
CERN
HSE
Occupational Health & Safety
and Environmental Protection unit

An Engineering Perspective on Risk Assessment: from Theory to Practice

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26th November 2018

CERN CONSEIL EUROPÉEN POUR LA RECHERCHE NUCLÉAIRE

1954:

- founded by 12 European states
- first European organisation
- fundamental research on nuclear physics

Sur le terrain du futur institut nucléaire

Sous la conduite de M. A. Picot, les membres du Conseil européen pour la recherche nucléaire se sont rendus hier à Meyrin pour reconnaître le terrain où s'élèvera le Centre nucléaire (voir en Dernière heure)

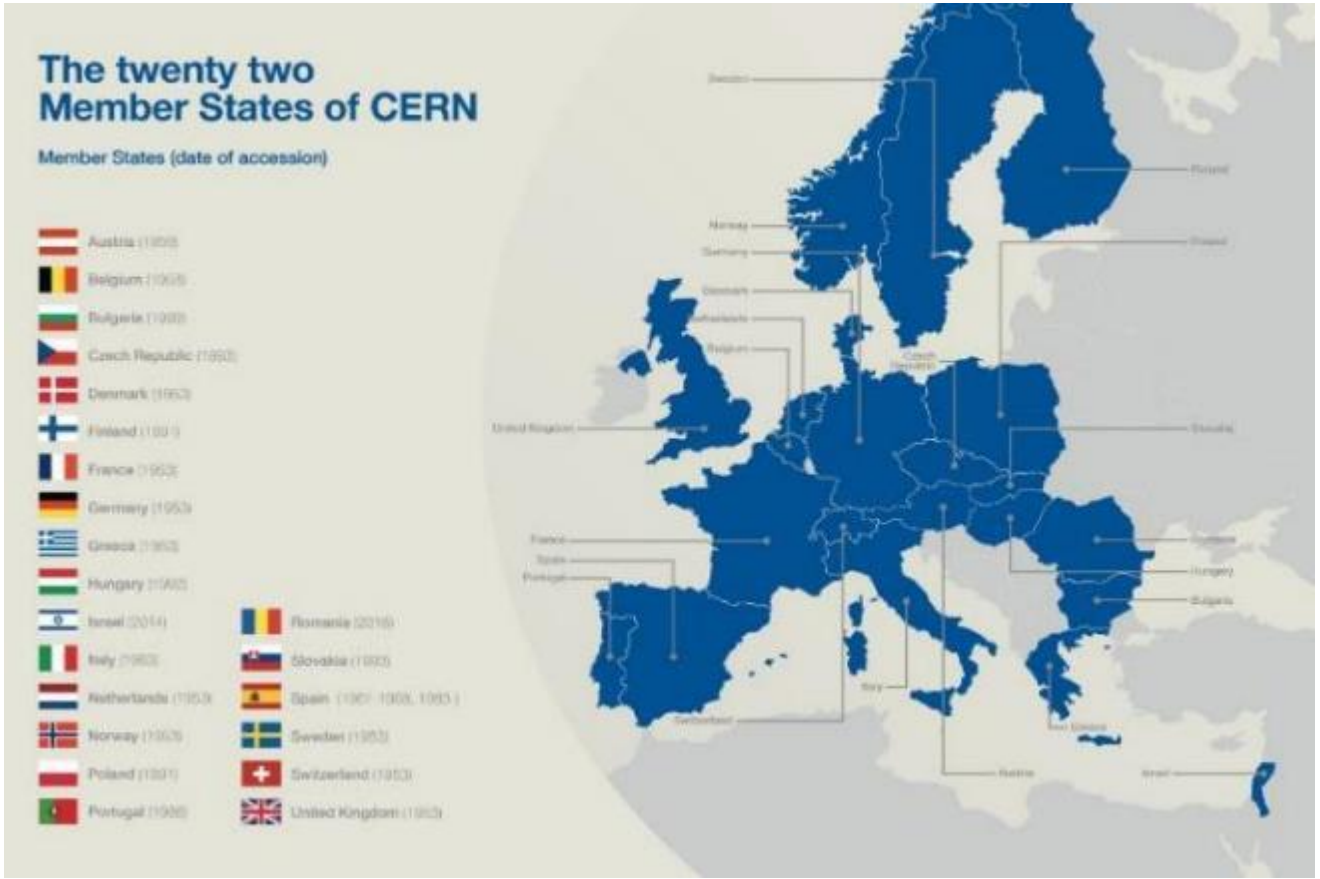
(Photo Freddy Bertrand, Genève)

La Suisse du 30 octobre 1953

World Laboratory for Particle Physics

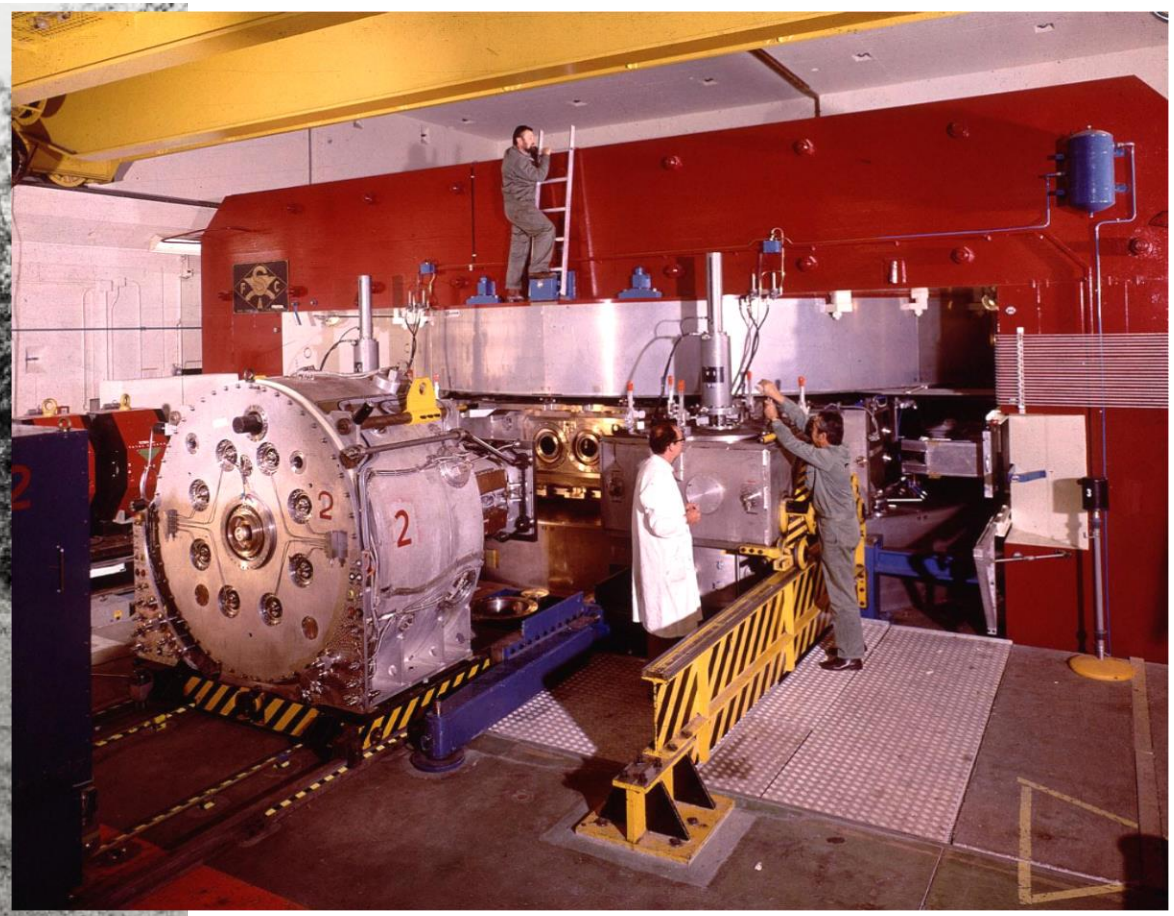
2018:

- 22 member states
- 8 associate member states
- 6 observers
- 50 ICA (International Cooperation Agreements)
- several candidates for membership or associate membership

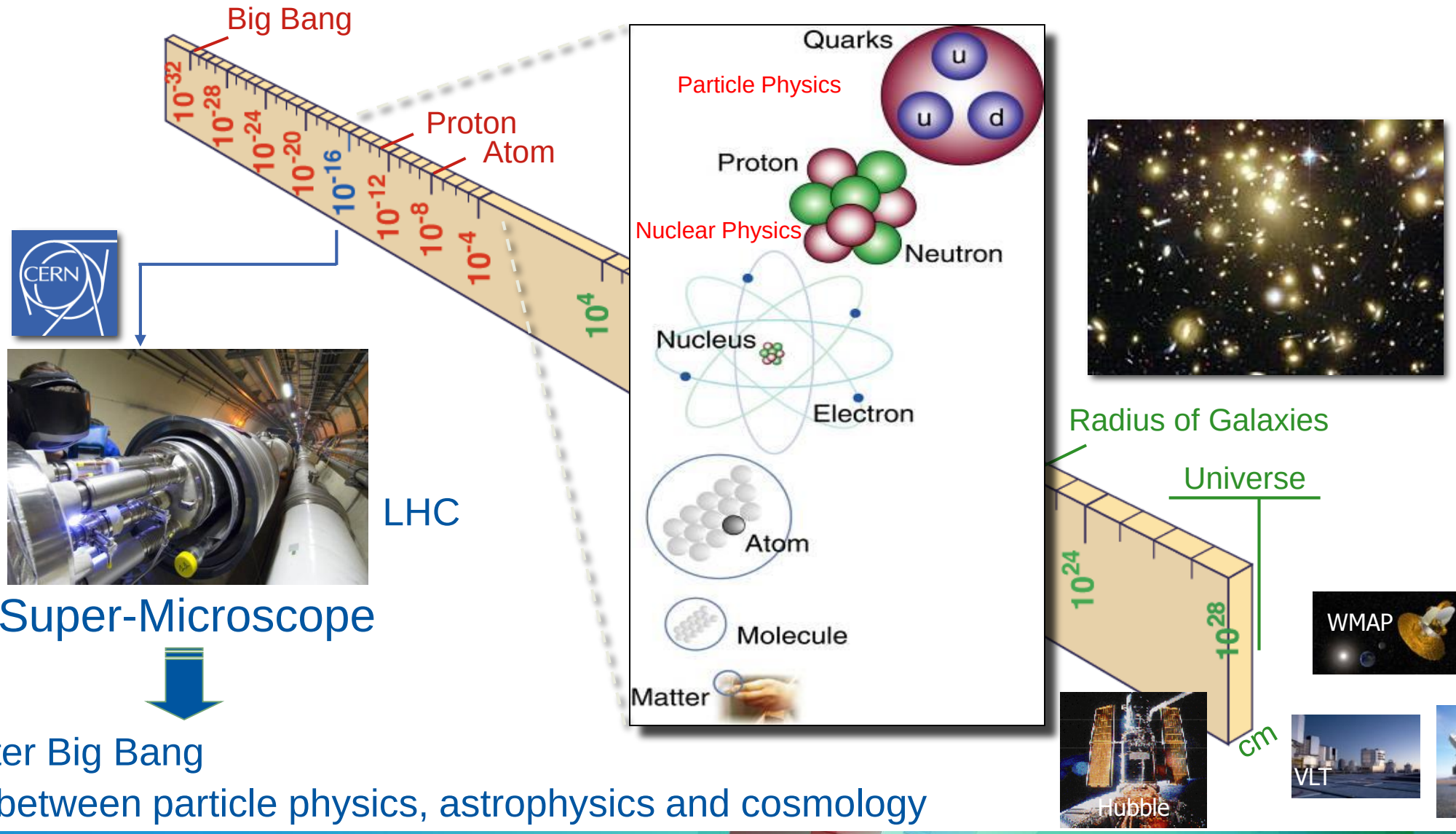


Fundamental research in particle physics

The First Accelerator



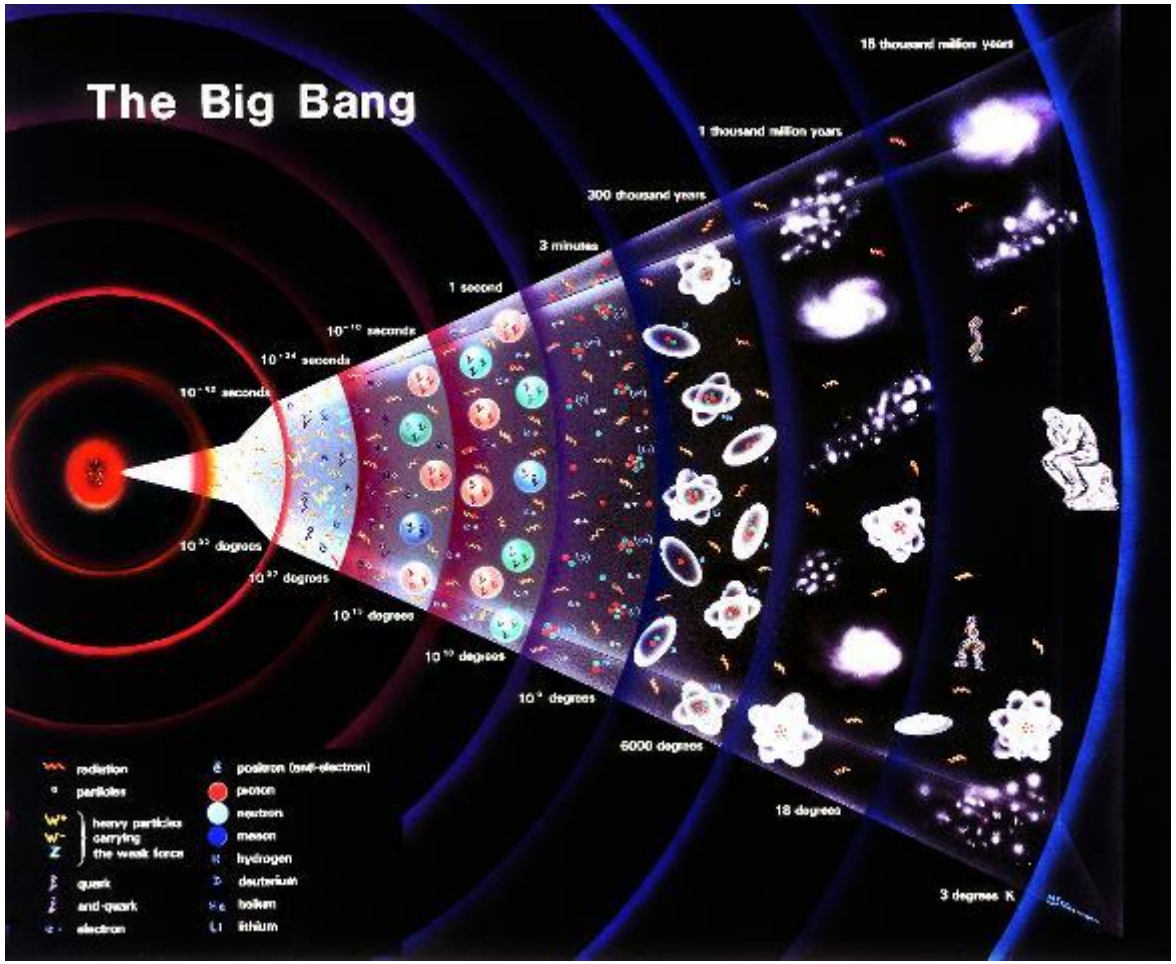
First beam: 1st August 1957



Physics after Big Bang

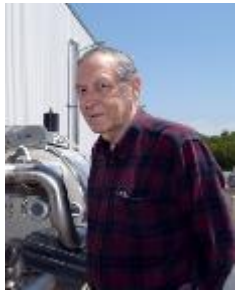
symbiosis between particle physics, astrophysics and cosmology

CERN's Discoveries & Inventions



W + Z Boson (1983)

Carlo Rubbia & Simon van der Meer



Higgs Boson (2012)

Peter Higgs, Francois Englert, Robert Brout

Penta Quarks (2015)

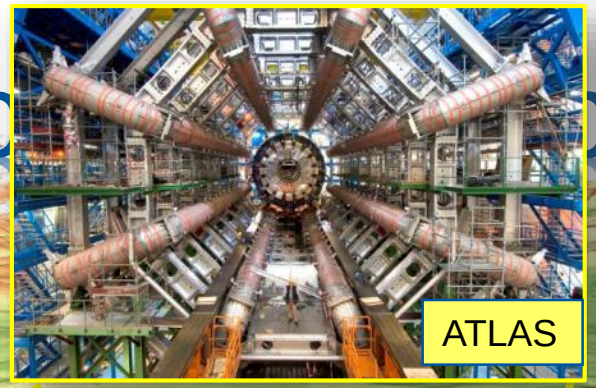
Multi wire chambers

Georges Charpak

World Wide Web (1990)

Tim Berners-Lee


CERN CONTROL CENTRE


ATLAS

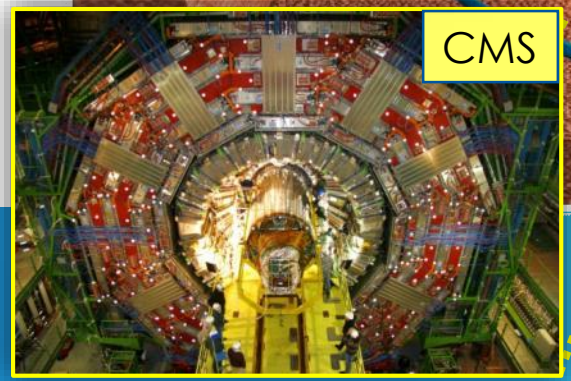

PS Tunnel


LHCb


ALICE


AWAKE Tunnel

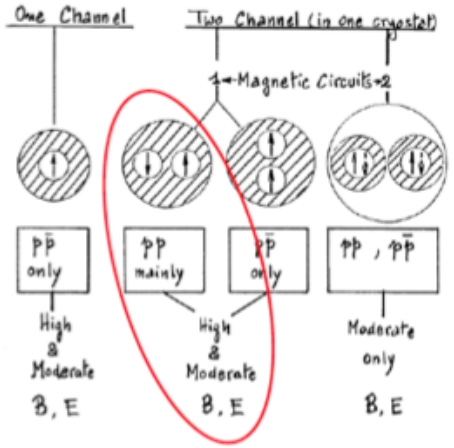

SPS Tunnel


CMS


LHC Tunnel

LHC

ECFA-CERN workshop



June 1994
first full scale prototype dipole

1994 project approved by council (1-in-2)

June 2007 First sector cold

April 2008
Last dipole down

25 years

9T- 1m single bore

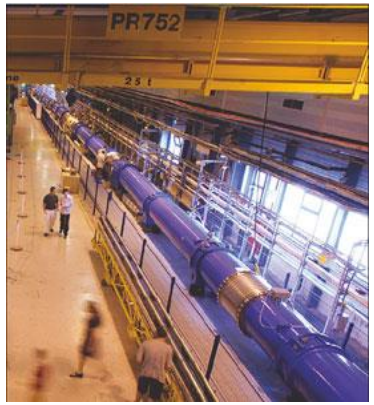
Main contracts signed

83 84 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10

Decision for Nb-Ti

9T -10 m prototype

2002 String 2



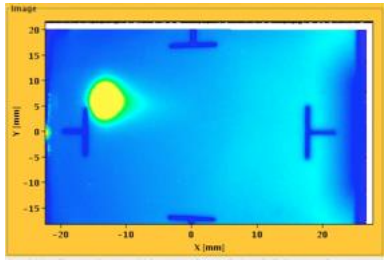
November 2006
1232 delivered

September 10, 2008
First beams around

Courtesy
F. Bordry

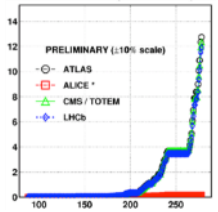
LHC

August 2008
First injection test

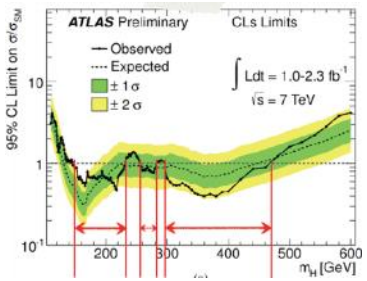


Sept. 10, 2008
First beams around

November 29, 2009
Beam back



October 14, 2010
L= 1x10^{+32}
248 bunches

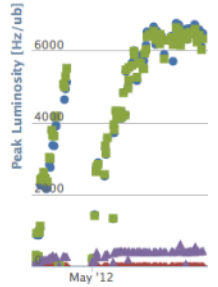


October, 2011
3.5x10^{+33}, 5.7 fb^{-1}

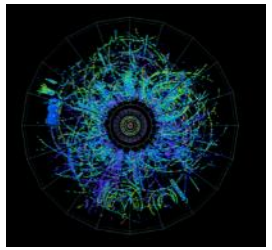
First Hints!!

June 28 2011
1380 bunches

1380

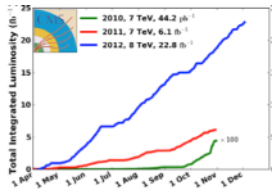


May 2012
Ramping Performance



Feb. 2013
p-Pb^{82+}
New Operation Mode

March 14th 2012
Restart with Beam



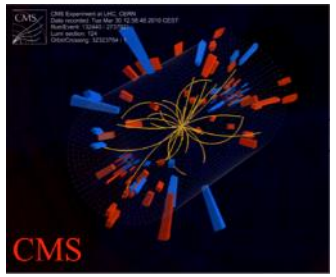
Nov. 2012
End of p^{+} Run 1

Repair and Consolidation

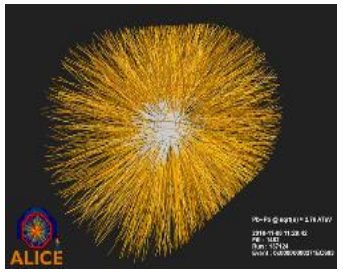
2008 | 2009 | 2010 | 2011 | 2012 | 2013

Sept. 19, 2008
Incident

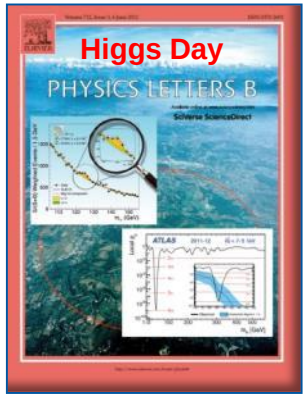
March 30, 2010
First collisions at 3.5 TeV



November 2010
Pb^{82+} Ions



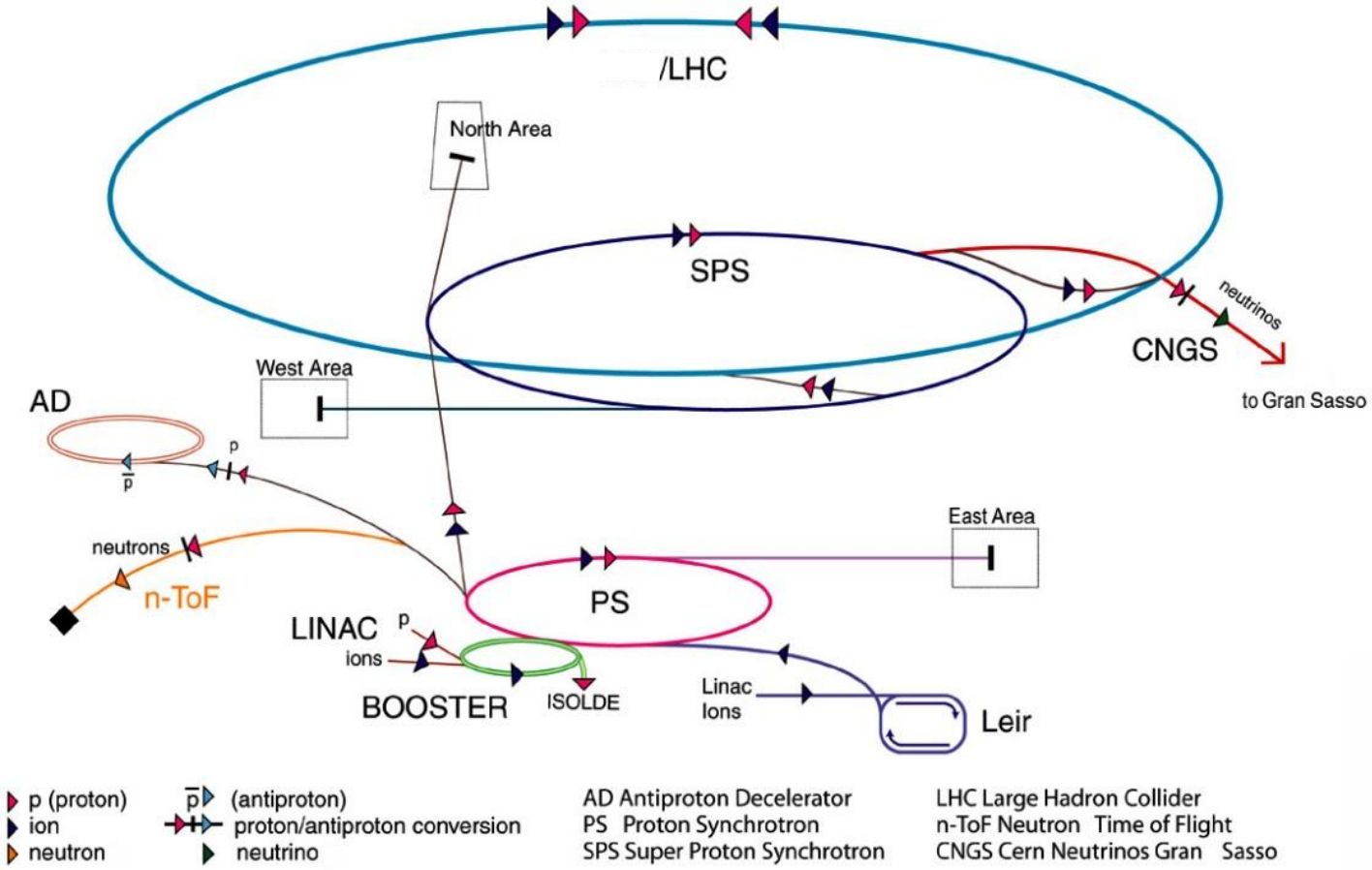
November 2011
Second Ion Run



LS1

Courtesy
F. Bordry

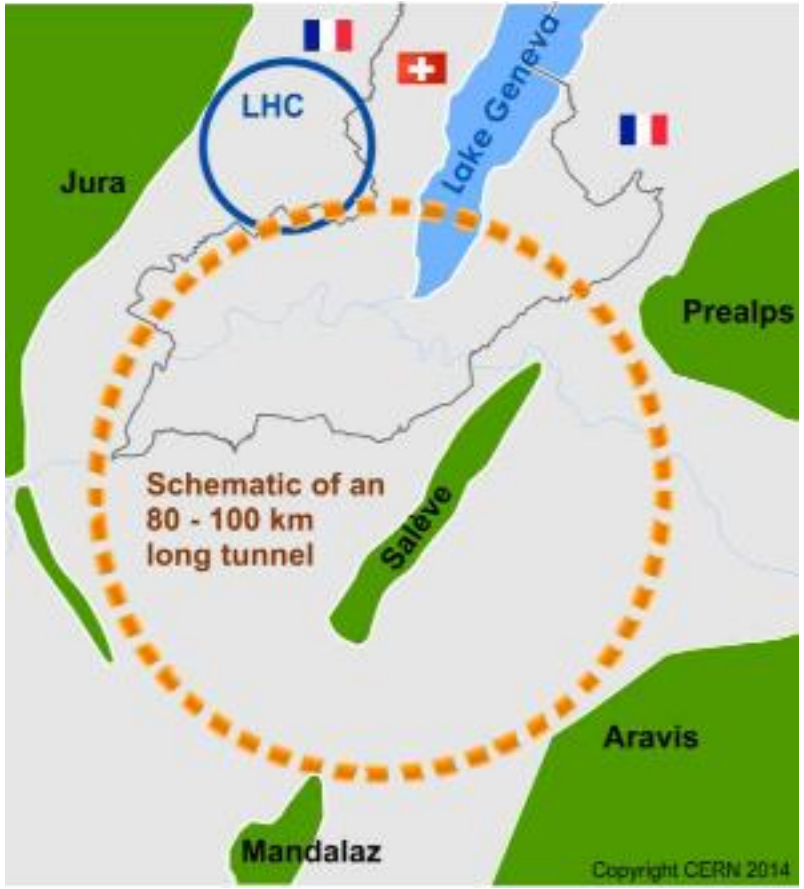
CERN's Accelerator Complex



AD: Antiproton Decelerator for antimatter studies
CAST, OSQAR: axions
CLOUD: impact of cosmic rays on aeorosols and clouds -> implications on climate
COMPASS: hadron structure and spectroscopy
ISOLDE: radioactive nuclei facility
NA61/Shine: heavy ions and neutrino targets
NA62: rare kaon decays
NA63: interaction processes in strong EM fields in crystal targets
NA64: search for dark photons
Neutrino Platform: **ν** detectors R&D for experiments in US, Japan
n-TOF: n-induced cross-sections
UA9: crystal collimation

Future Circular Collider (FCC)

FCC-hh:	√s=100 TeV	L~3x10^{35}	100 km ring
FCC-ee:	√s= 90-365 GeV	L~200-1.5 x 10^{34}	100 km ring
FCC-eh:	√s=3.5 TeV	L~1.5x10^{34}	100 km ring
HE-LHC:	√s=27 TeV	L~1.6x10^{35}	LHC tunnel



Major focus: development of new generation 16T Nb_3Sn magnets

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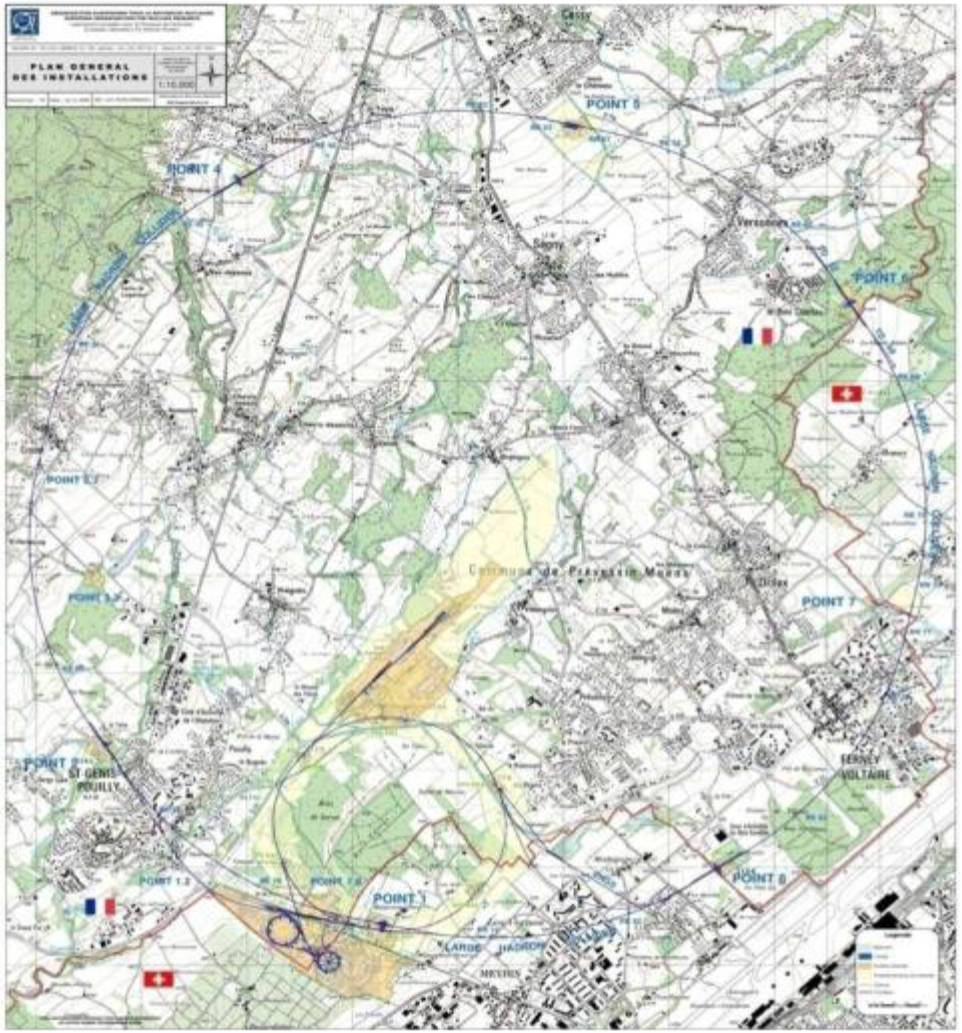
F. Bordry

Complexity of CERN's site: key numbers



Two main sites :

Meyrin (CH-FR) : 80 hect.
Prévessin (FR) : 83 hect

15 satellite sites

Total CERN fenced territory : 208 hect.
Total CERN unfenced territory : 418 hect

Number of buildings :~ 674
10m² up to 20.000m² , 425,000 m² of surface
60% of the buildings are 30+ years old

Tunnel lengths : > 70 km
Caverns: > 80
30 km of roads

495 hostel rooms

~ 2500 Staff
~ 2000 Fellows and Paid Assoc.
~ 12300 Users
~ 4000 Contractor employees
~ 135000 visitors/y

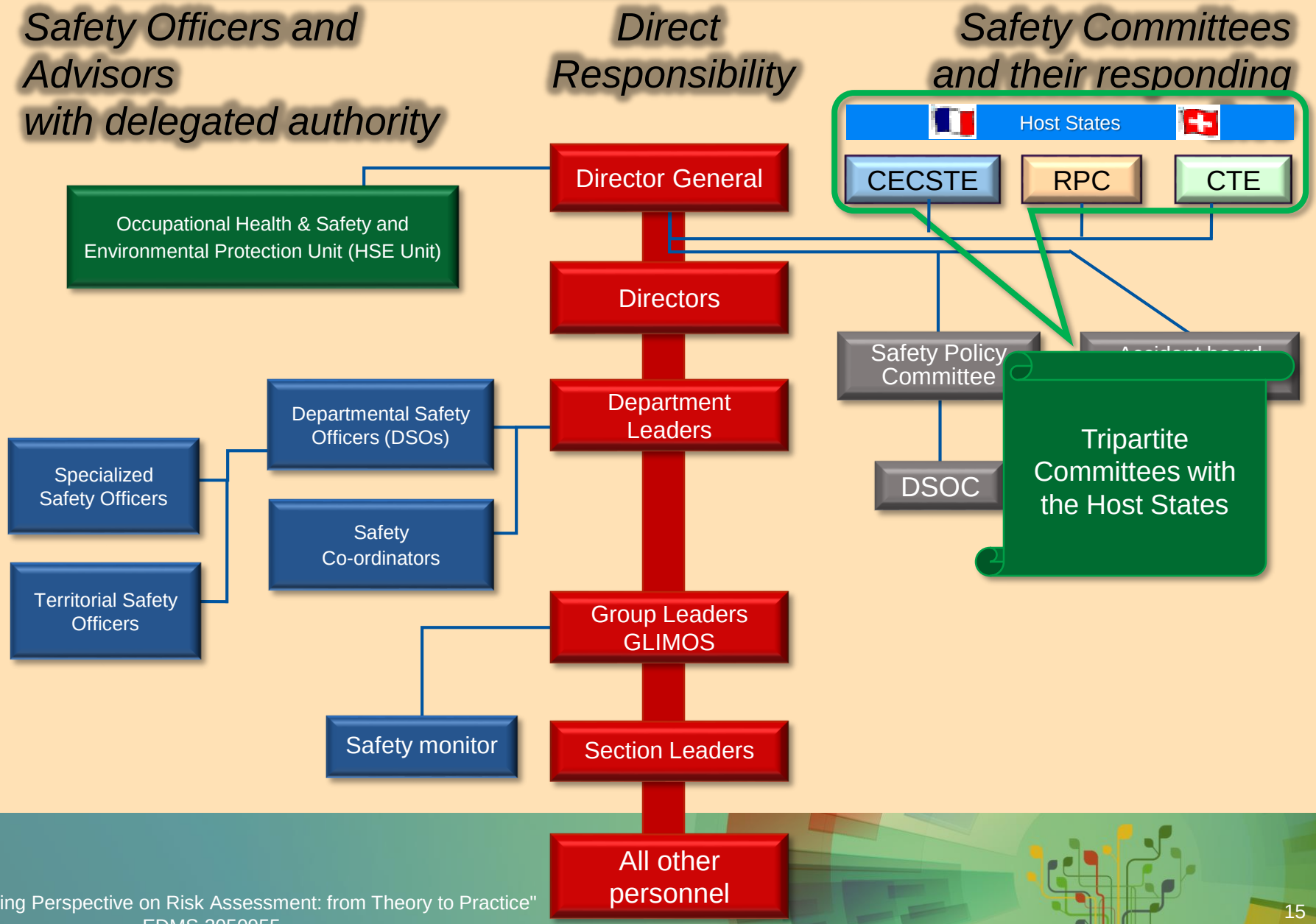
On average 9'500 people every day at CERN

CERN’s Legal Status

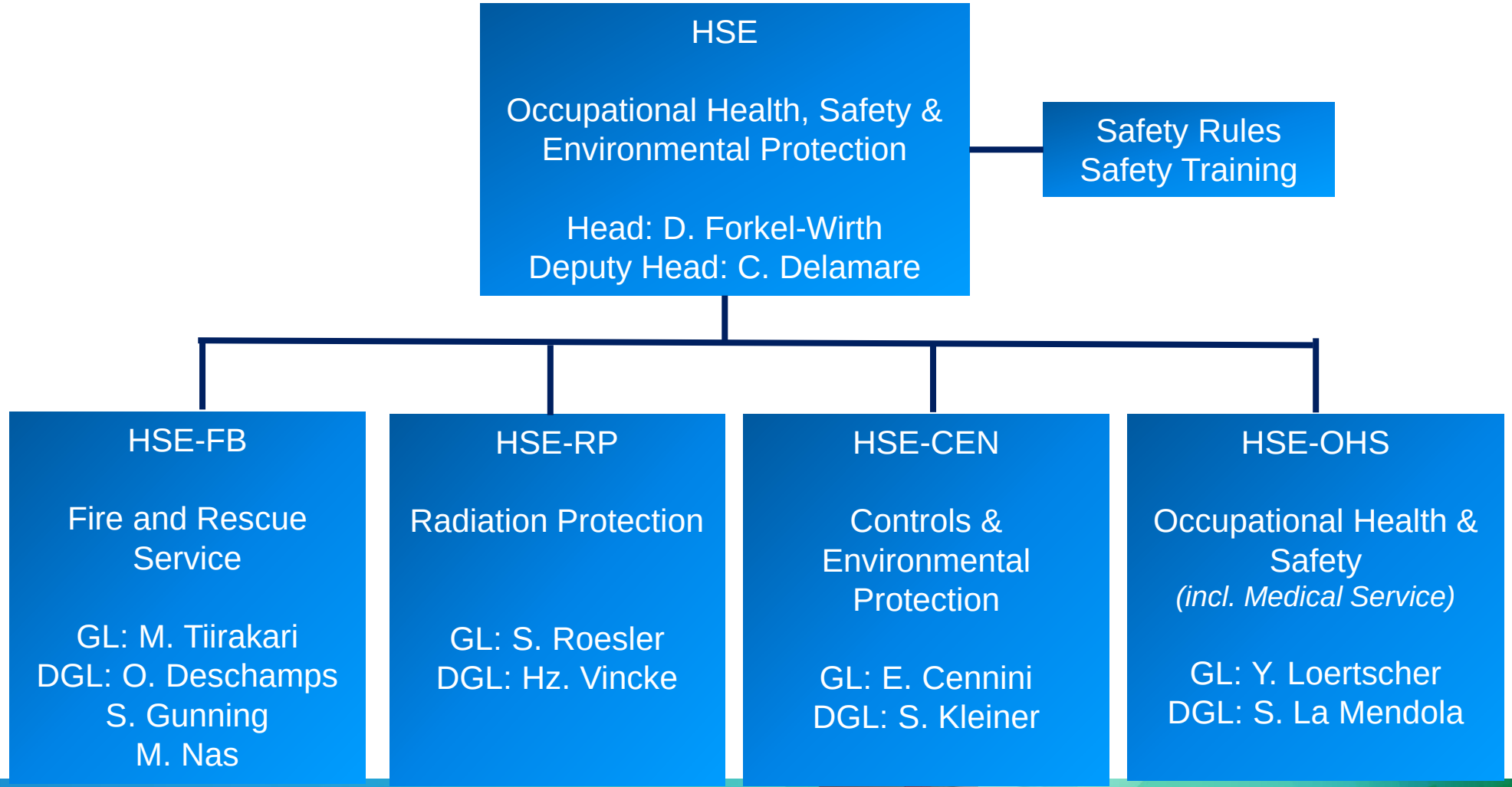
- Intergovernmental Organization governed by public international law with international status (IS) recognized by member states (via treaties)

- IS and the associated privileges and immunities guarantees functioning of the Organization without interference by individual States

Safety organisation at CERN



HSE Organisation – since 1st January 2018

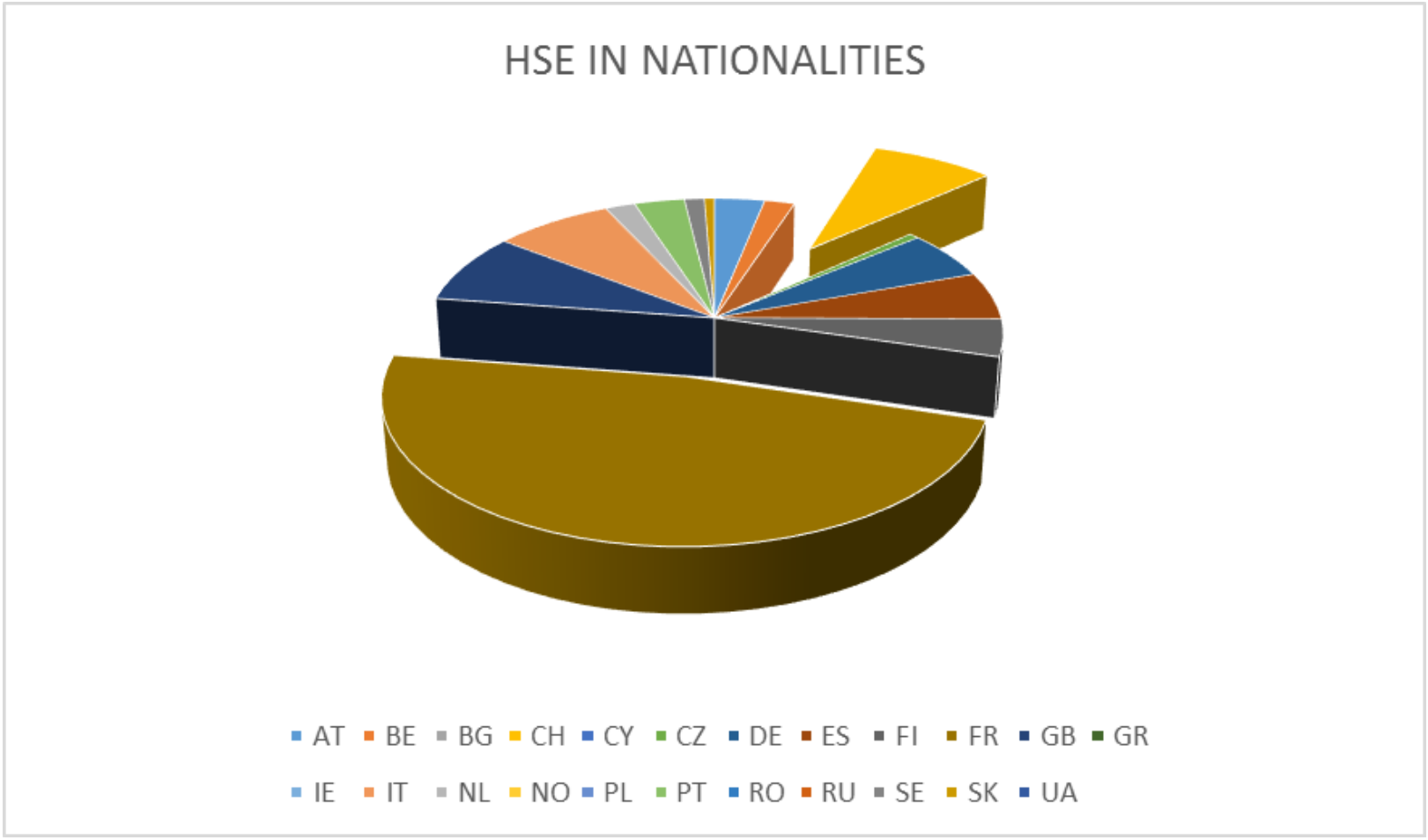


HSE Unit – 23 Nationalities

160 staff members
- 37 fellows
- 14 students
- 5 trainees

15 TEMP

20 – 30 Contractors



HSE at CERN

ADVISING & AUTHORISATION & MONITORING
of personal, activities and projects

Occupational Health & Safety

safety studies
(e.g. fire prevention)
risk analysis
technical inspections

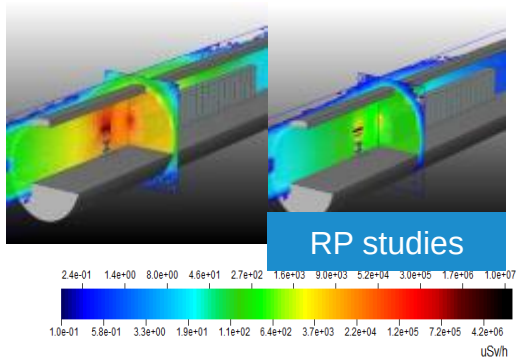
Electrical substation

Fire and Rescue Service

numerous interventions/year

Radiation Protection

RP studies
50 km of radiation areas (op. RP)
radioactive waste management



Safety Training

Safety Rules

Environmental Protection

impact studies
monitoring (NO_x, O_3, radioactive releases, effluent water…)

Occupational Medicine

Duty and organization of OHS Group

Inspection SI

Services SV



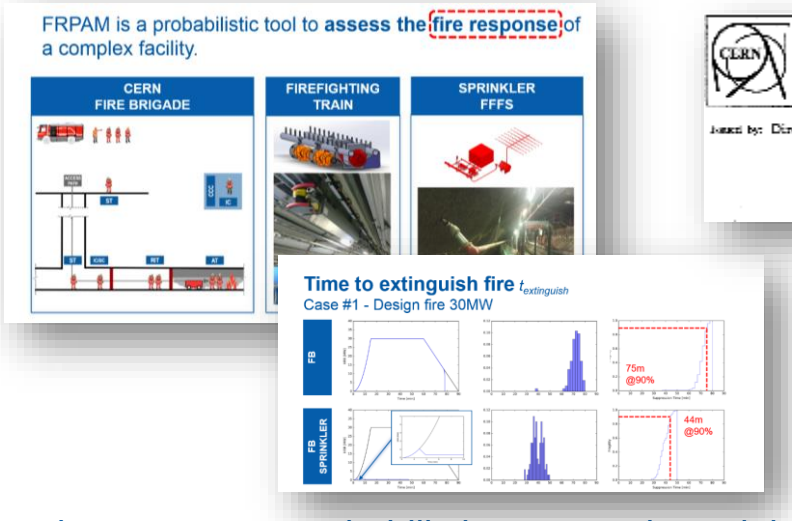
Medical Services ME

Experts XP



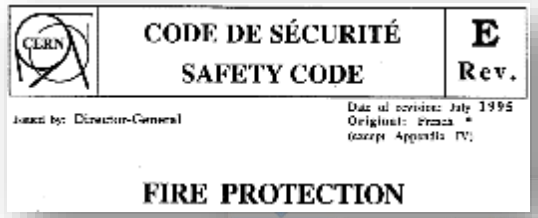
HSE at CERN – **Fire Safety Engineering**

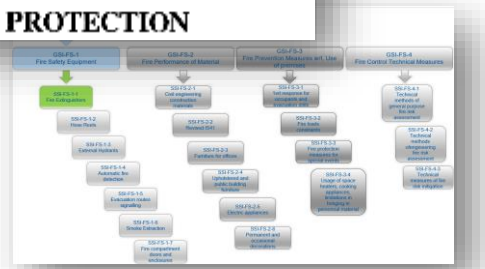
FRPAM



Fire Response Probabilistic Approach Model

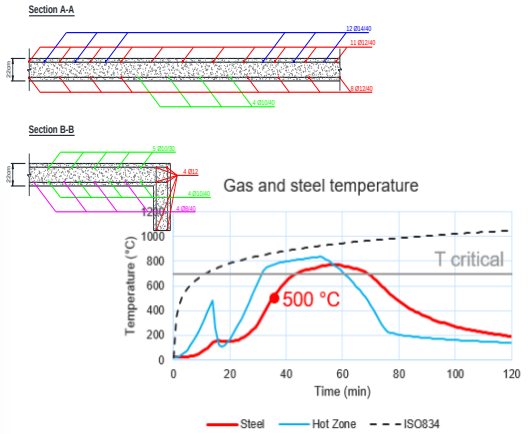
Fire Safety Rules





Support Fire Safety Rules Development and Implementation

Fire-Structural analysis



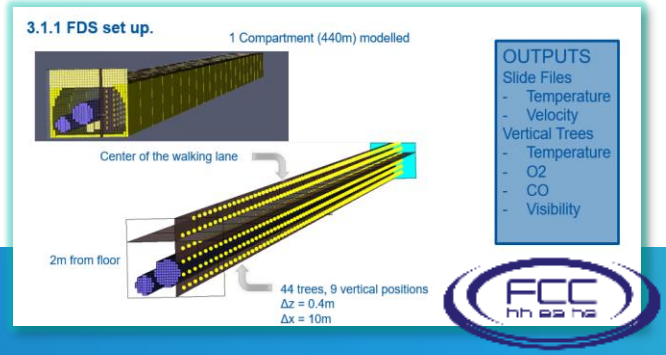
Structural Fire Resistance Assessment

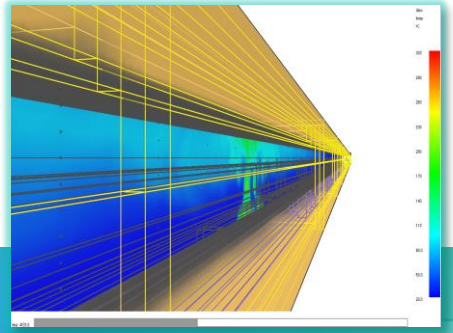
FSE Network

Fire Safety Engineering collaboration with other physics accelerator facilities

Performance Base Design Projects – & CFD modelling

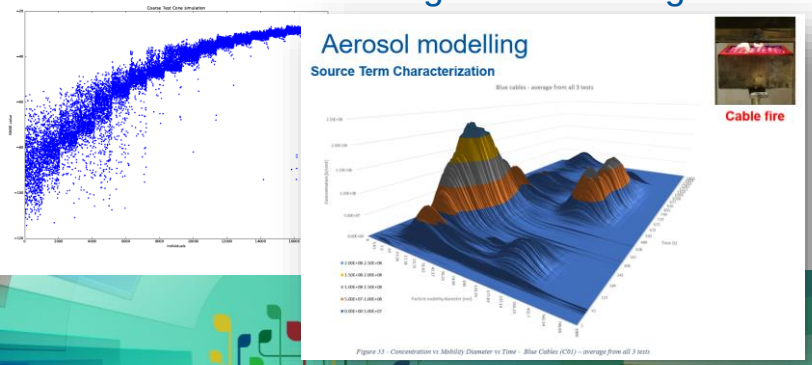
PBD analysis for future CERN project (e. g. FCC) and existing facilities





R&D

Advanced Cables testing and modelling



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