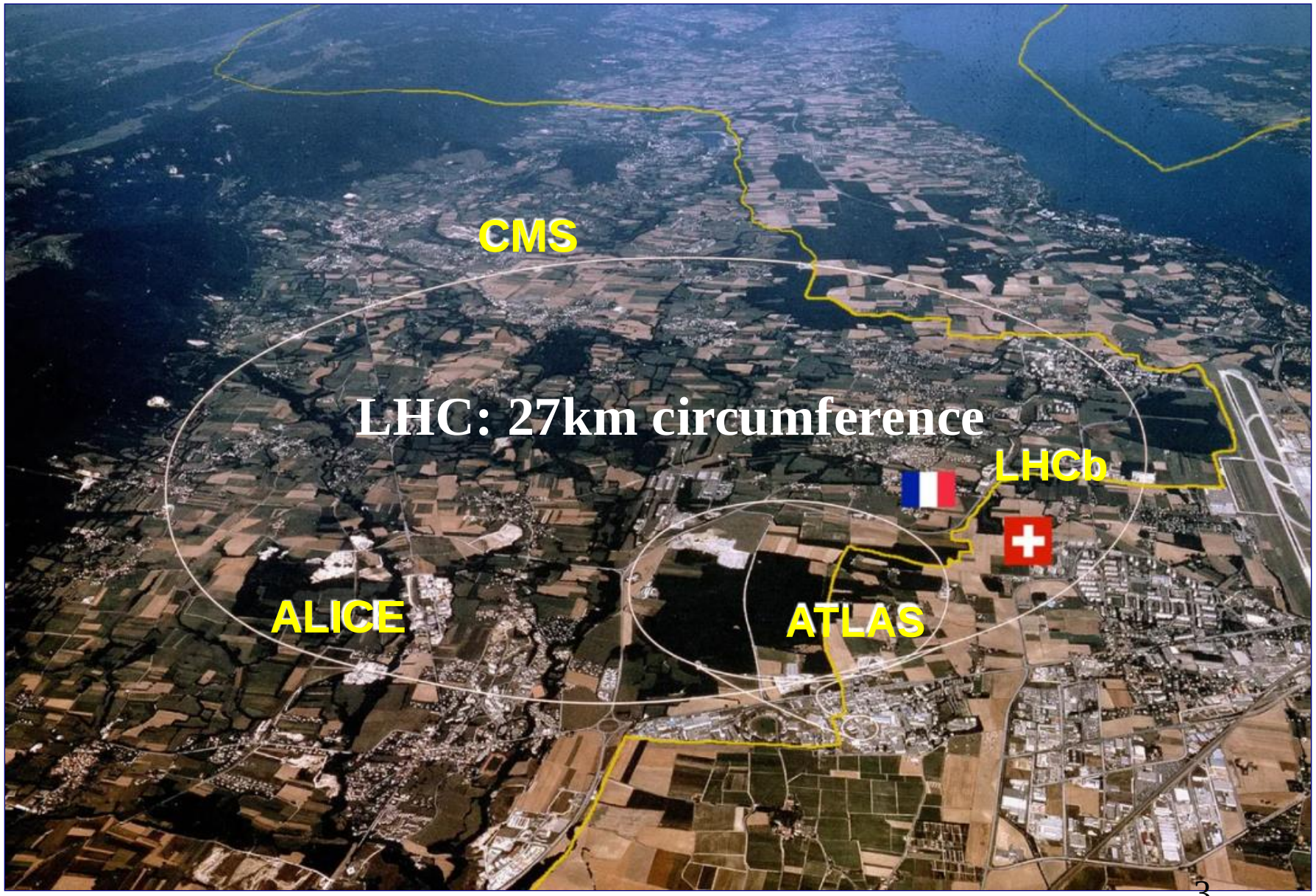
**Accelerator and Technology Sector (ATS) includes:** ***see presentation by Per-Olof Friman***

- *Engineering department*: inc. Accelerator Coordination & Eng., Mechanical & Materials Eng., Information Management…
- *Technology department*: inc. Magnets, Superconductors & Cryostats, Cryogenics, Machine Protection & Electrical Integrity…

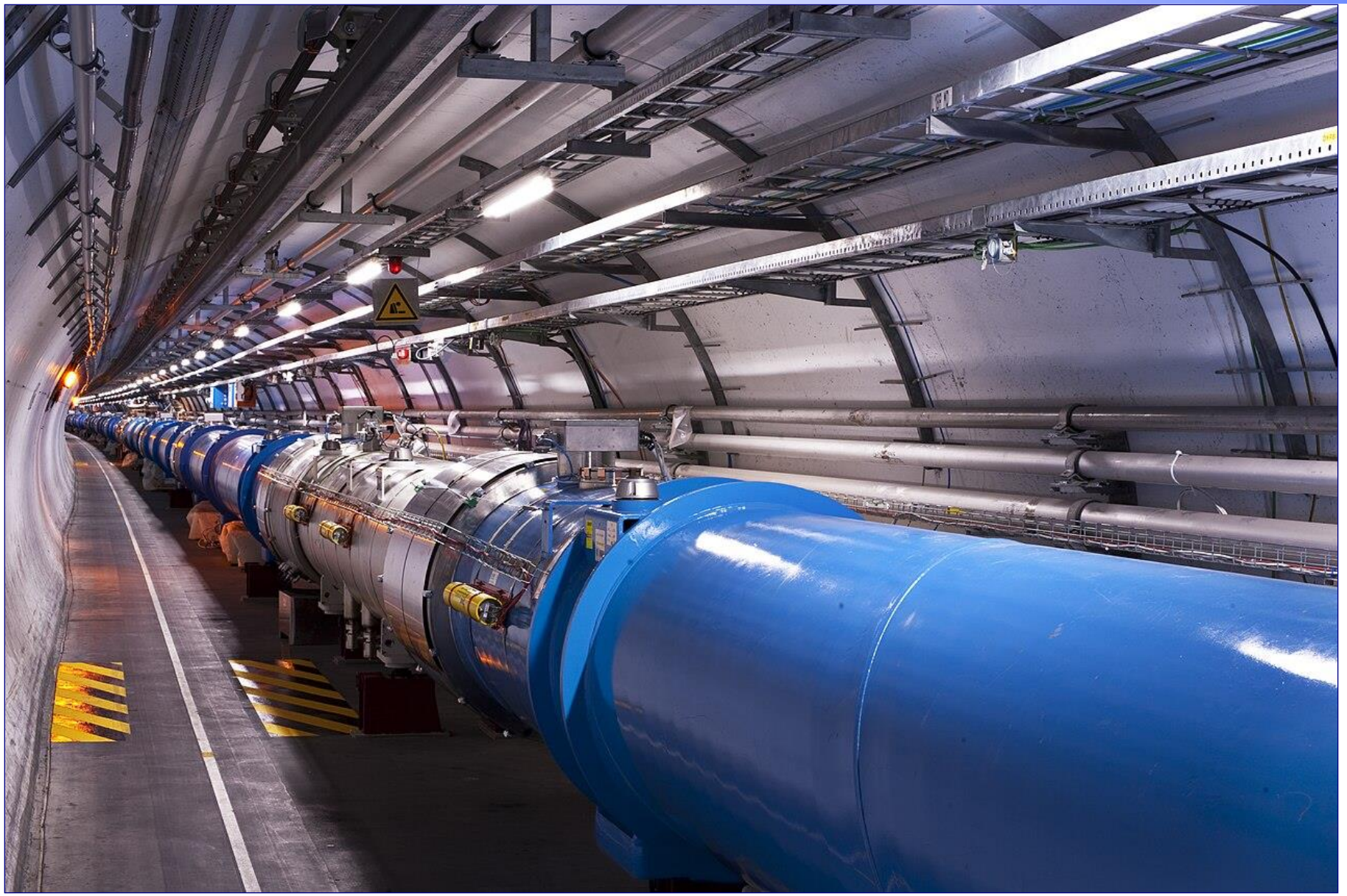
**Research and Computing Sector (RCS) includes:** ***see presentation by Thomas French***

- *Experimental Physics department*: hosts 12000 users, develop electronics & detector technologies + participate to experiments

# CERN's present flagship: Large Hadron Collider



# The Large Hadron Collider

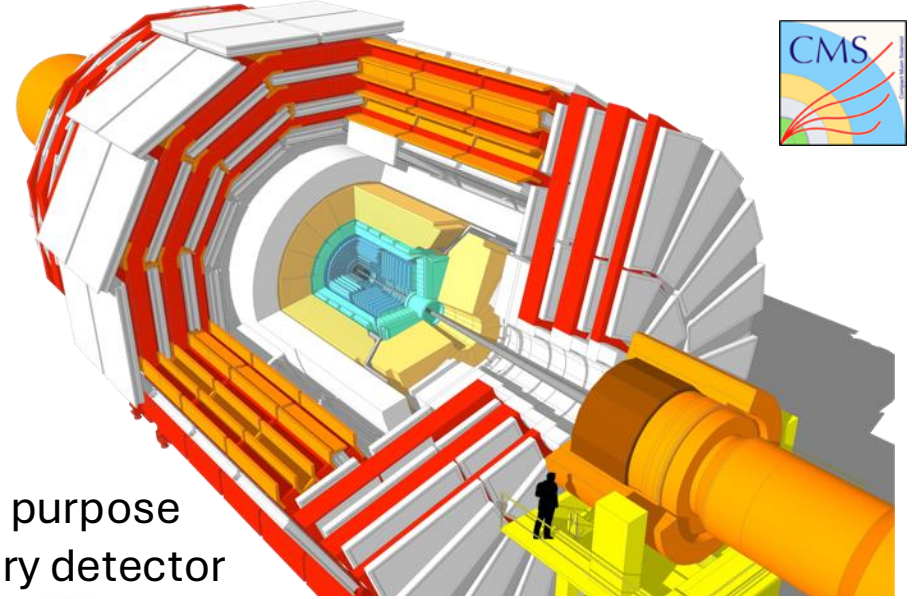


## 27km circumference

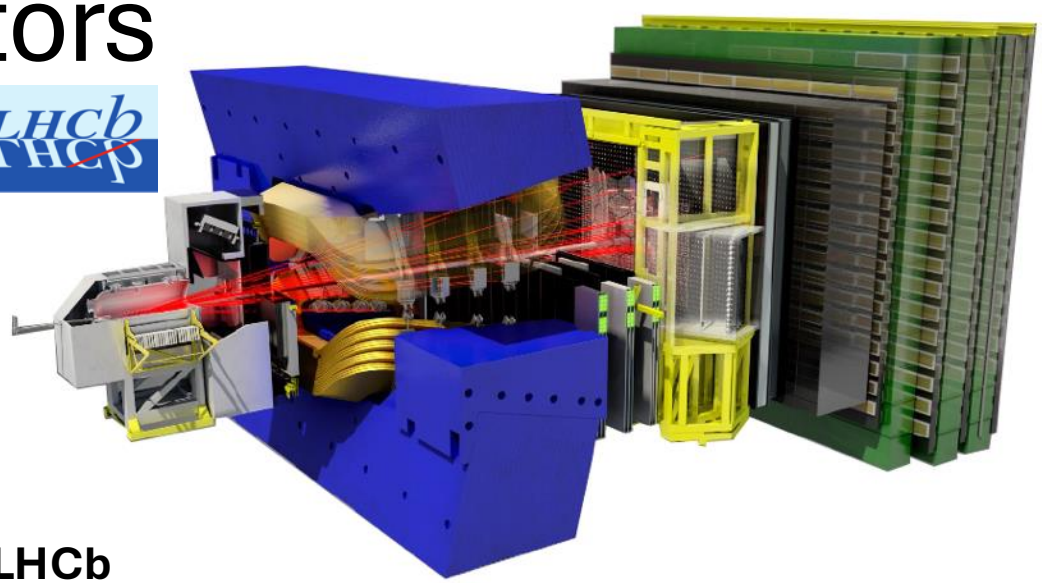
Particles lap 11245 times/second
Nearly 10000 magnets inc.
~1200 superconducting dipoles
~400 superconducting quadrupoles
➔ Cooled to 1.9K (world's largest cryogenic installation)

About 800 GWh per year

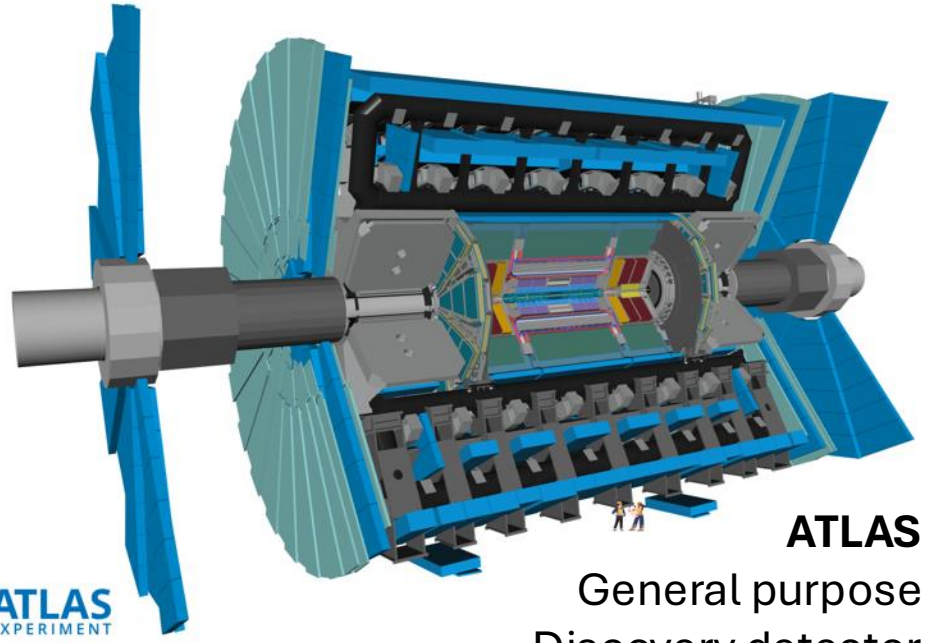
# The four main LHC detectors



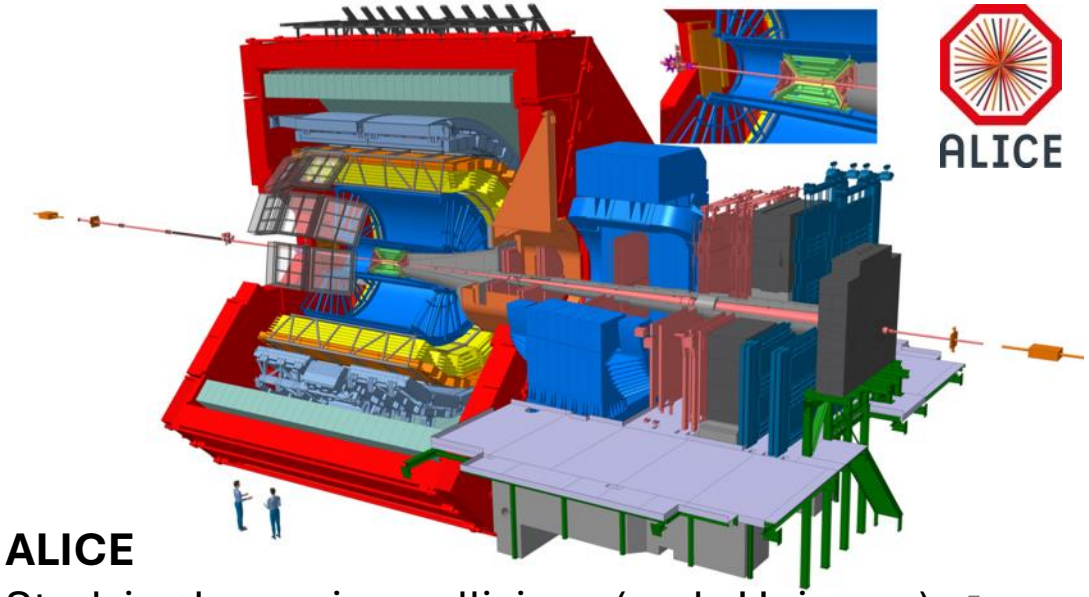
**CMS**
General purpose
Discovery detector



**LHCb**
Looking for CP violation (why is there no antimatter?)

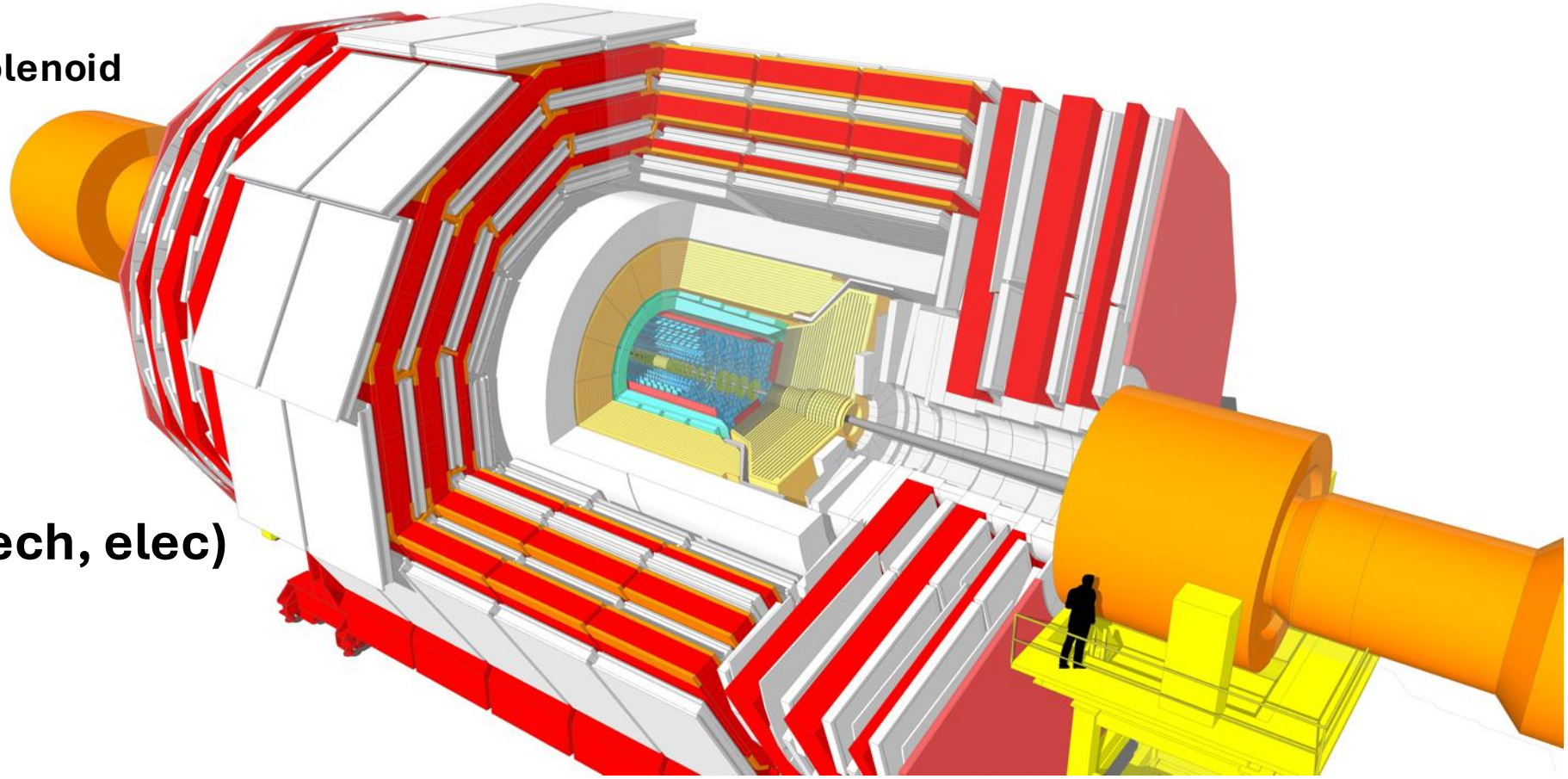


**ATLAS**
General purpose
Discovery detector



**ALICE**
Studying heavy-ion collisions (early Universe)

**CMS**
**Compact Muon Solenoid**
General purpose
Discovery detector



**Around 6100 people**
**Inc. 1000 engineers (mech, elec)**

**Operational since 2008**
**Will operate until 2041**

**14000 tonnes**
**4T superconducting solenoid → liquid He cryogenics**
**~200 million detector channels → ~1 MW power dissipation; optical/electrical cables**
**Several sub-detectors operate at -30 degrees C → bi-phase $CO_2$ cooling**
**Components up to 1700 tonnes can be moved with mm precision**