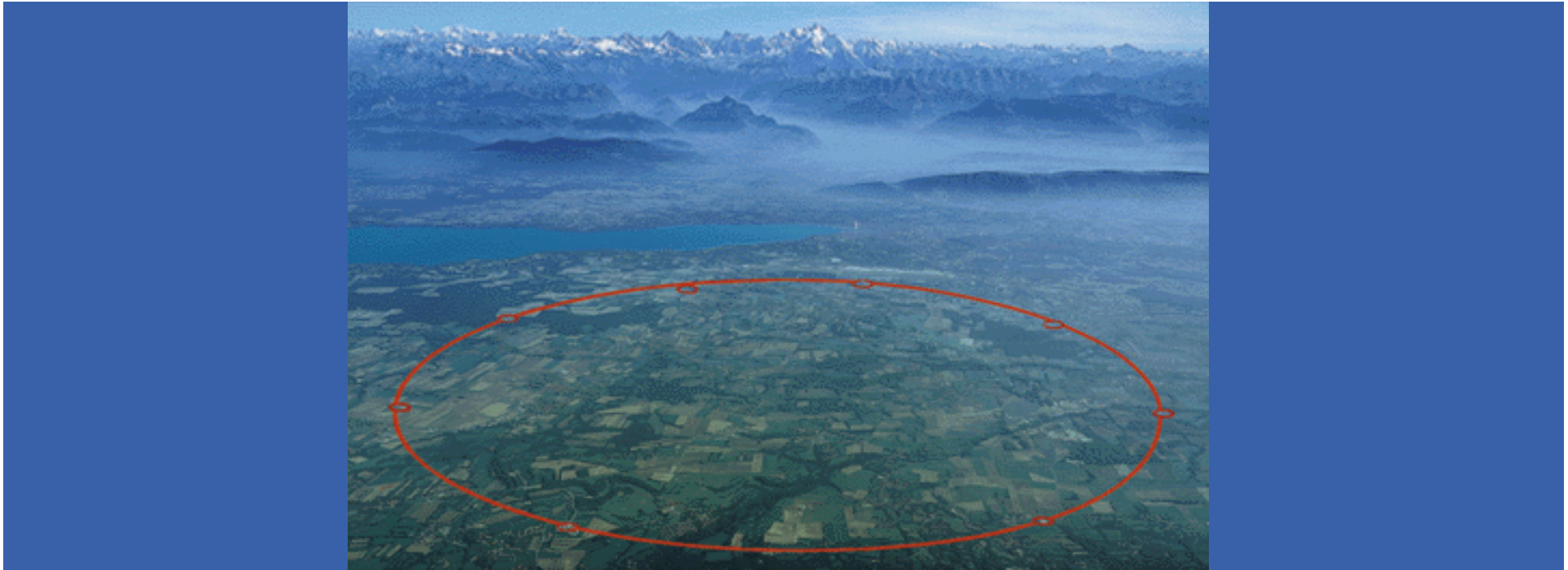


# CERN and Grid Computing



Wolfgang von Räden

*Head, IT Department, CERN - Geneva (Switzerland)*

# CERN stands for over 50 years of

- fundamental research and discoveries
- technological innovation
- training and education
- bringing the world together



**1954 Rebuilding Europe**  
First meeting of the  
CERN Council



**1980 East meets West**  
Visit of a delegation from Beijing

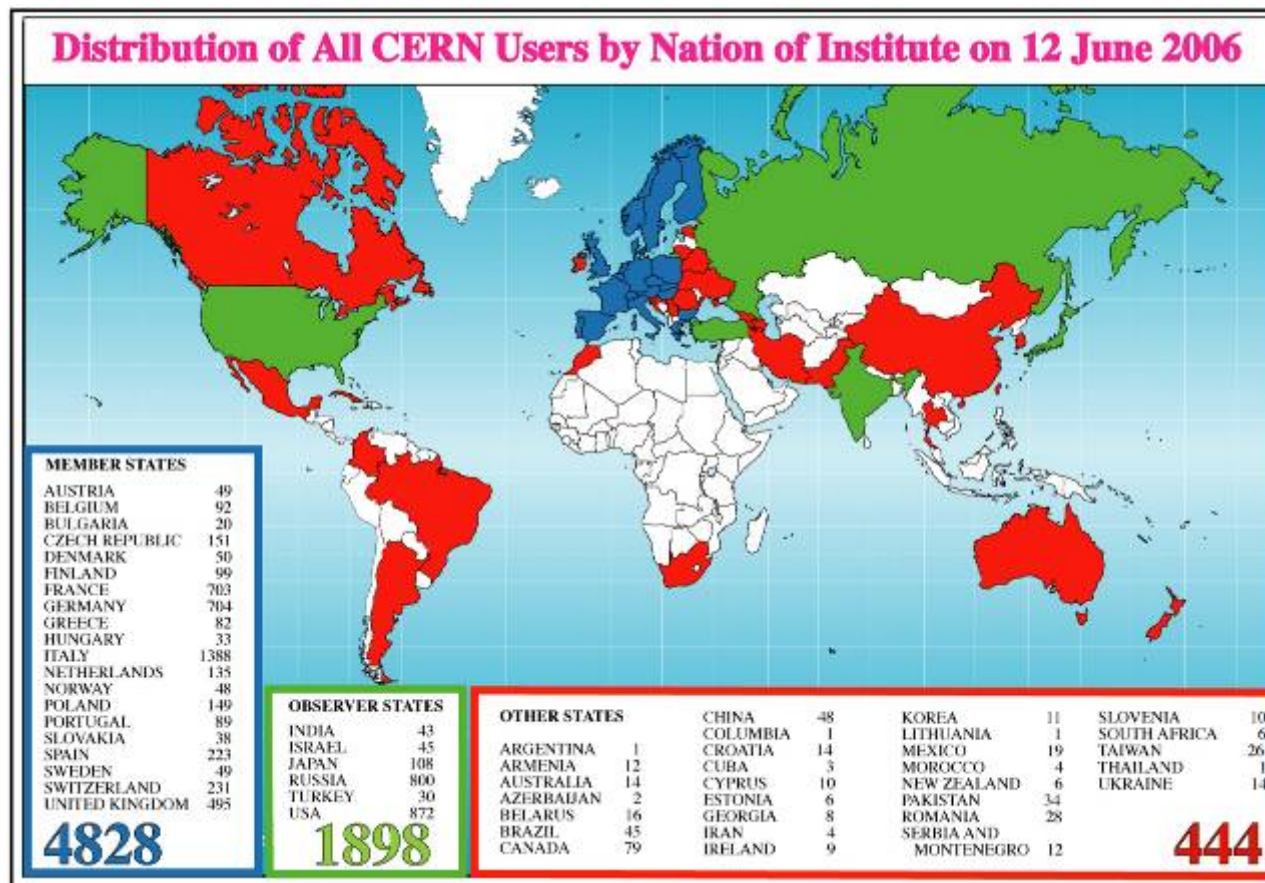


**2006 Global Collaboration**  
The Large Hadron Collider  
involves over 80 countries



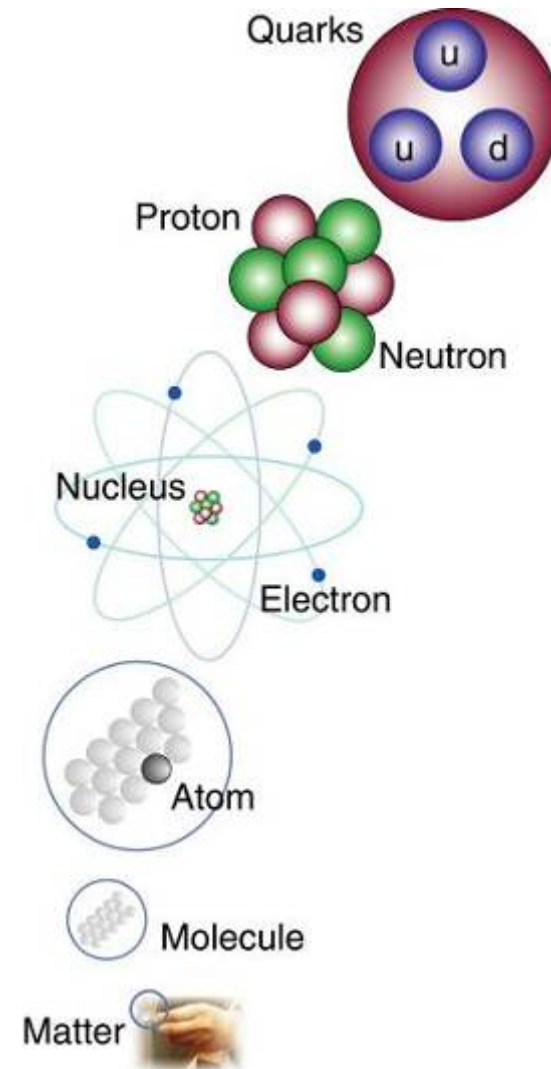
# CERN in numbers

- 2660 staff , 680 Fellows and Associates , 7170 users
- Budget (2006) 1240 MCHF (785M Euro)



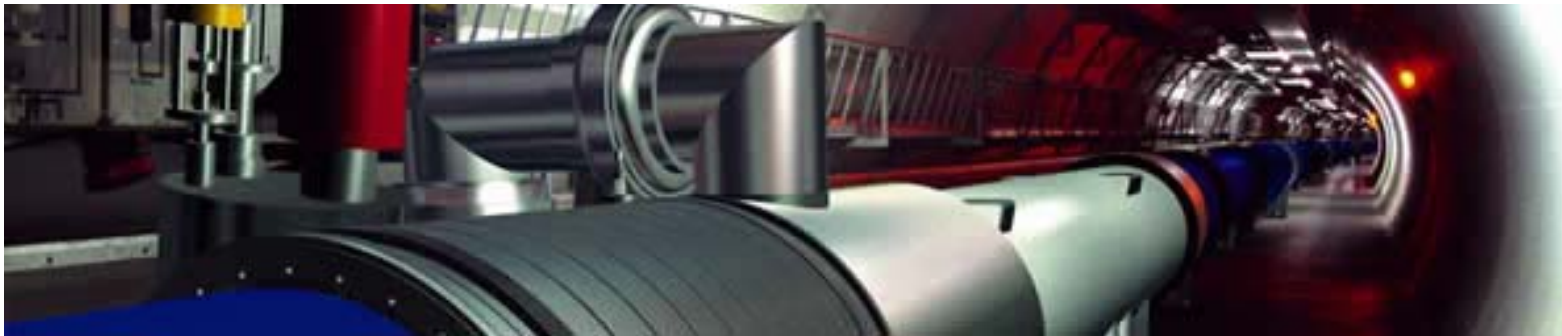
# CERN's Mission in Science

- Understand the fundamental laws of nature by studying elementary particles and fields and their interactions
- Provide a world-class laboratory to researchers in Europe and beyond



# CERN's Tools

- This requires special tools:
  - **ACCELERATORS**, huge machines able to speed up particles to very high energies before colliding them into other particles
  - **DETECTORS**, massive instruments which register the particles produced when the accelerated particles collide
  - **COMPUTING**, to collect, store, distribute and analyse the vast amount of data produced by the detectors



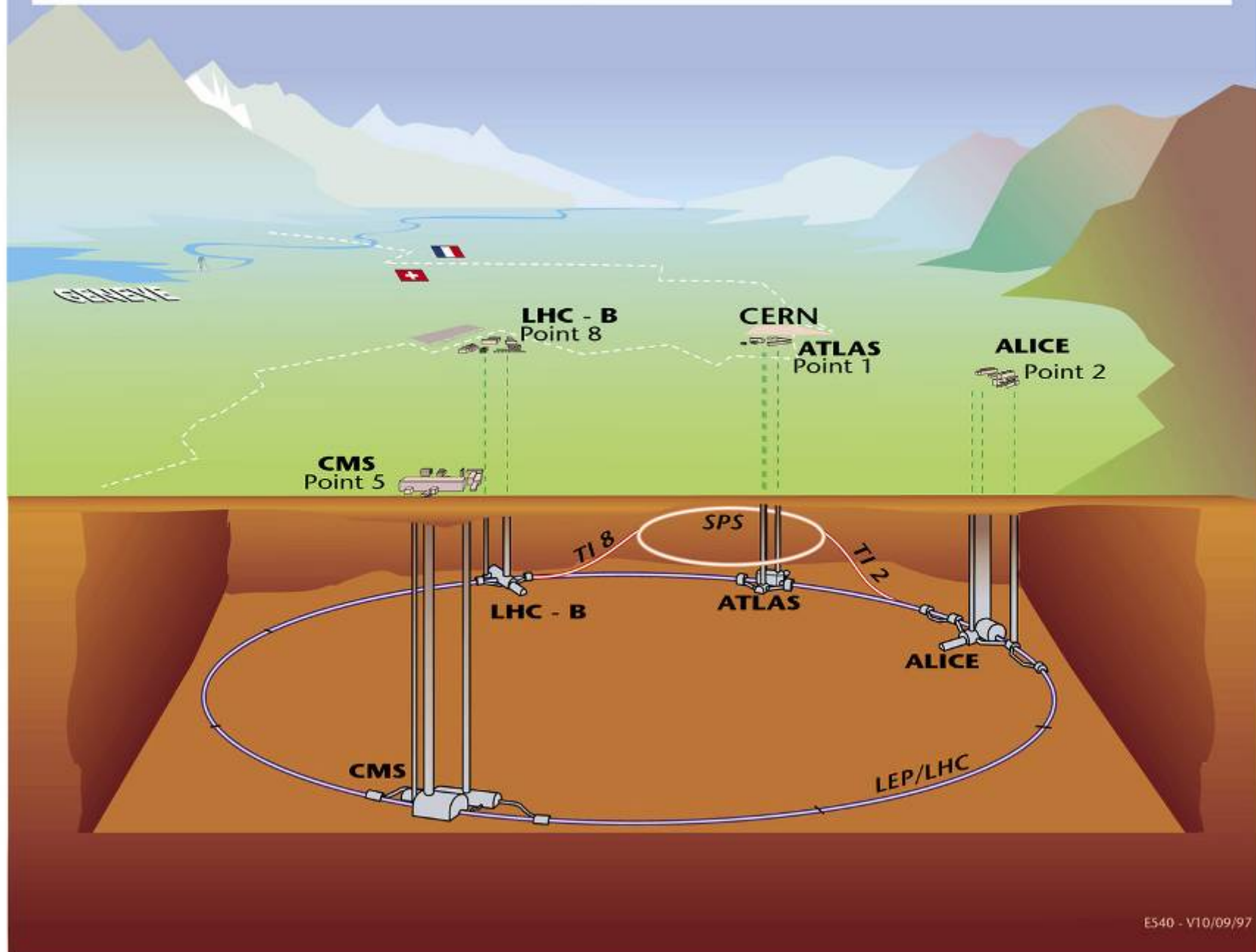
## CERN's LHC

**Jos Engelen, Chief Scientific Officer, CERN:**

*“We are about to cross a very important threshold, allowing an experimental observation of electroweak symmetry breaking or alternative mechanisms. This prospect is incredibly exciting...”*



# Overall view of the LHC experiments.



View of LHC tunnel

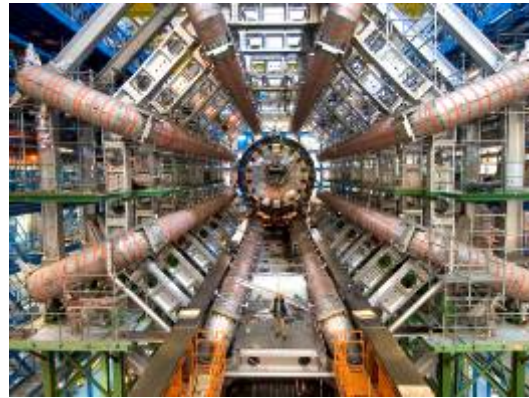




# CERN's Detectors

- To observe the collisions, collaborators from around the world are building four huge experiments:

CMS



ATLAS

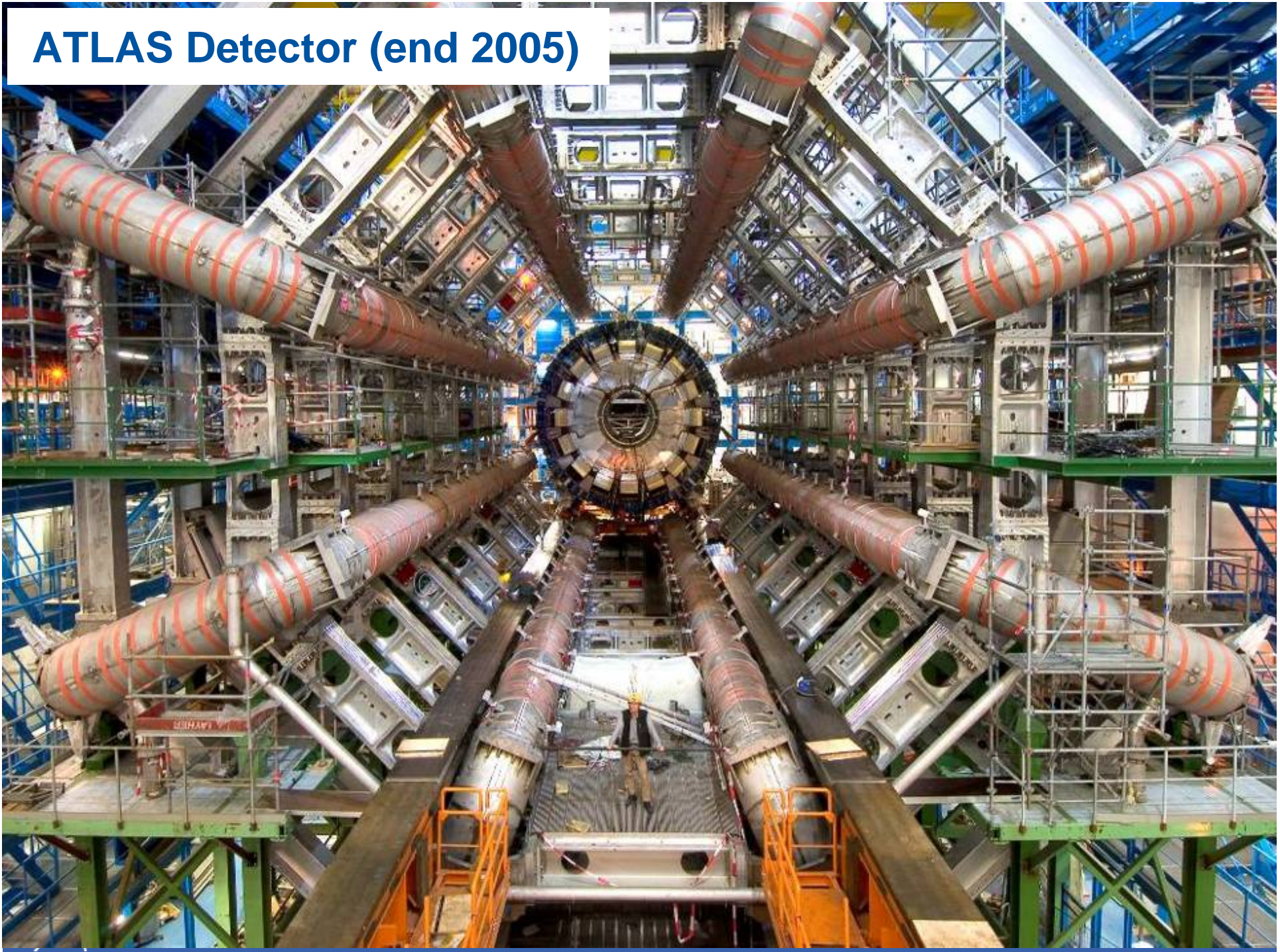


ALICE

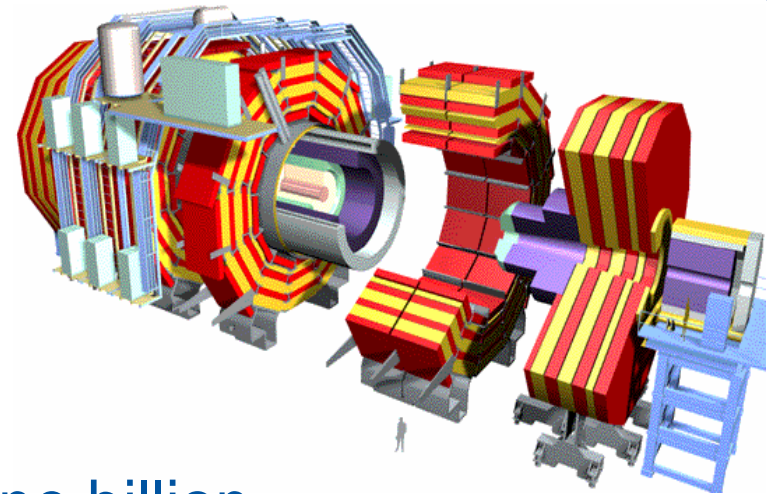
LHCb



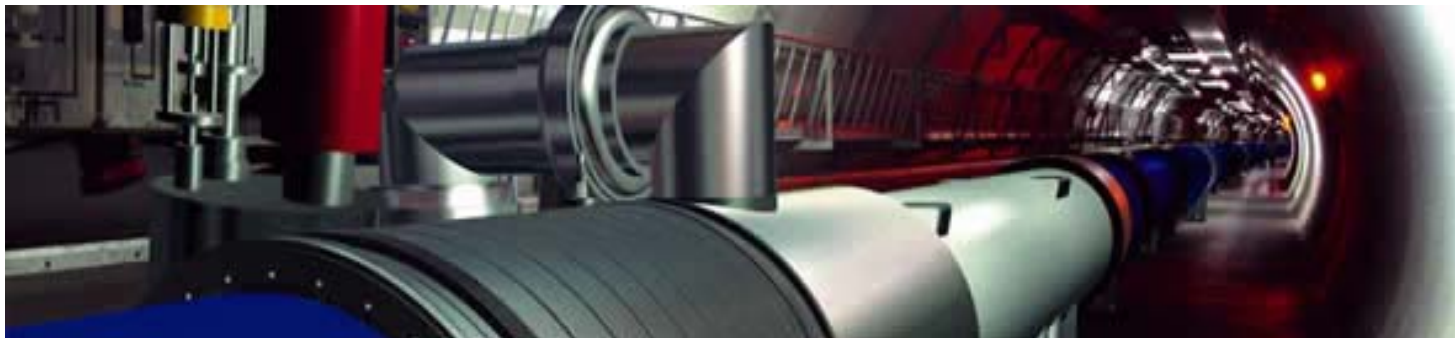
# ATLAS Detector (end 2005)



# The LHC Accelerator

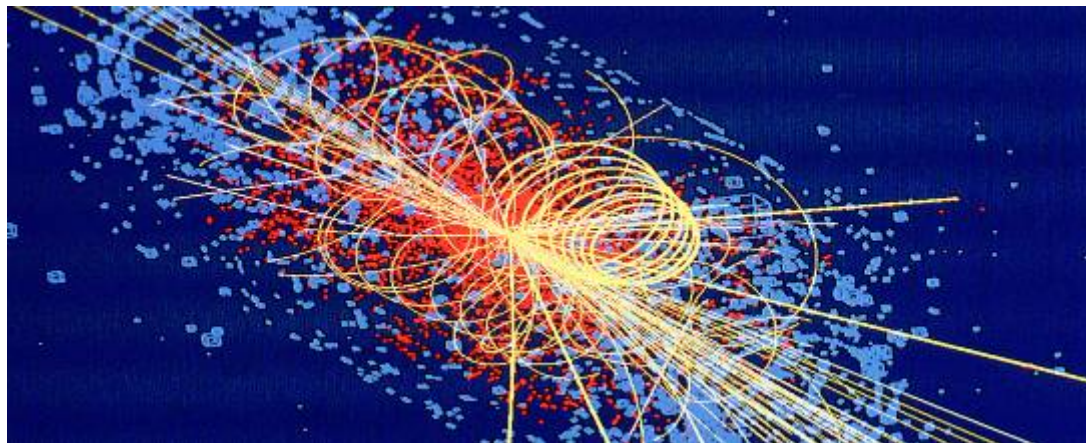
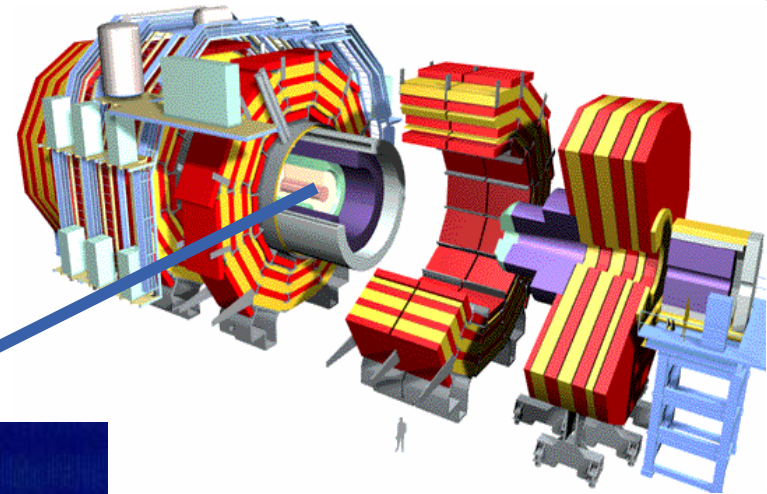


The accelerator generates nearly one billion particle collisions (events) every second at the centre of the ATLAS and CMS detectors



# LHC DATA

This is reduced by online computers that filter out a few hundred “good” events per second



To be organised,  
distributed and  
analysed worldwide

Which are recorded on disk and magnetic tape  
at 100-1,000 MegaBytes/s

~15 PetaBytes per year  
for all four experiments



# CERN and the Grid

- CERN can only provide ~20% of the required computing capacity
- Therefore, the LHC relies on many computing centres around the world interconnected using Grid technology
- CERN leads two major global Grid projects:
  - **WLCG**: World-wide LHC Computing Grid Collaboration
  - **EGEE**: Enabling Grid for E-science project for all sciences
- The LHC Computing Grid project launched a service with 12 sites in 2003. Today 200 sites in 40 countries with 20,000 PCs
- WLCG depends also on **OSG** and other Grid projects





## LCG/EGEE/OSG e-Science Grid is in production:

- World-wide Coverage
- Over 200 sites
- > 20'000 CPUs
- Multi-petab...

**Grid Infrastructures  
and their long-term support  
are mission critical for the LHC project**



# CERN openlab

## Concept

- Partner/contributor sponsors latest hardware, software and brainware (young researchers)
- CERN provides experts, test and validation in Grid environment
- Partners: 500'000 €/ year, 3 years
- Contributors: 150'000 €, 1 year

## Current Activities

- Platform competence centre
- Grid interoperability centre
- Security activities
- Joint events



## PARTNERS



## CONTRIBUTORS



# Summary

For more than 50 years CERN has been:

- Seeking answers to questions about the Universe
- Advancing the frontiers of technology **...Grids**
- Training the scientists of tomorrow **...Grid Schools**
- Bringing nations together through science **...EGEE Conference**

