



# **Large Collaborative international scientific endeavours and open science**

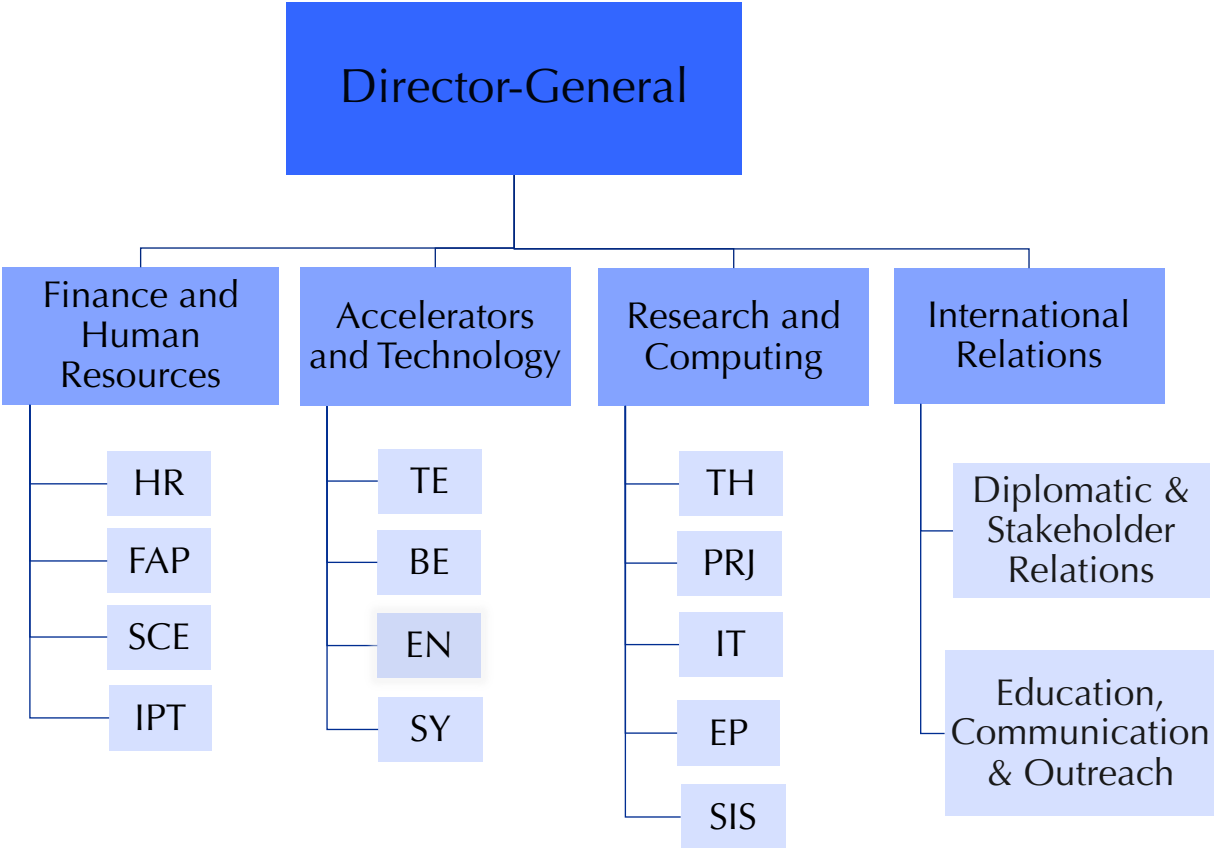
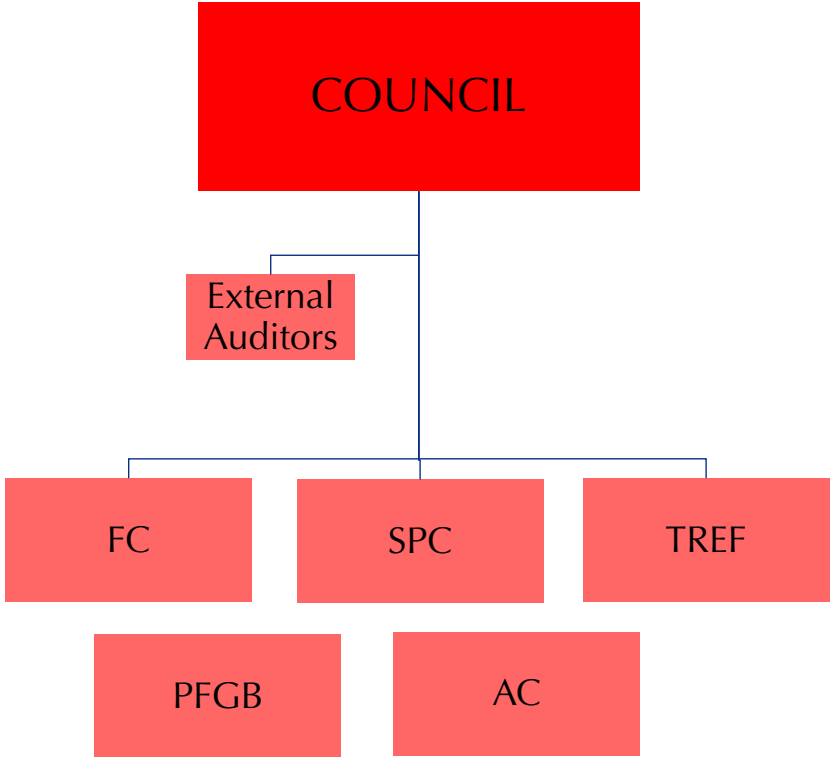
## **Governance of CERN and the Large Experiments**

Pippa Wells, GESDA Day, June 2024

# CERN's Governance

Supreme Decision-Making Authority

Management structure



# CERN Council

## Supreme decision-making authority

- Determine scientific, technical and administrative policy
- Admit new Member States and Associate Member States
- Approve programmes of activities
- Approve European Strategy for Particle Physics
- Approve the Medium Term (5y) Plan and Budget
- Approve financial statements and annual report
- Appoint Director-General and top-level personnel
- Responsible for the Pension Fund and appoint Pension Fund CEO

## Composition

- 2 delegates per Member State appointed by government as well as possible advisors

## Council President

- appointed by the Council, normally from amongst the delegates, for maximum 3 years

## Functioning

- laid down in the Council Rules of Procedure, adopted by the Council

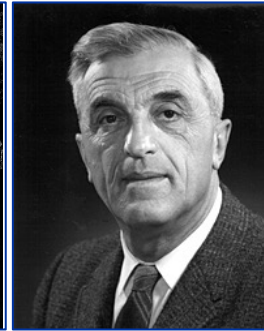


# Directors General

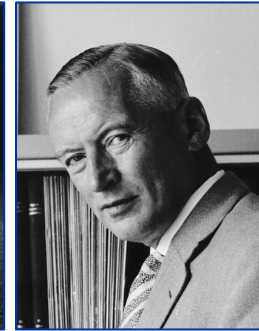
- CERN executive organ
- Legal representative of CERN
- **Management of CERN laboratory**
- Preparation and submission of proposals for decision by Council
- Implementation of Council's decisions
- Reporting to Council
- **Oversees implementation of European Strategy for Particle Physics**



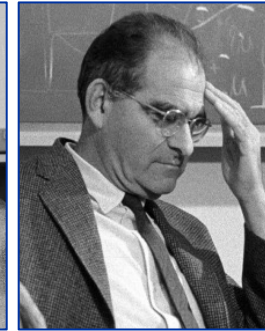
*Edoardo Amaldi*



*Felix Bloch*



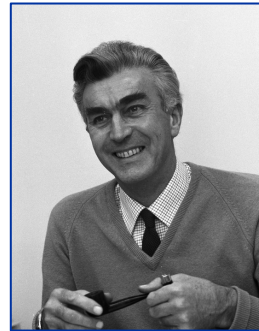
*Cornelis Bakker*



*Victor Weisskopf*



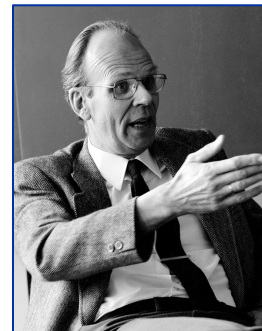
*Bernard Gregory*



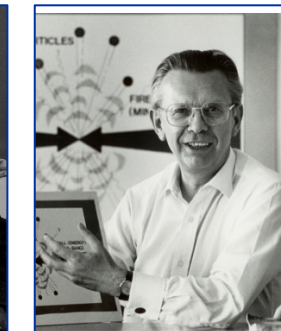
*John Adams*



*Willibald Jentschke*



*Léon van Hove*



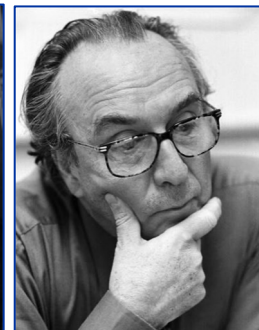
*Herwig Schopper*



*Carlo Rubbia*



*Christopher  
Llewellyn-Smith*



*Luciano Maiani*



*Robert Aymar*



*Rolf Heuer*



*Fabiola Gianotti*

# Accelerators & Experiments

***CERN Convention* stipulates “the operation of particle accelerators and the necessary ancillary apparatus for use in the research programmes”**

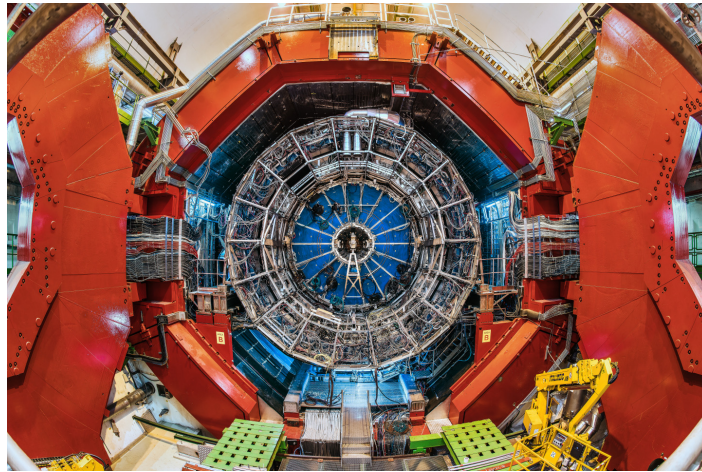
Since the days of LEP (1980s)

- **accelerators funded from the CERN budget** (from Member States) and project contributions from non-member states (NMS)
- **experiments constructed by (in-kind) contributions** from institutes in Members States and non-Member States; may be supplemented by a cash contribution to a **Common Fund** for the joint procurement of infrastructure
- experiments are operated jointly by the collaborating institutes and supported by a **Maintenance and Operations Budget** financed by all institutes (through their funding agencies), of which CERN is typically one
- collaborating institutions are expected to contribute at the level of their share in the experiment, e.g. by authors or some other agreed scheme

# Four large LHC Experiments at CERN

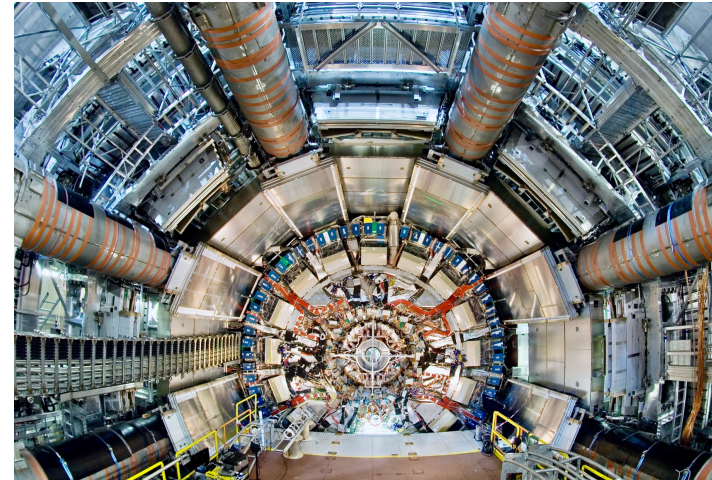
ALICE

~2000 members



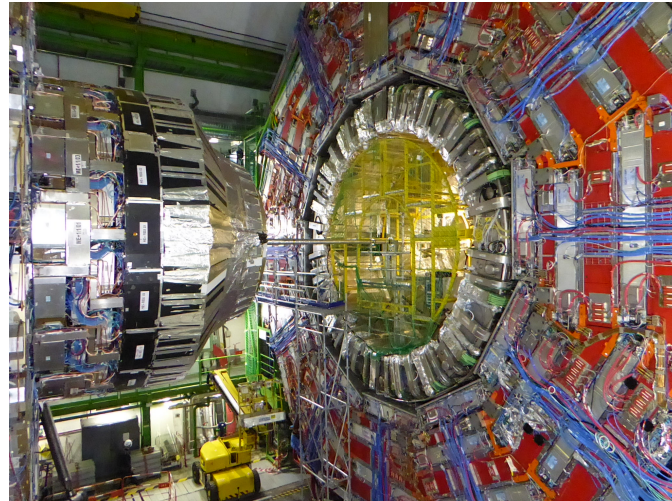
ATLAS

>3000 members



CMS

>3000 members



LHCb

>1400 members



# Experimental Collaborations

- Interested physicists form a proto-Collaboration and propose an experimental set-up that is deemed capable of carrying out a measurement programme of interest using infrastructure at CERN
- Once approved the physicists **constitute a formal Collaboration** with the aim to build and operate the apparatus and to analyse and publish the data recorded jointly
  - their home institute commits to support their activity
  - the results are published under the name of the Collaboration
- **Collaborations are open** - new institutes may join following a well-defined procedure

# Approval and Review by Scientific Committee (LHCC)

- The competent Scientific Committee is called by the Director responsible for research. These committees are constituted by international and independent experts that peer-review the proposals and progress reports
  - For the LHC, 4 proposals were received for general purpose detectors. Two merged (1992) to become ATLAS. Another was CMS.
  - Expression of Interest → Letter of Intent → Technical Design Reports
- Progress is compared to milestones set at the approval of the experiment
  - Now significant upgrades are in progress – similar procedure
- Problems are flagged to the experiments, CERN management and funding agencies
- Research Board receives the concise reports of the Committee



# Research Board

- Research Board (RB) is chaired by the Director General of CERN and consists of the Directors, the CERN Department Heads and the chairs of the Scientific Committees
- The RB approves the experiment – or not – based on
  - scientific recommendations from Scientific Committee
  - assessment of the financial situation of the experiment and
  - resource implication at CERN (support, services, technical installation, technology requirements). The Department Heads of the relevant technical groups at CERN assess the implications beforehand
- **Final decision is taken by Council through the approval of the Medium Term Plan**

# Participation in Experiments at CERN

- General Conditions (GC) are **the legally binding basis** for participation in a CERN hosted experiment
  - GC set out the rules for users and describe the host lab responsibilities
- Engagement in an experiment is concluded by a **Memorandum of Understanding** (MoU) between the collaborating institute (funding agency) and CERN, signed by the Director responsible for research
  - MoUs describe the responsibilities for the construction of the experiments, the operation of the apparatus and its dismantling
  - Funding Agencies have direct oversight of their funds via the Resources Review Board

**GC last update Dec 2020:**

ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE

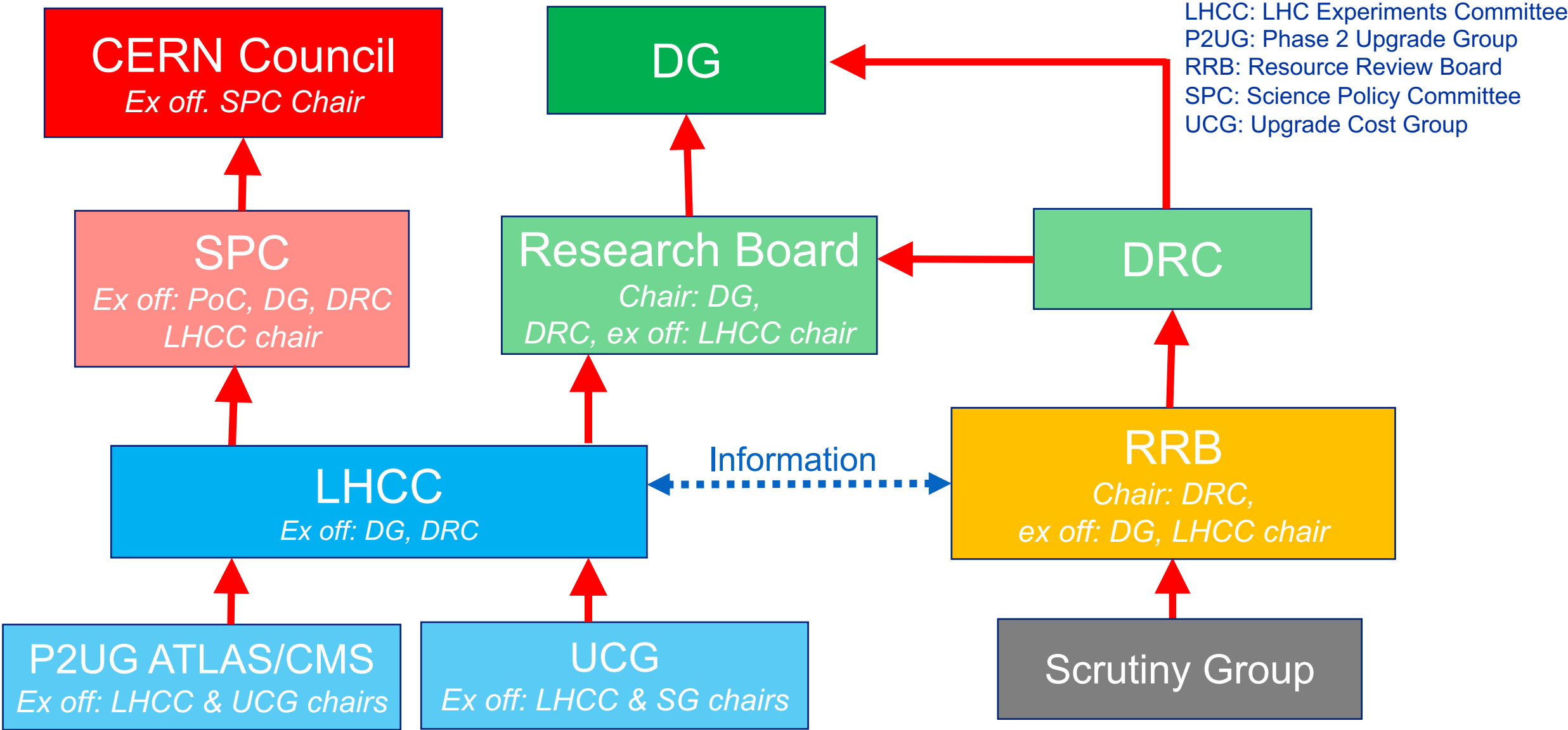
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

Laboratoire Européen pour la Physique des Particules  
European Laboratory for Particle Physics

**CERN GENERAL CONDITIONS**

APPLICABLE TO THE EXECUTION OF  
EXPERIMENTS

# Sketch on Reporting on LHC experiments



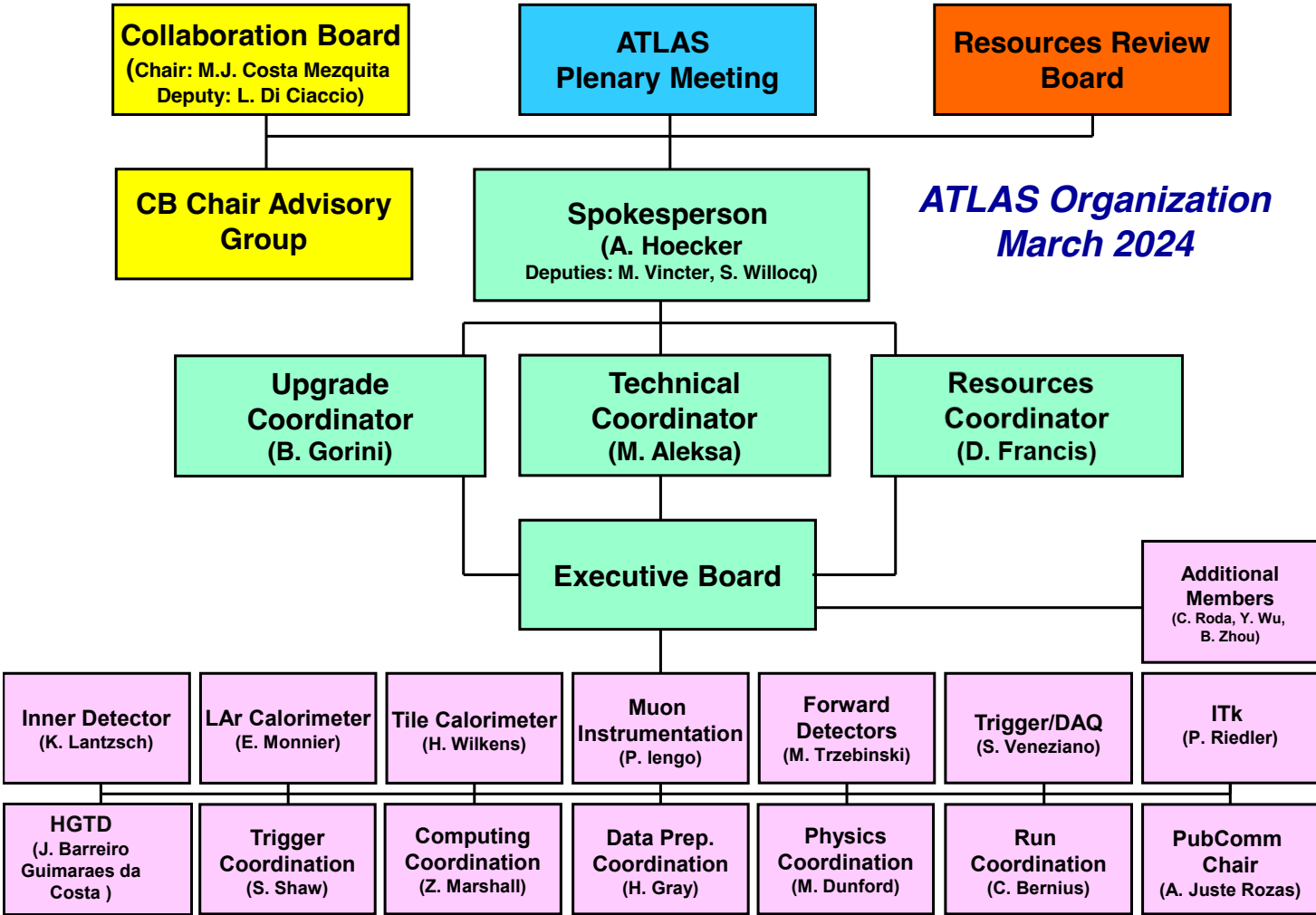
# Experiment Organisation

## Example - ATLAS

Broad engagement of the participating institutes

Groups of institutes build parts of the apparatus

The data are available to all physicists for analysis, organised in dedicated working groups



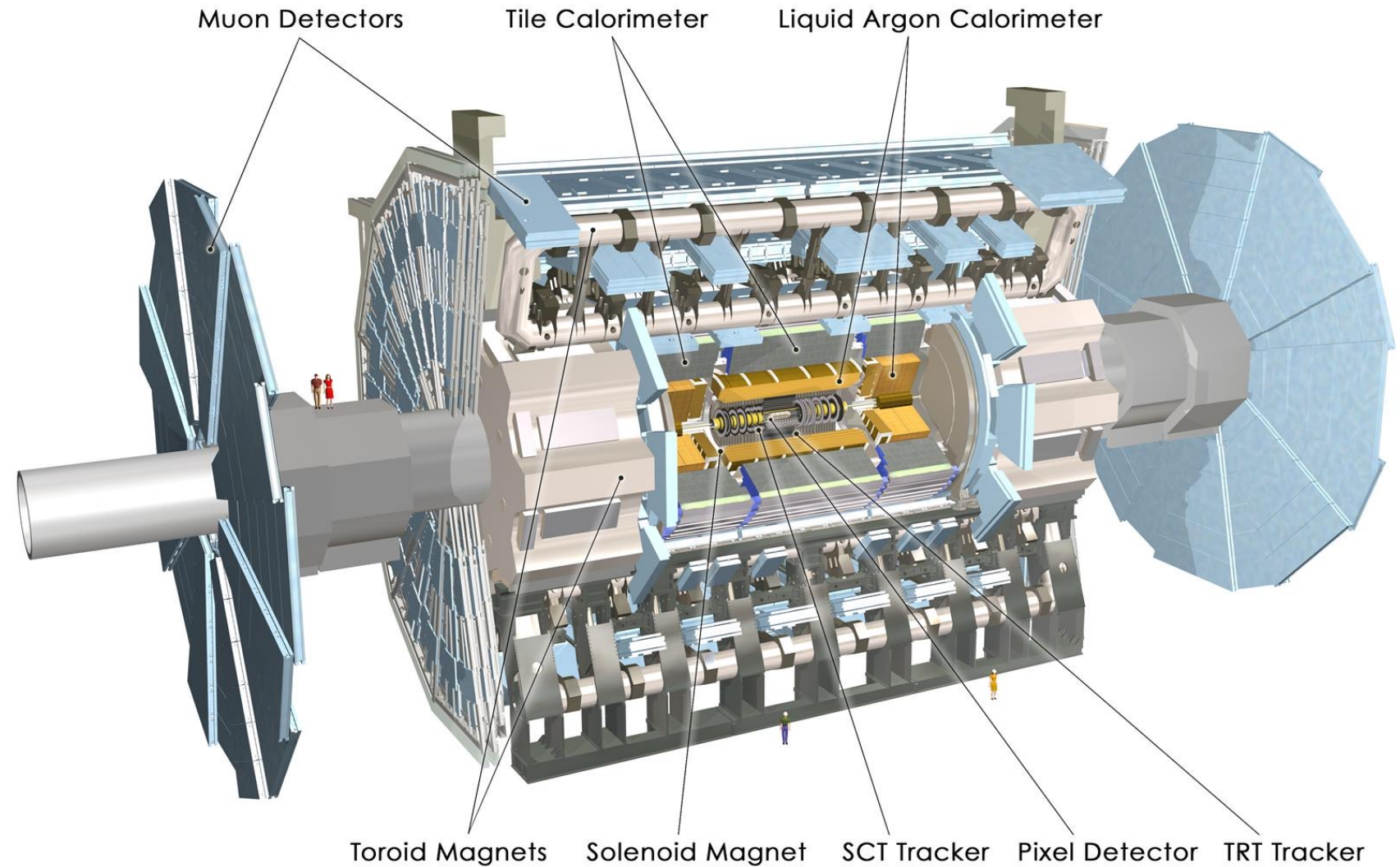
# ATLAS detector

25m high, 44m long

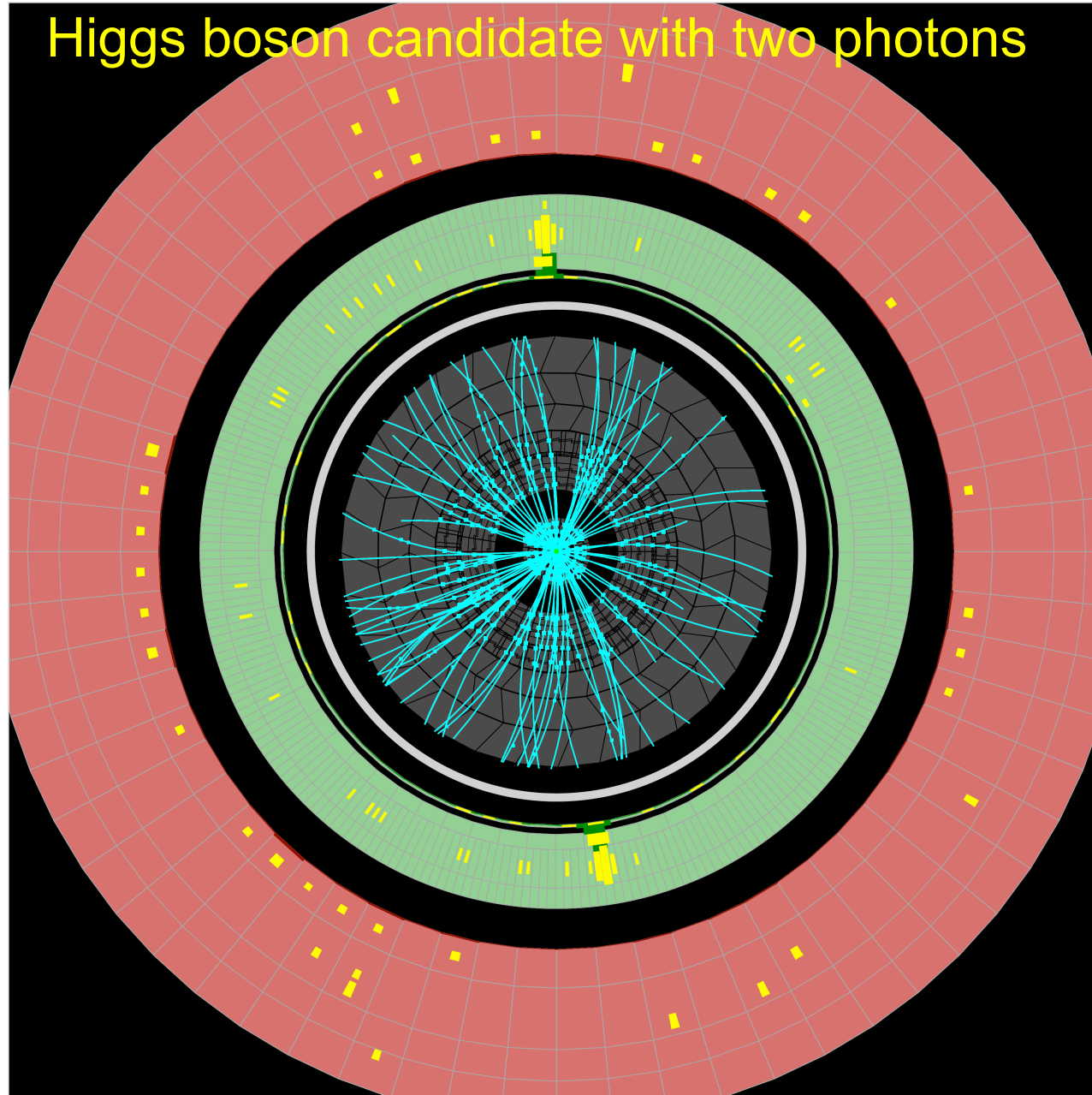
Total weight 7000 tonnes

100 million “pixels” per picture.

3000 scientists including 1000 students

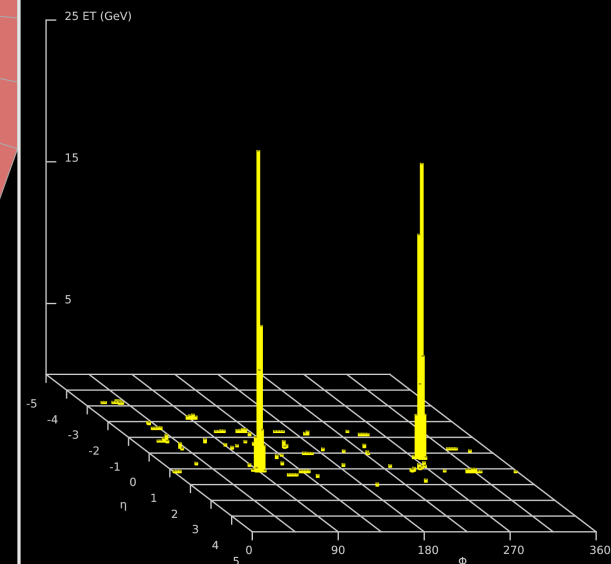


# Higgs boson candidate with two photons



Run Number: 203779, Event Number: 56662314

Date: 2012-05-23 22:19:29 CEST



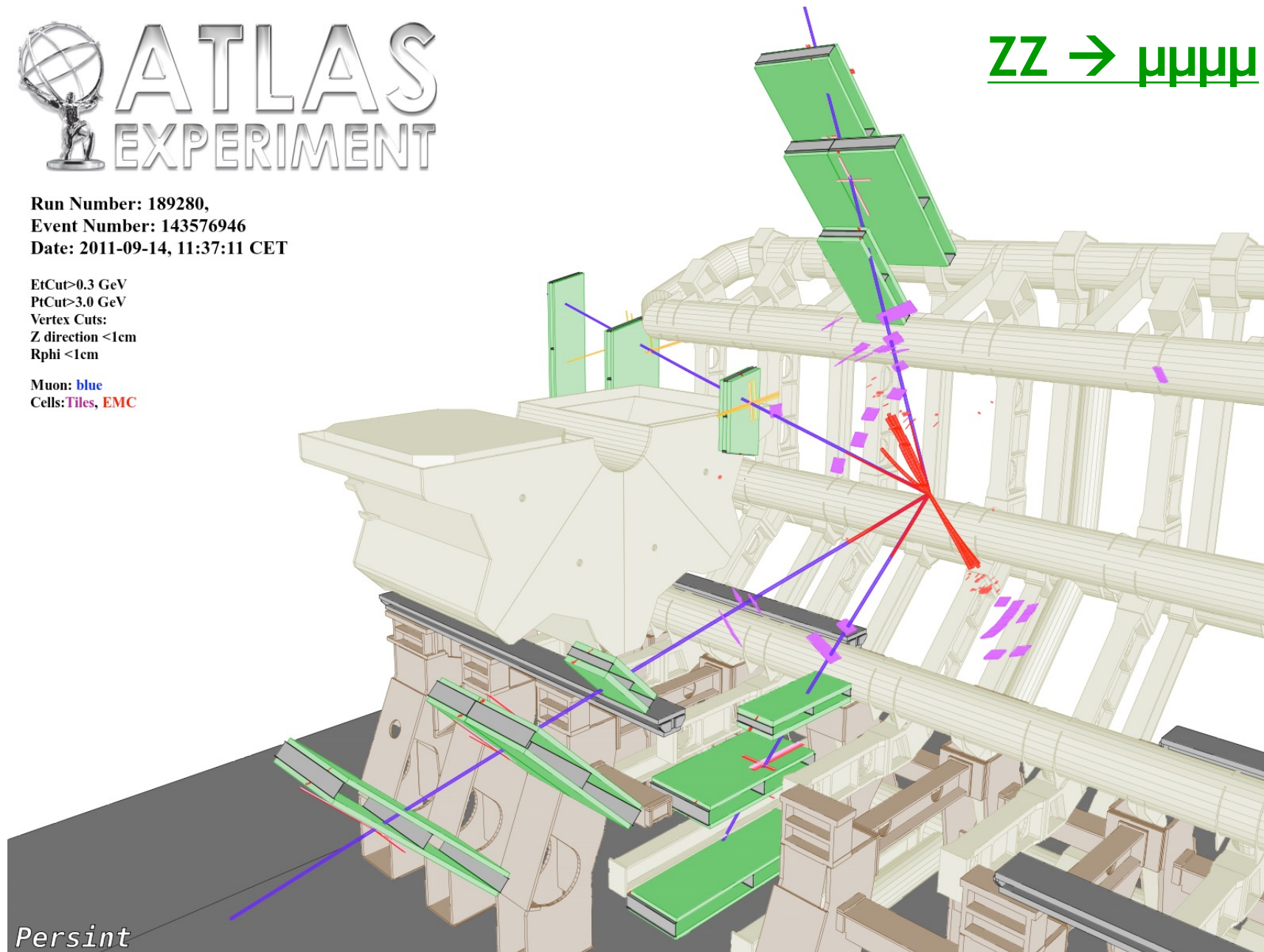
# ATLAS EXPERIMENT

Run Number: 189280,  
Event Number: 143576946  
Date: 2011-09-14, 11:37:11 CET

EtCut>0.3 GeV  
PtCut>3.0 GeV  
Vertex Cuts:  
Z direction <1cm  
Rphi <1cm

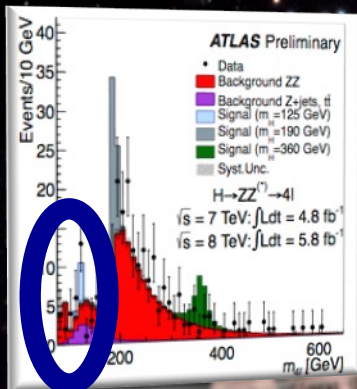
Muon: blue  
Cells: Tiles, EMC

ZZ → μμμμ



Persint

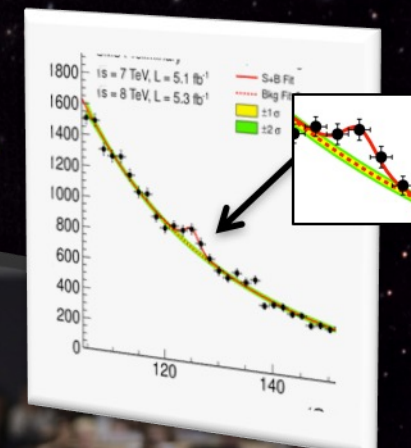
4 July 2012 – “I think we have it”  
(Rolf Heuer)



Fabiola Gianotti



Joe Incandela

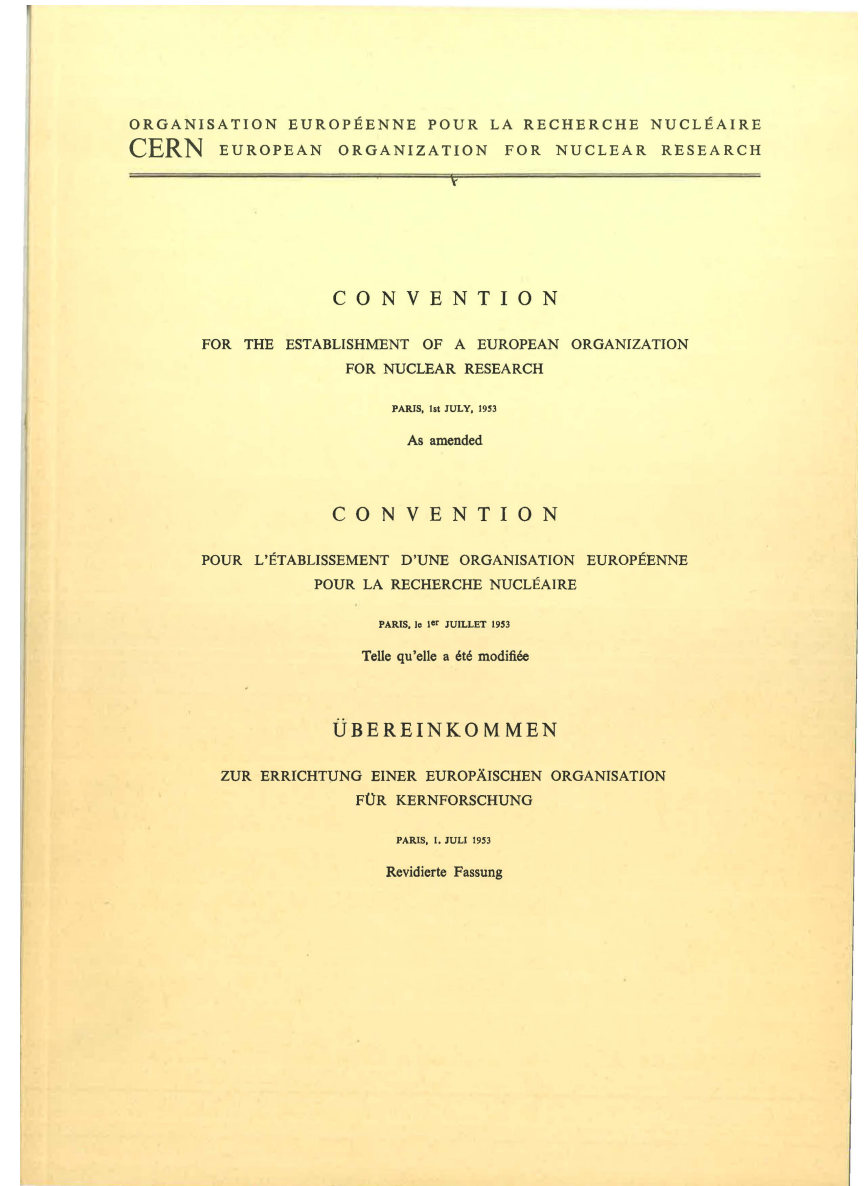




# CERN Convention



Founding principles of the Organization include that ...  
*the results of its experimental and theoretical work shall  
be published or otherwise made generally available.*



# Open Science

- **Open Access Policy (2014)**

- >90% of research produced at CERN published OA (CC-BY licenses)

- Sponsoring Consortium for Open Access Publishing in Particle Physics - SCOAP<sup>3</sup> (44 countries)

- Inspired major global OA initiatives: PlanS, OA2020, etc.

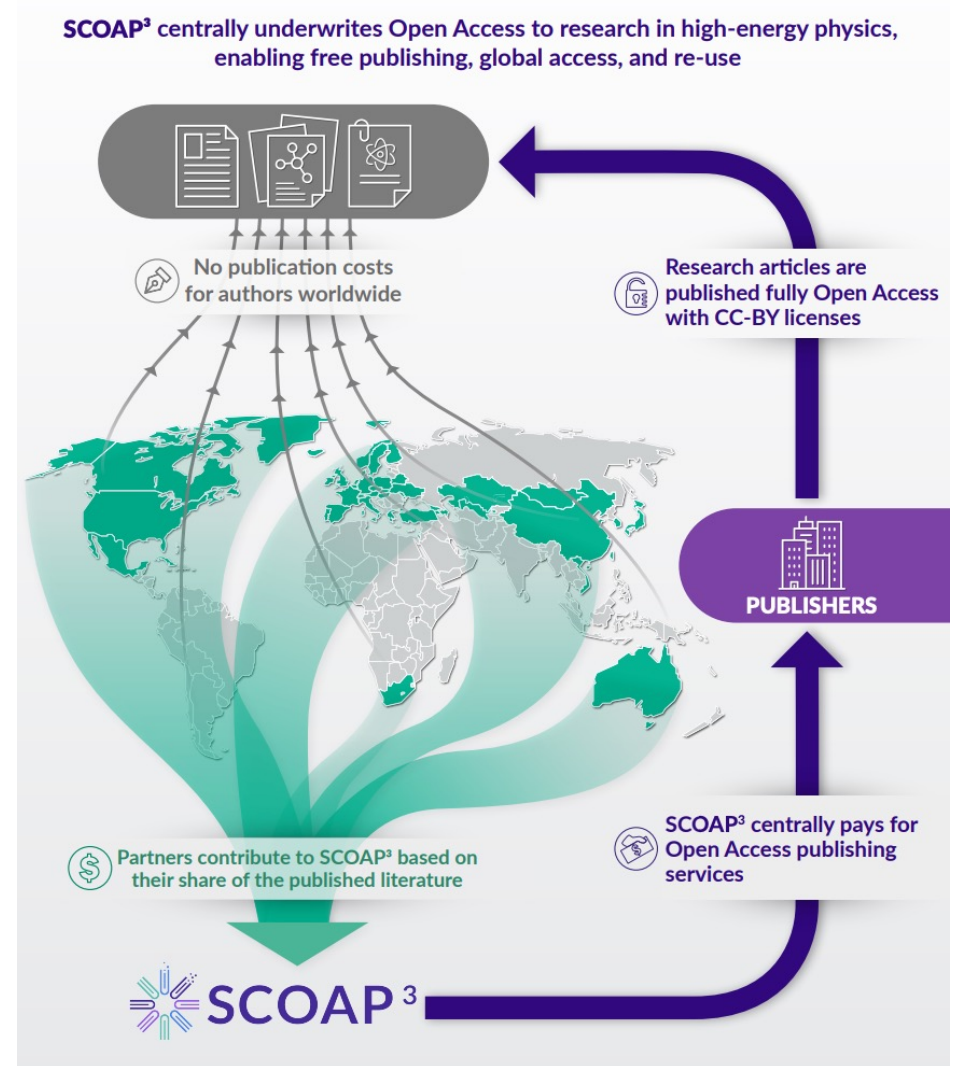
- **LHC Open Data Policy (2020)**

- LHC experiments committed to release experimental data for diverse scientific and educational uses

- Data released together with associated analysis tools

- **CERN Open Science Policy (2022)**

- Policy broadened to explicitly include other aspects



# Open Science Policy

1. Open access to publications
2. Open data
3. Open source software
4. Open hardware
5. Research integrity, reuse and reproducibility
6. Infrastructure provision for open science
7. Research assessment and evaluation
8. Education, training and outreach

# Summary

- The governance of experiments at CERN has a long and highly successful tradition
  - it has grown from small experiments of some ten people in the 1960s to the large collaborations comprising more than 3000 members today
- Built on fair sharing, on a joint (physics) goal and the determination to succeed
- The monitoring of the scientific success and the efficient use of resources involves committees with international experts
- The experiment results and data are available in the spirit of Open Science