EN Engineering Department

Welcome to the Engineering Department at CERN

Katy Foraz, ACE Group Leader, 2nd February 2016

Who are we ???

Conseil Européen pour la Recherche Nucléaire
World largest Particle Physics Laboratory (1954)

Yearly Budget

~1100 MCHF (~ 1000 MEUR)

Experiments financed externally.

Personnel

2300 Staff
730 Fellows & Associates
200 Students

11000 Users from 500 universities

2000 External companies

21 Member Countries

Austria, Belgium, Bulgaria, Check Republic, Denmark, Finland, France, Germany, Greece, Italia, Israel, Hungary, Holland, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, UK.

7 Observers Countries

EU, USA, Russia, India, Japan, Turkey, UNESCO

2 Candidate Countries

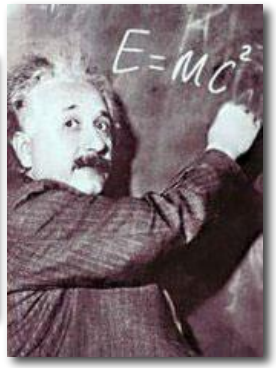
Romania and Serbia

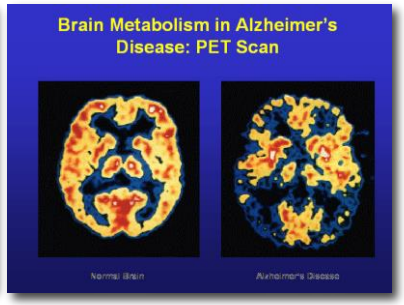
1 Associate Country

Pakistan

The Missions of CERN

- Push forward the frontiers of knowledge
  - e.g. the secrets of the Big Bang … what was the matter like within the first moments of the Universe's existence?
- Develop new technologies for accelerators and detectors
  - Information technology - the Web and the GRID
  - Medicine - diagnosis and therapy
- Train the scientists and the engineers of tomorrow
- Unite people from different countries and cultures





The instruments used

1. Particle accelerator :

Boost particles to high energies and make them collide

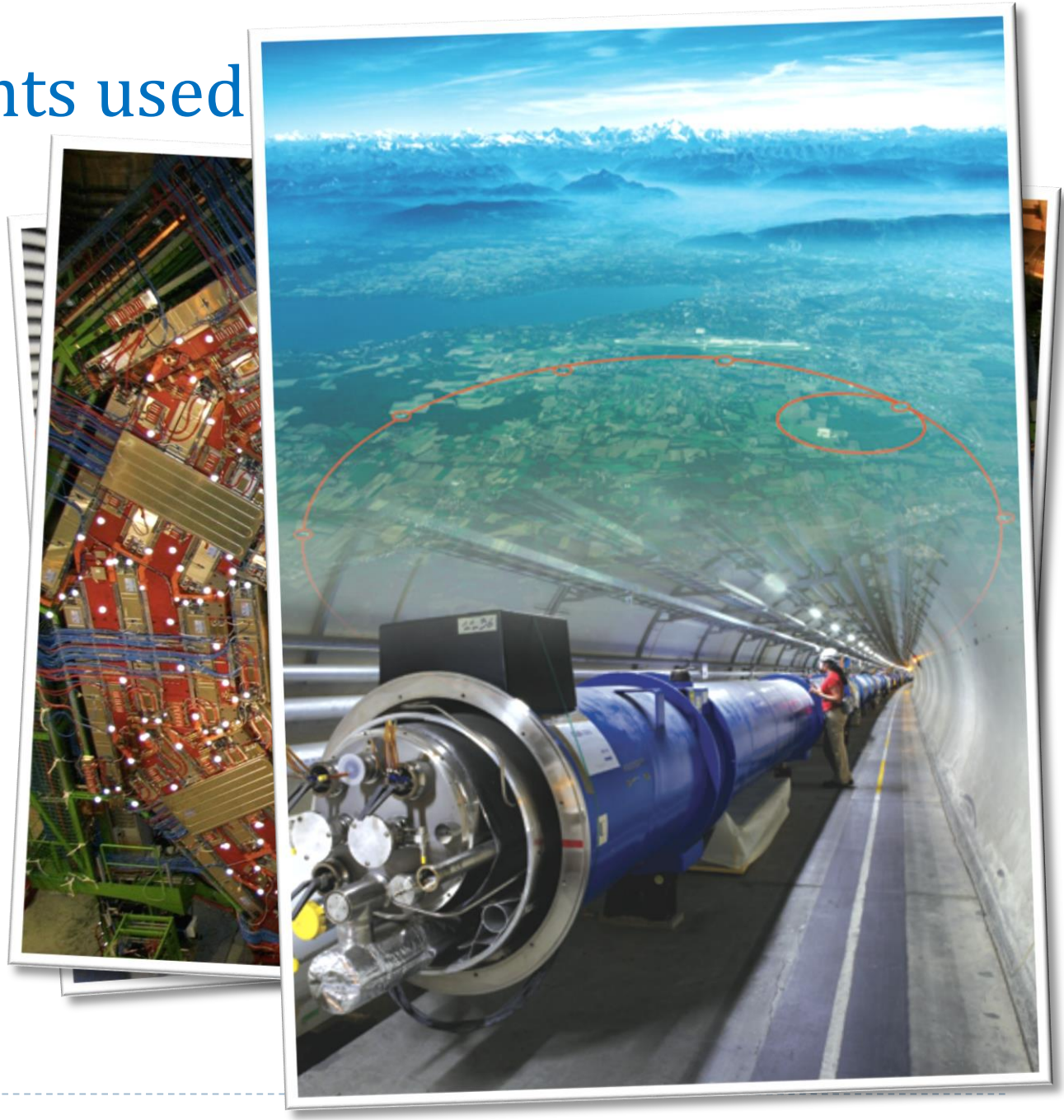
2. Detectors :

Gigantic instruments that observe and record the results of the collisions

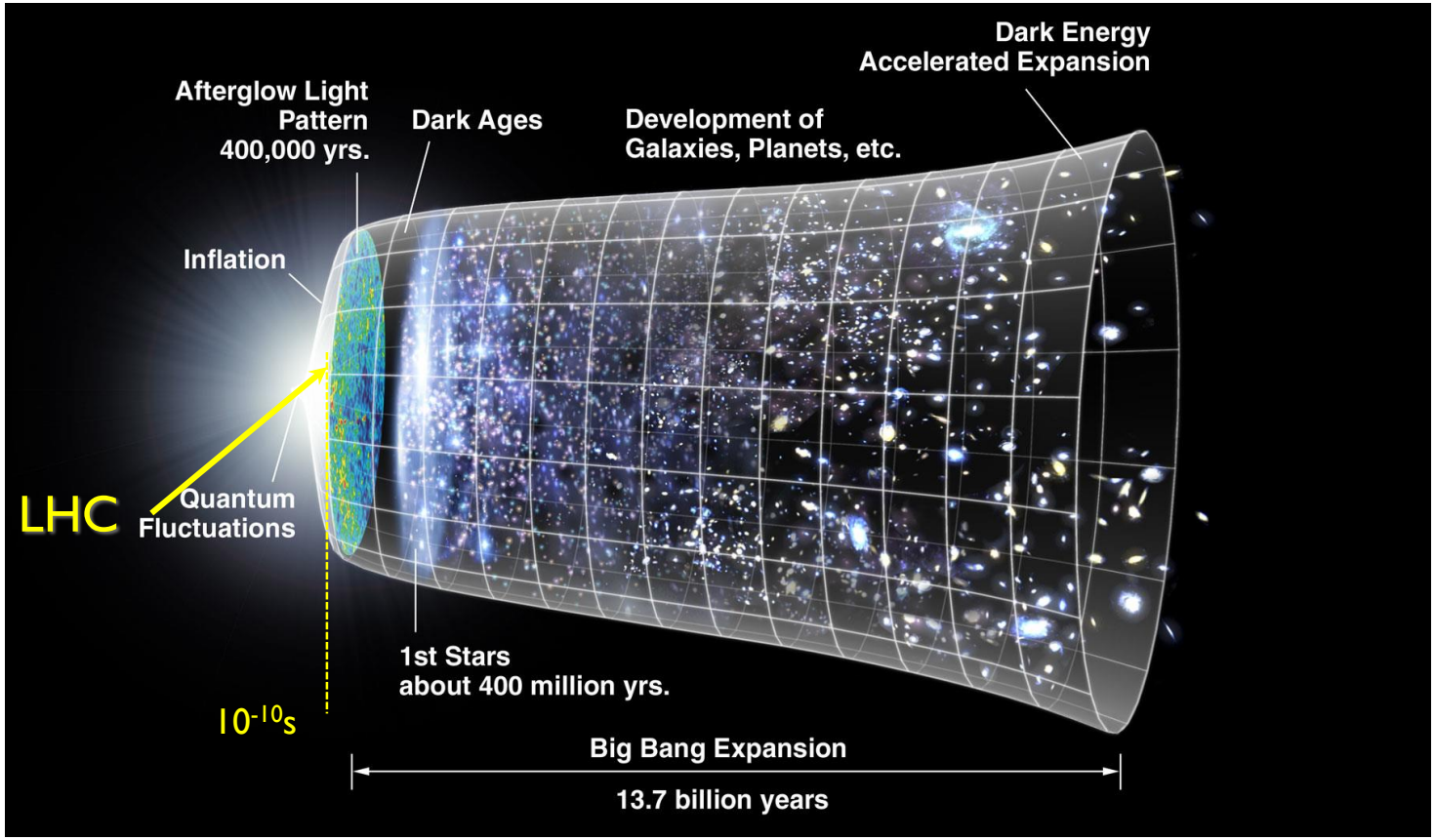
(particle trajectories, energy, charge…)

3. Computers :

Collect, store, and send around the world the big quantity of data received from the detectors for data analysis

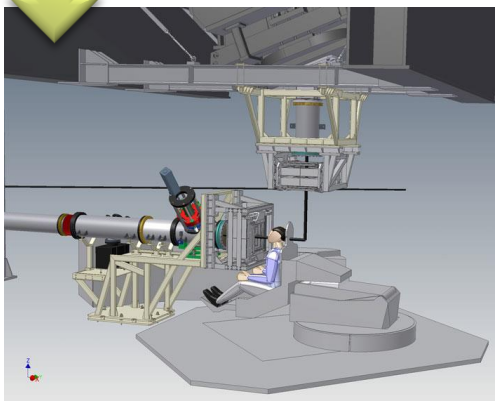


The next scientific challenge is to understand the very first moments of our Universe after the Big Bang



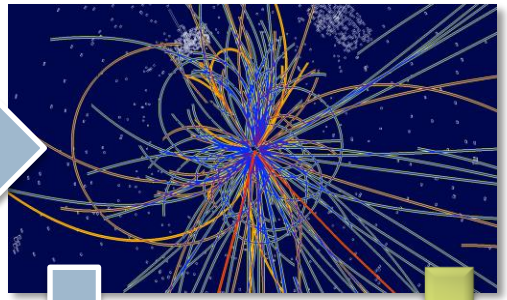
The technologies developed at CERN generate innovation

Accelerators

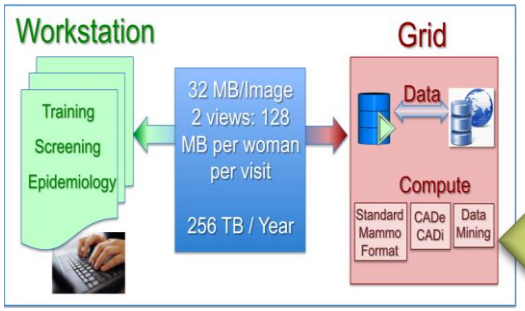


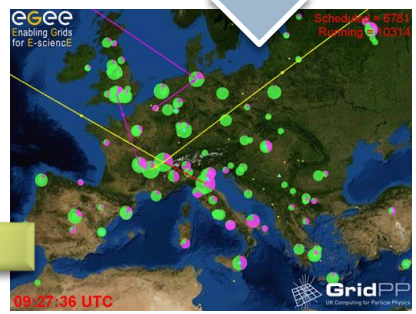
Hadron therapy

Detectors



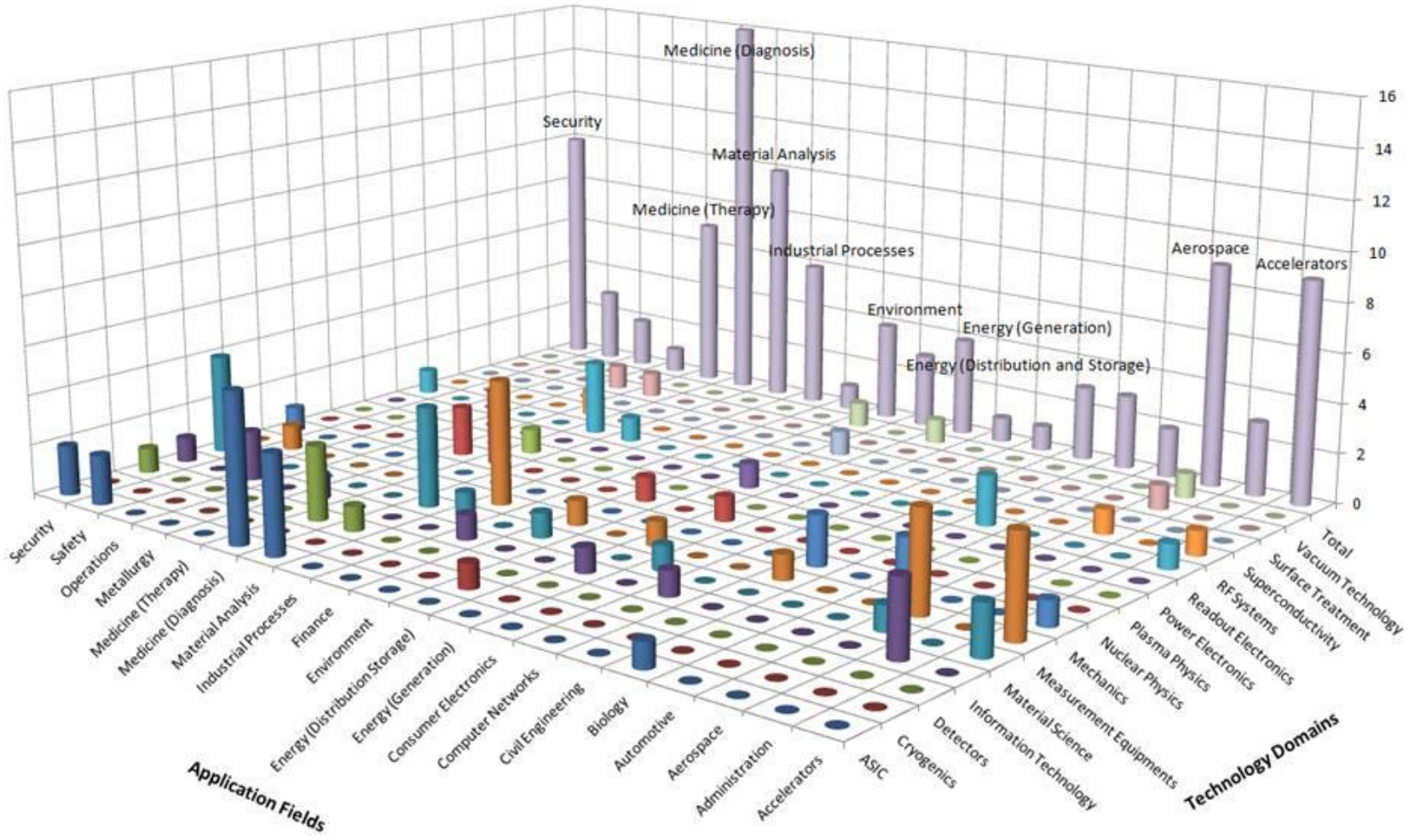
CAT



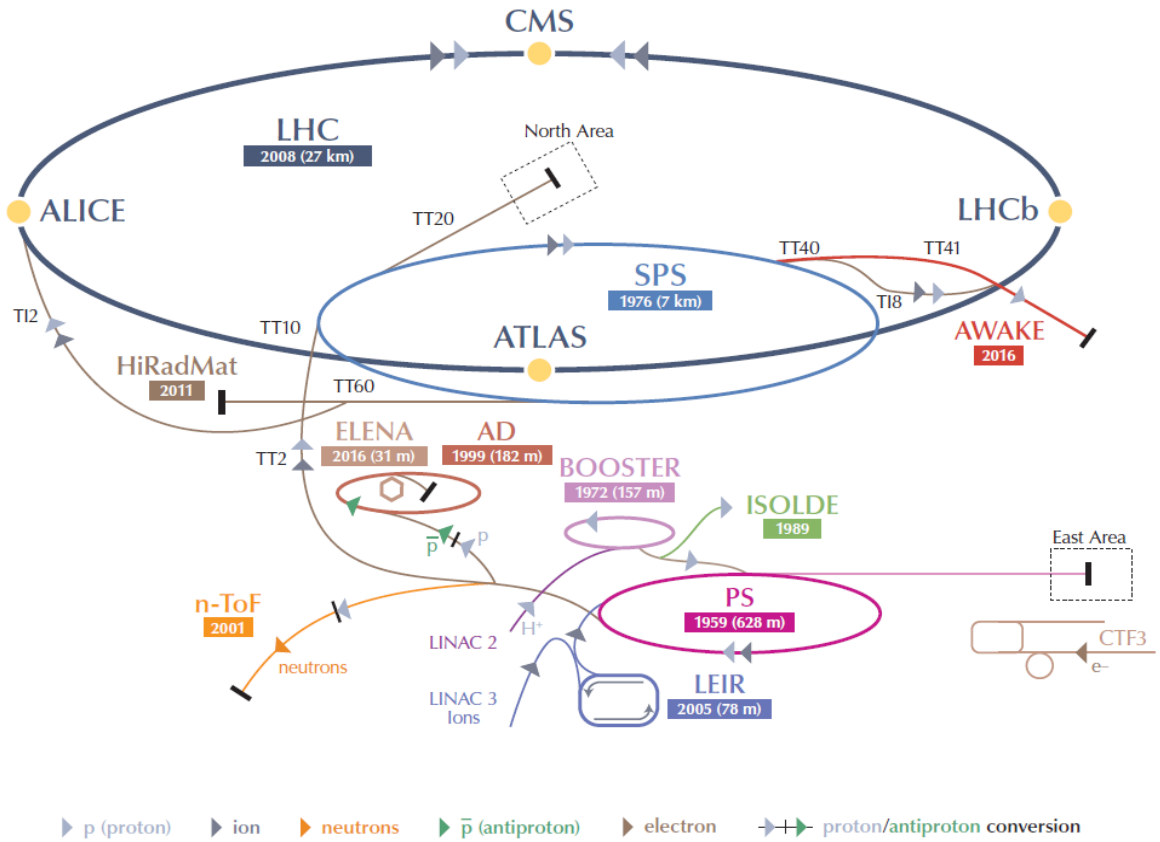


The Computing Grid

The impact of the technologies developed at CERN



The CERN Accelerator Complex



LHC Large Hadron Collider SPS Super Proton Synchrotron PS Proton Synchrotron

AD Antiproton Decelerator CTF3 Clic Test Facility AWAKE Advanced WAKefield Experiment ISOLDE Isotope Separator OnLine DEvice

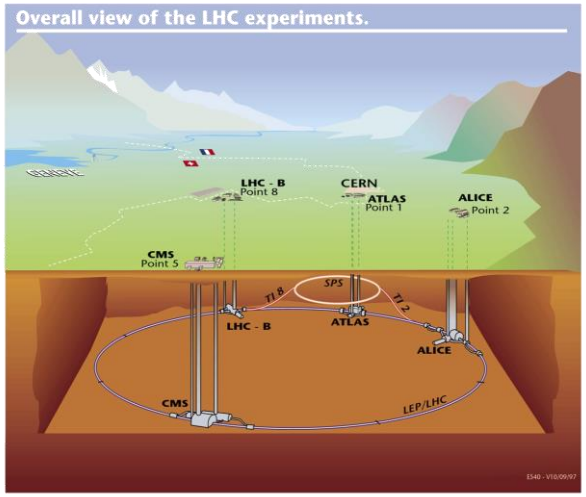
LEIR Low Energy Ion Ring LINAC LINear ACcelerator n-ToF Neutrons Time Of Flight HiRadMat High-Radiation to Materials

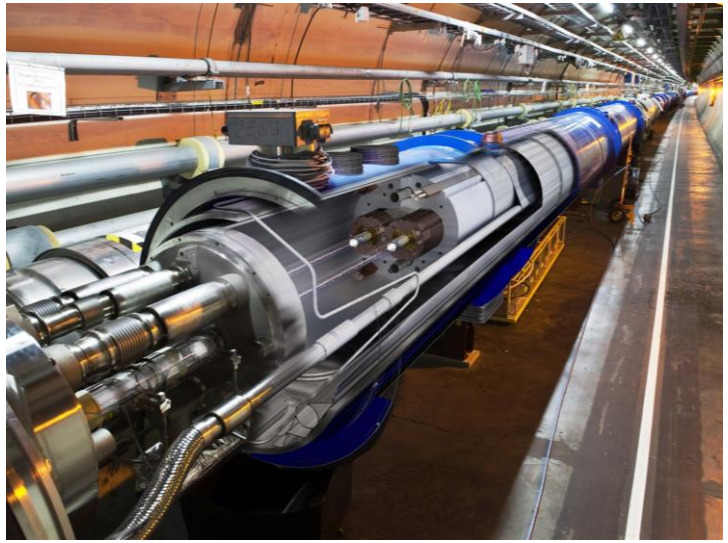
The LHC

A collider situated in an underground 27 km in an almost circular tunnel designed to accelerate two proton beams to 7 TeV

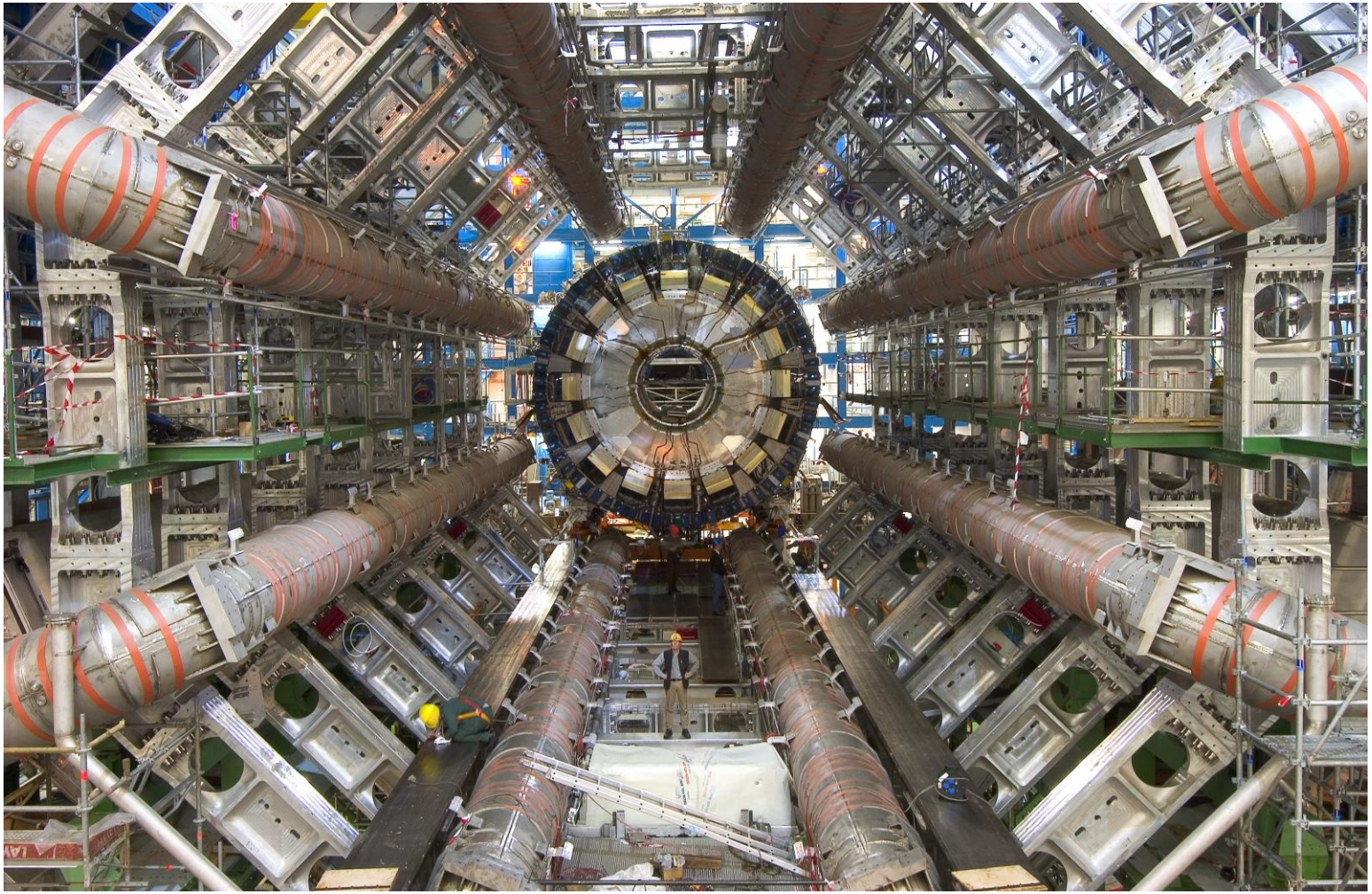
+ than 25 years

1982 : First studies
1994 : Project Approved by the CERN Council
1996 : Final Decision and start of the construction
2004 : Installation Starts
2006 : Hardware Commissioning Starts
2008 : End of Hardware Commissioning
2009-2030: Physics

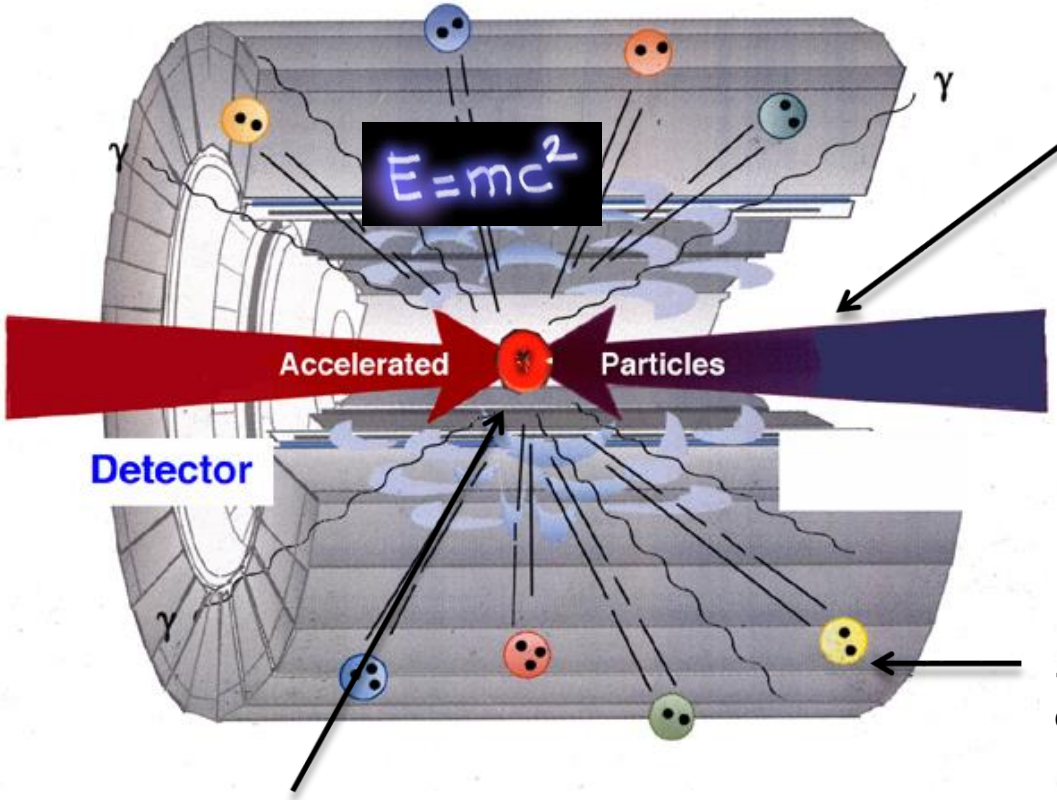




A Big Experiment at the LHC : ATLAS



How do we study the elementary particles?



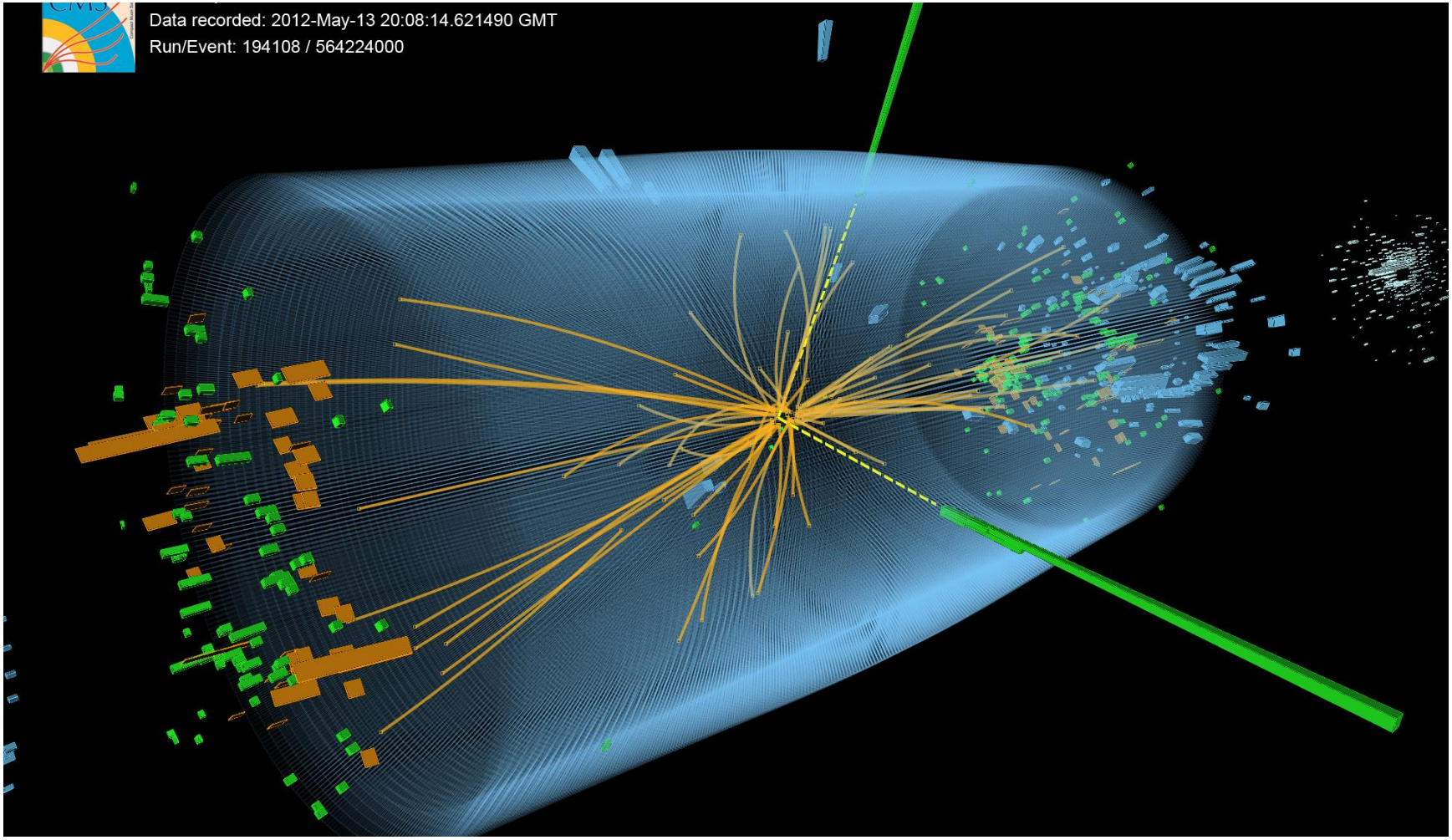
1) Accelerate protons or ions to high energy

2) Collide these head-on to recreate the conditions of the Big Bang

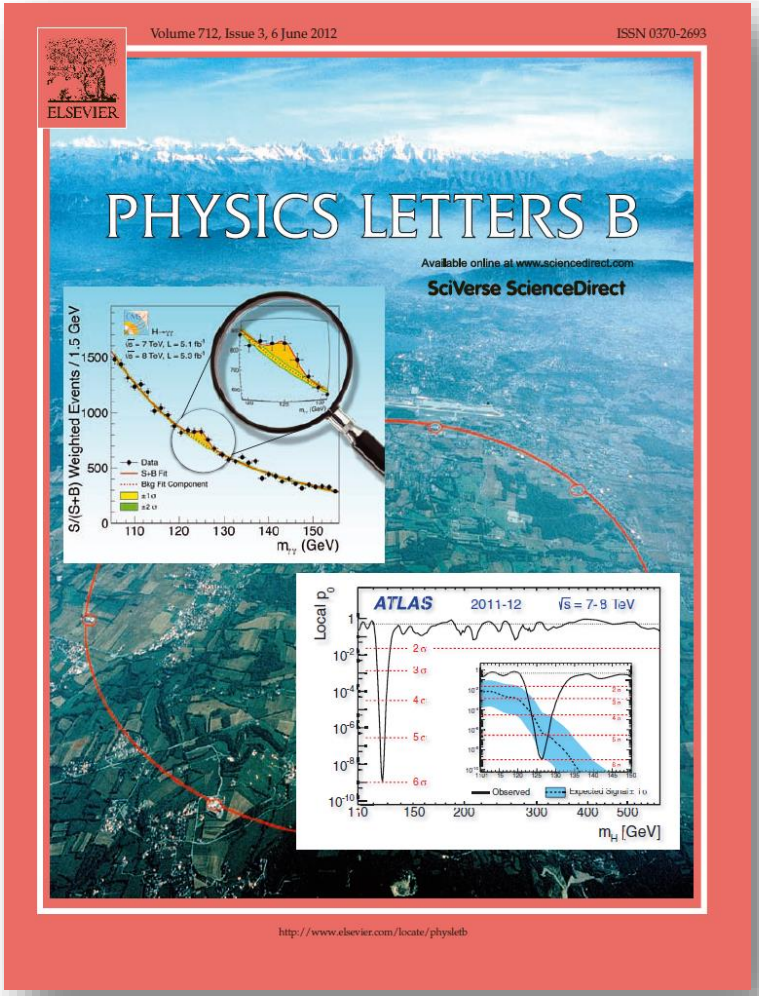
3 Identify the particles created in the collisions

4) Collect and analyze the data from many collisions

H → γ γ


Data recorded: 2012-May-13 20:08:14.621490 GMT
Run/Event: 194108 / 564224000

2012 : The year of the Higgs Boson

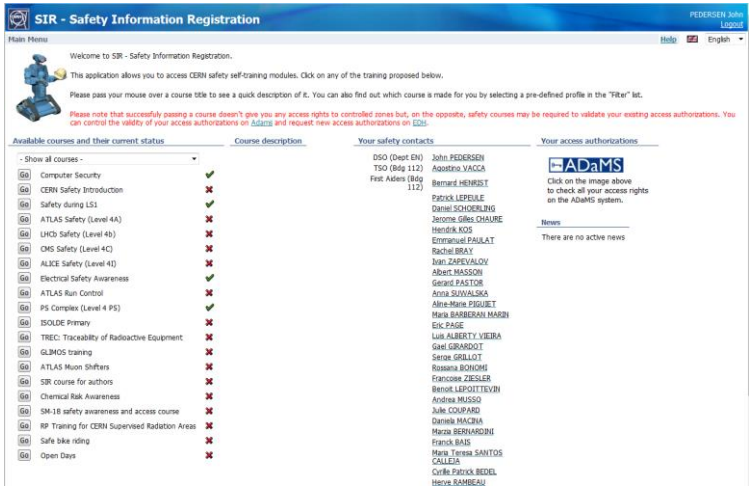


Occupational health and safety in EN

At CERN Safety is our highest priority!

To be allowed to work on CERN sites you must complete basic safety training.

You find it in the Safety Information Registration application, Type SIR in your browser's address window.



More advanced safety training is needed to perform certain tasks or to access certain areas.

The list is found in the HR web-page

Occupational health and safety in EN

Your role in safety:
You are responsible for your own safety! If you take risks you are at fault. By taking up work at CERN you agree to work at minimum risk, and do everything to obtain the information that you need to do so.

Your supervisors role in safety:
Your supervisor is responsible for the safety of your activities. Do not make his life difficult: Respect the rules; respect the signs!

Surely you would not ignore this sign?

So why ignore this one? This is also for your safety

Occupational health and safety in EN

Radiation safety

In the EN department there is a Radiation Safety Officer, or RSO. Each group has Radiation Support Safety Officers, or RSSO. Their job is to help their colleagues to prepare interventions in radiation areas.

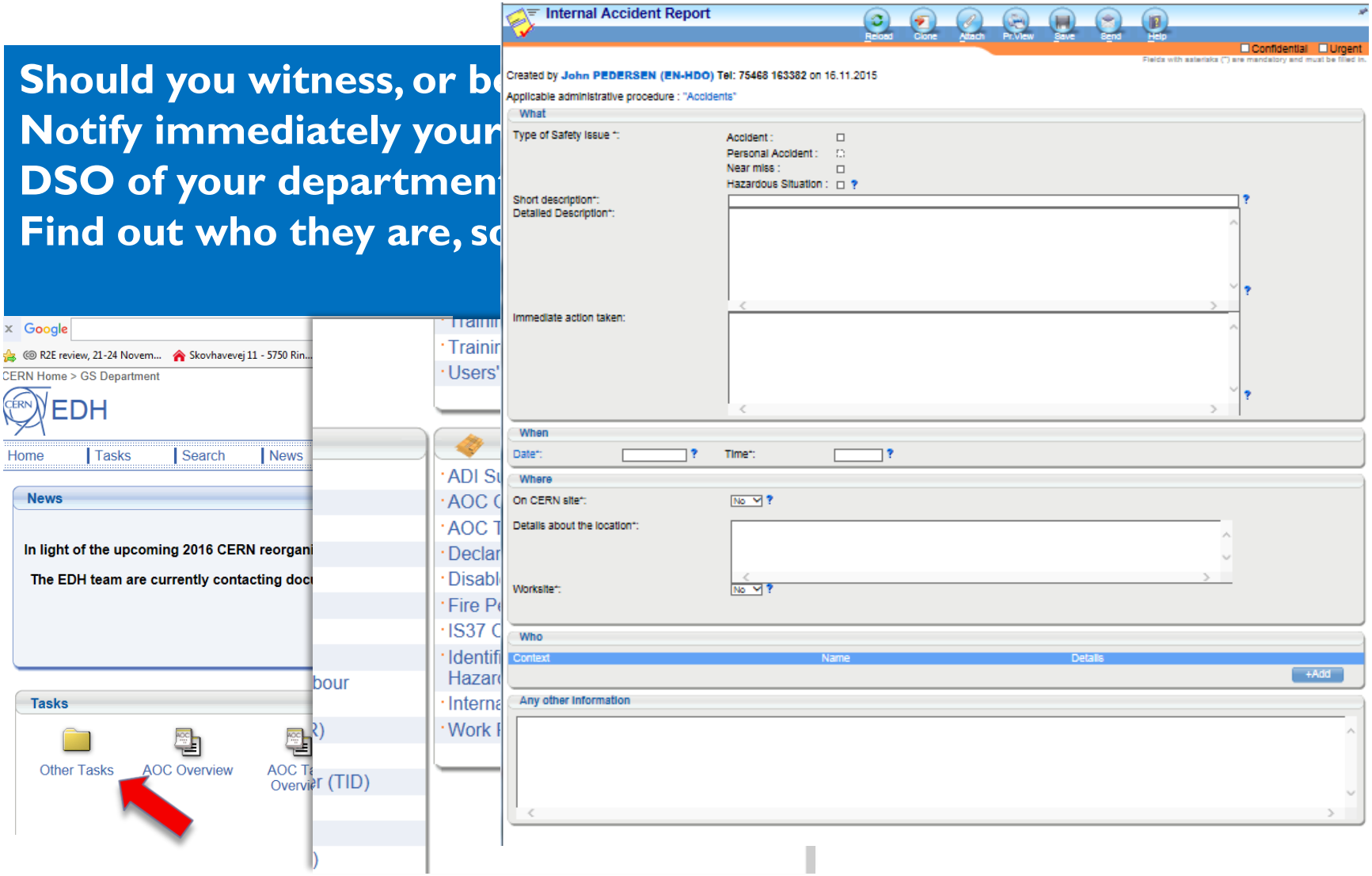
Access Control

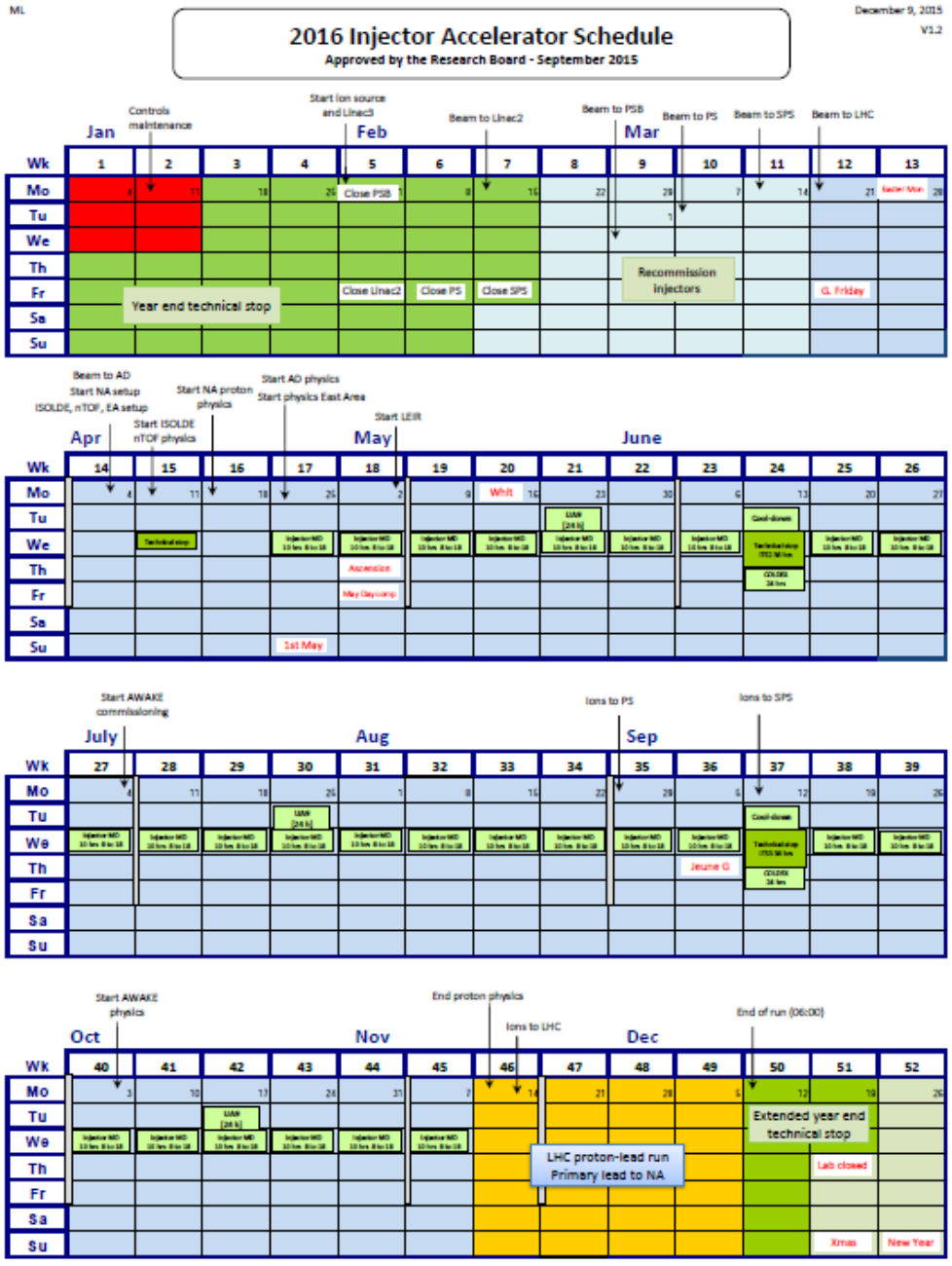
The access to many areas at CERN, in particular underground, is controlled. In order to access these areas you need to complete the required safety training. Once you have done so, you must request access. When access has been granted by the access controller of the area, you may access.

Do not forget the obligatory Personal Protection Equipment!

Occupational health and safety in EN

Should you witness, or b
Notify immediately your
DSO of your departmen
Find out who they are, s




ML
December 9, 2015
V1.2
2016 Injector Accelerator Schedule
Approved by the Research Board - September 2015
Jan
Feb
Mar
Controls maintenance
Start Ion source and Linac3
Beam to Linac2
Beam to PSB
Beam to PS
Beam to SPS
Beam to LHC
Wk
Mo
Tu
We
Th
Fr
Sa
Su
Close PSB
Close Linac2
Close PS
Close SPS
Year end technical stop
Recommission injectors
Apr
May
June
Beam to AD
Start NA setup
ISOLDE, nTOF, EA setup
Start ISOLDE nTOF physics
Start NA proton physics
Start AD physics
Start physics East Area
Start LEIR
Ascension
May Day comp
1st May
Whit
July
Aug
Sep
Start AWAKE commissioning
Ions to PS
Ions to SPS
Jeune G
Oct
Nov
Dec
Start AWAKE physics
End proton physics
Ions to LHC
End of run (06:00)
Extended year end technical stop
LHC proton-lead run
Primary lead to NA
Lab closed
Xmas
New Year
Injector Complex MD Block
Technical stop for the Injector Chain
AD Setting-up & Studies
Ions to LHC/NA
HiRadMat: possible beam request

ML

December 12, 2015
V1.0

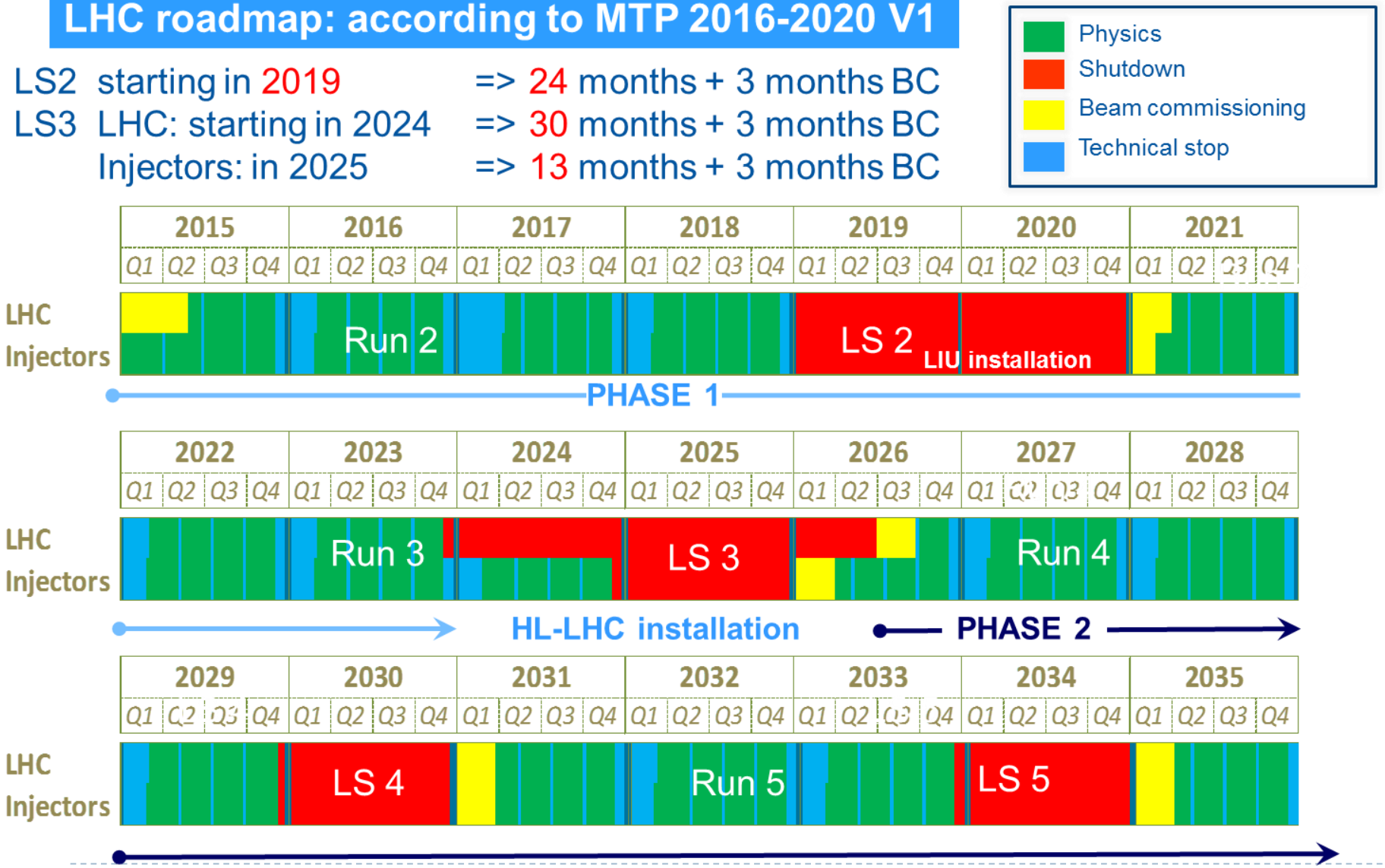
LHC Schedule 2016

Approved by the Research Board, December 2015

A longer term perspective

LHC roadmap: according to MTP 2016-2020 V1

LS2 starting in 2019 => 24 months + 3 months BC
LS3 LHC: starting in 2024 => 30 months + 3 months BC
Injectors: in 2025 => 13 months + 3 months BC



CERN Structure

Directorate in 2016

Director-General	Fabiola Gianotti
Director of International Relations	Charlotte Lindberg Warakaulle
Director for Research and Computing	Eckhard Elsen
Director for Accelerators and Technology	Frédérick Bordry
Director for Finance and Human Resources	Martin Steinacher

CERN Structure

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Director for Finance and Human Resources	Martin Steinacher

Heads of departments in 2016

Experimental Physics	Manfred Krammer
Theoretical Physics	Gian Giudice
Information Technology	Frederic Hemmer

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Heads of departments in 2016

Beams – BE	Paul Collier
Technology – TE	José Miguel Jimenez
Engineering – EN	Roberto Losito

CERN Structure

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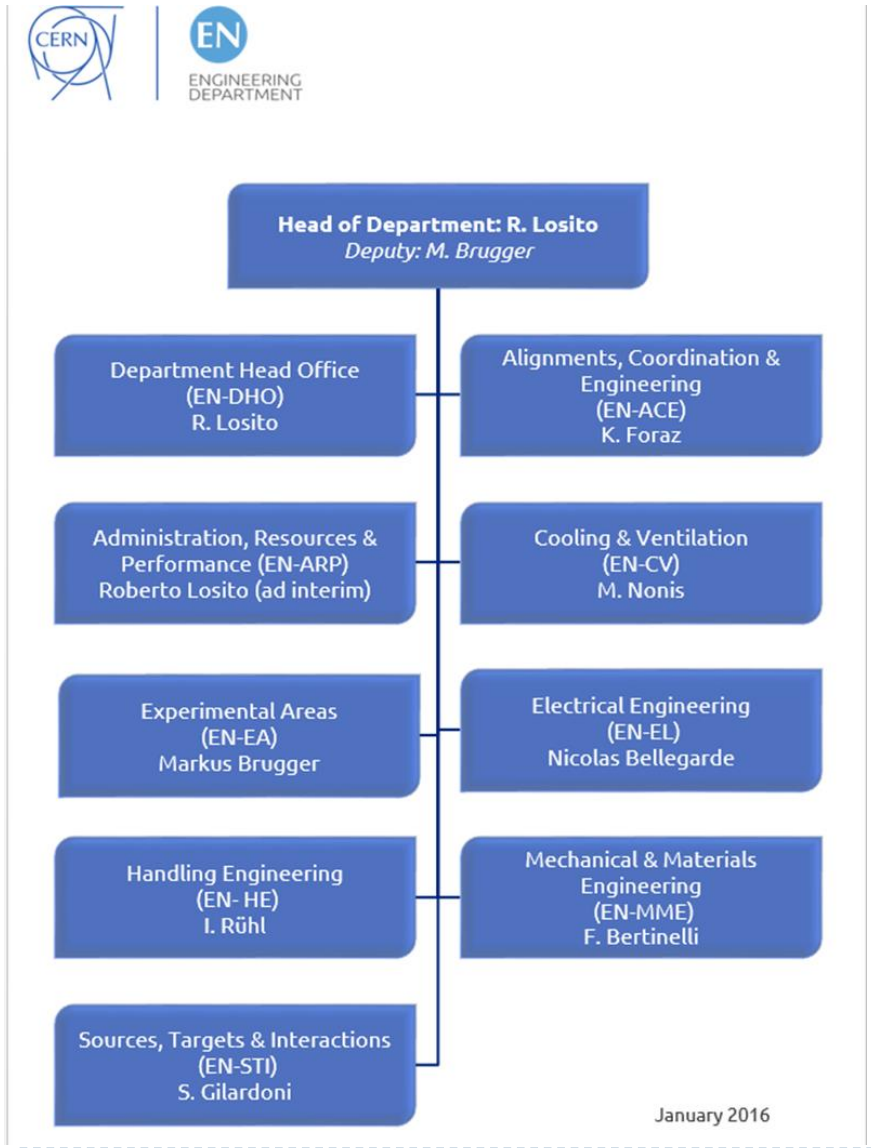
Heads of departments in 2016

Human Resources Finance and Administrative Process	Anne-Sylvie Catherin Florian Sonnemann
Industry, Procurement and Knowledge Transfer	Thierry Lagrange
Site Management and Buildings	Lluis Miralles

EN Engineering Department



Head of Department: Roberto Losito

- Operation
  - Infrastructure
  - Accelerators
  - Experimental Areas
- Projects
  - Consolidation
  - Upgrades
  - New facilities
  - Design & Manufacturing
- Studies

Who are we, in EN?

AT	BE	CH	D	DK	ES	FI	FR	GB	GR	IT	NL	NO	PL	PT	SE
4	22	11	17	2	17	3	225	22	3	41	8	2	5	9	3

Scientific & Engineering Work	150
Technical Work	200
Manual Work, Crafts & Trades	28
Administrative Work	16

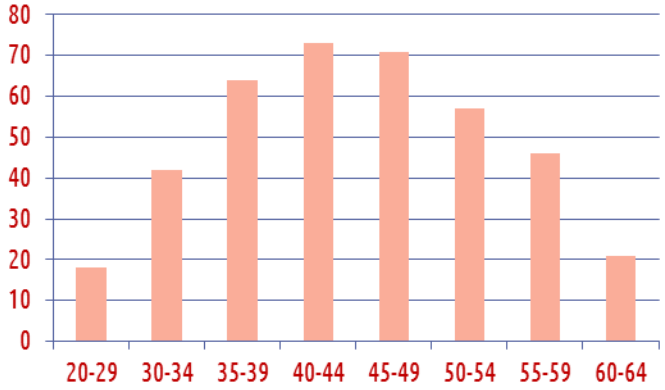
38%

58%

4%

Staff	394
Fellows	79
Doctoral Students	20
Technical Students	30
Trainees	19
Associates	117
Total	659

F	M
11%	89%



+ many colleagues in industrial support contracts

+46 with respect to 2014

CV: The Cooling and Ventilation Group

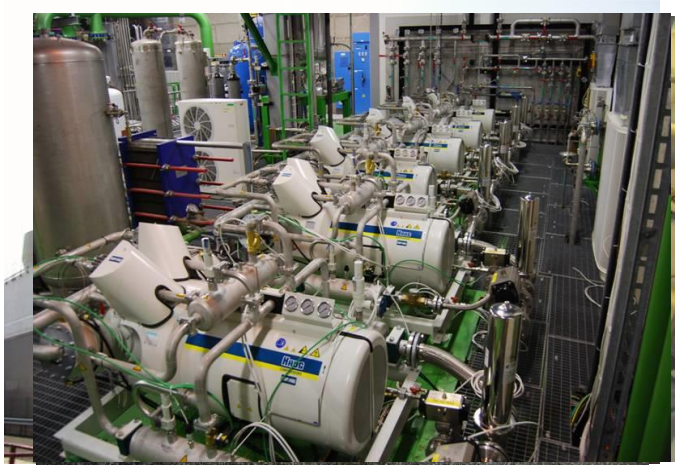
The mandate The operation and maintenance of the **cooling systems, pumping stations, air conditioning installations and fluid distribution systems** for the PS, SPS and LHC including their experimental areas and **special cooling systems of LHC sub-detectors**. It also provides service to the Computer Centre and some miscellaneous installations.

Group Leader
Mauro Nonis

Cooling station

Cooling

Cooling plants (raw, demineralised water, C_3F_8, C_6F_{14})	150
Pipelines	800 km
Hydrants	800 points
Cooling towers (450 MW)	22
Chilled water plants 6-12 °C (73 MW)	35
Water network with three pumping stations	5'400 m^3/h



Equivalent to a small town of 45'000 inhabitants
10% of the water needs of Geneva

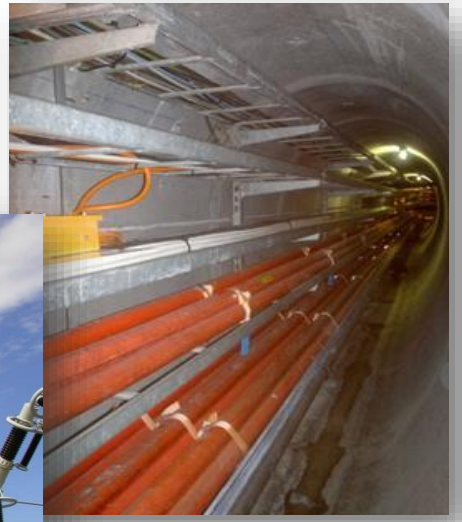
Ventilation

Heating, ventilation and air conditioning	1'500 units from 2'000 to 120'000 m^3/h each
Compressed air	14 stations 200 km network

	km	m^3/h
Eurotunnel	50	*540'000*
LHC	27	*290'000*

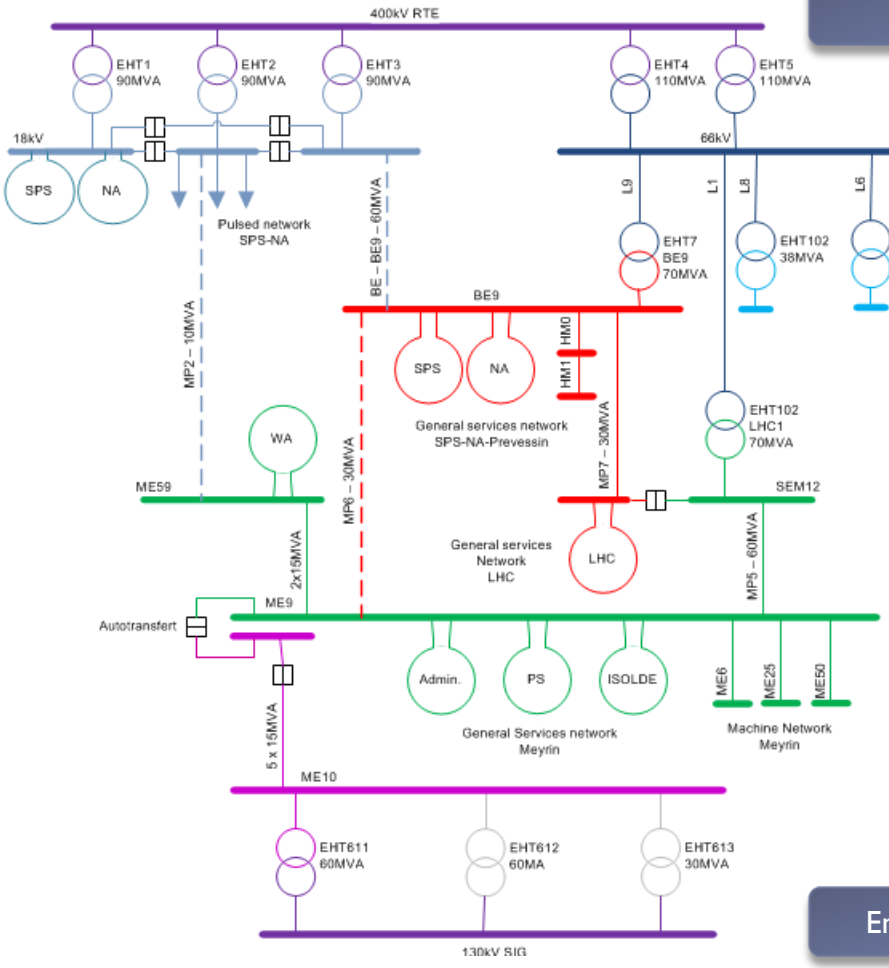
EL : The Electrical Engineering Group

The EL group is responsible for the **CERN electrical distribution network** from 400 kV to 400/230 V. Its main missions are to operate, maintain, extend and renovate the network, analyse and make projections for CERN electrical energy consumption and manage relations with the energy suppliers.



Group Leader
Nicolas Bellegarde

Electricity Distribution



Normal source EDF > 300 MW

Annual Consumption 1.26 TWh
⅙ of Geneva

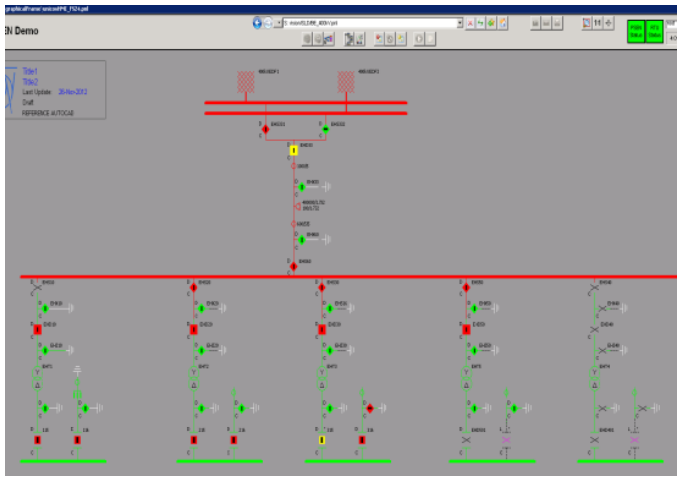
Instantaneous Power 180 MW
½ - ⅓ of Geneva

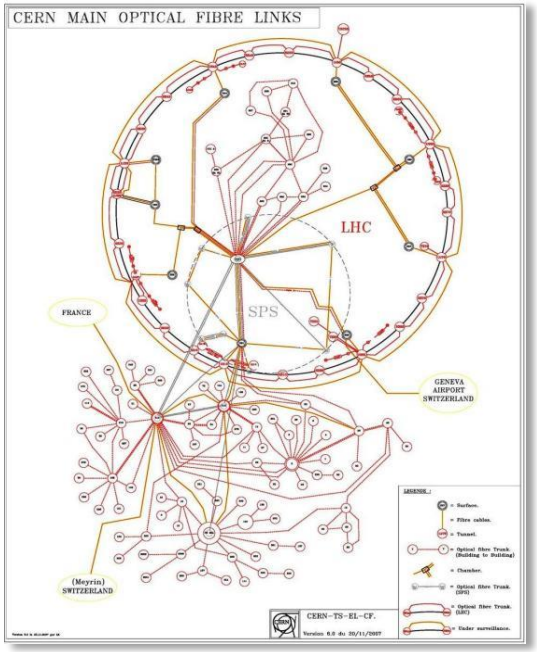
Emergency source SIG/ALPIQ ≤ 60 MW

EL : The Electrical Engineering Group

The EL group is also responsible for the **cabling activities.** Its main missions are to install control cables, Water cooled cables and fibre optics for users. This activities include the management of infrastructures (cable trays, ducts, patch panels,...) and the necessary removal of old and unused installations.

EL is also in charge of the control of it's distribution network including a SCADA system and automation of process.





ARP : Administration, Resources and Performance group

The ARP group is in charge of the **management of department resources** in terms of personnel, material, industrial support, as well as **group secretariats**.

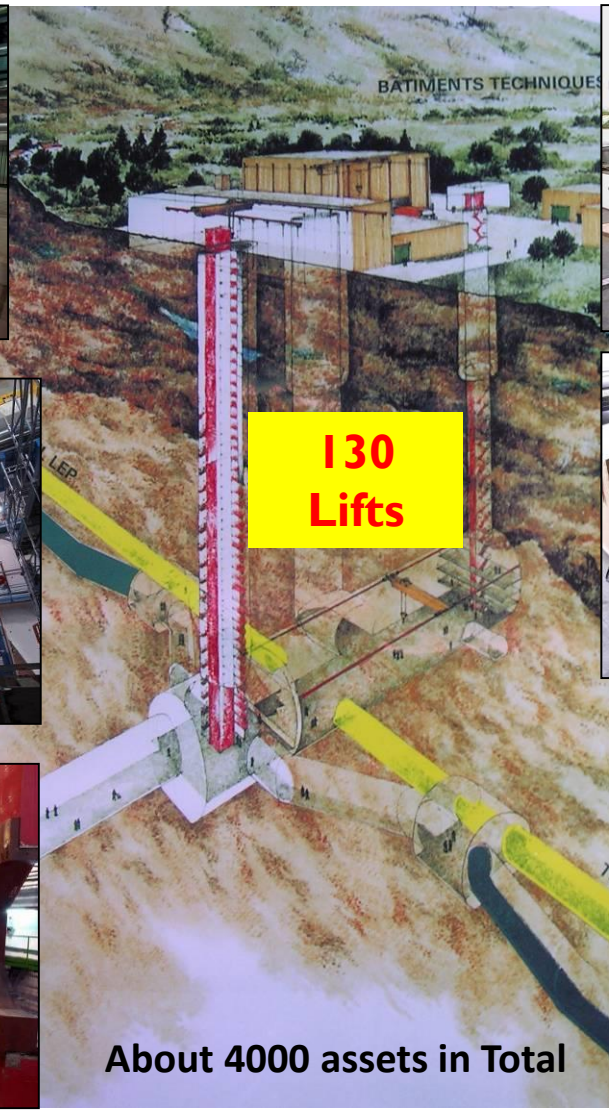
Group Leader
Roberto Losito (ad-interim)

HE : The Transport and Handling Group

The mandate : provide **transport and handling services** for the technical infrastructure of CERN, accelerators and experiments. This includes the design, the tendering/procurement, the installation, the commissioning, the operation, the maintenance and decommissioning of **standard industrial and custom built transport and handling equipment**.

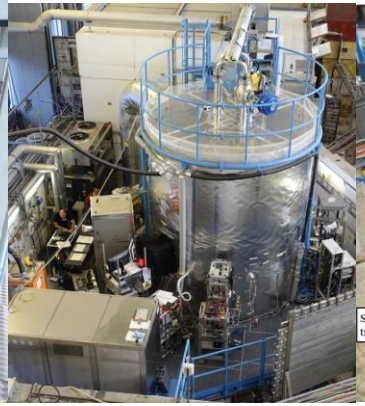
Group Leader
Ingo Ruehl

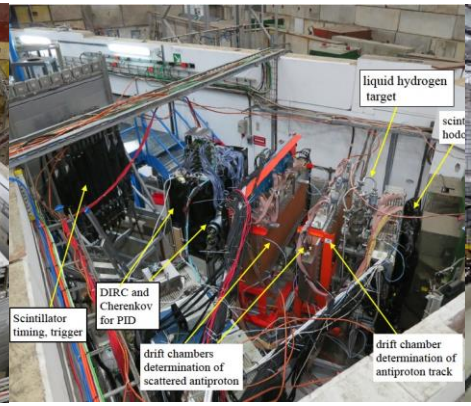
Transport and Handling Equipment



EA : Experimental Areas Group

The EA Group in the Engineering Department is responsible for the beamlines, infrastructure and management of CERN's experimental areas and provides engineering support and services including associated contracts. EA is furthermore supporting the LHC experiments and managing the respective ATS interface, as well as participating in and partly hosting the management of a number of CERN-wide projects (AWAKE, R2E, etc.).





Group Leader
Markus Brugger

EA : Experimental Areas Group

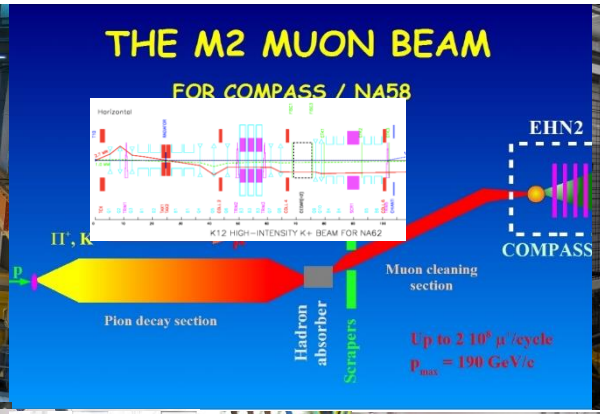
EN Engineering Department

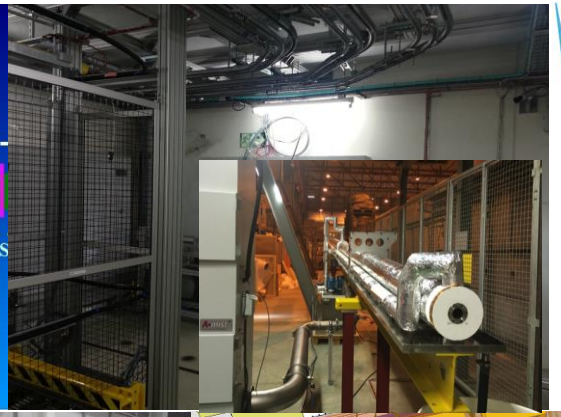
EXPERIMENTAL AREAS

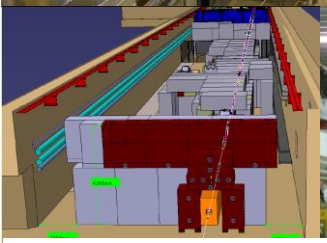
BEAMLINES

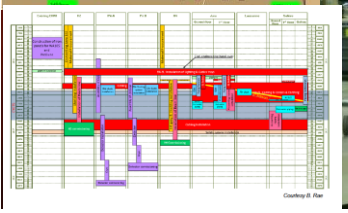
FACILITIES

PROJECTS









SUPPORT ACTIVITIES

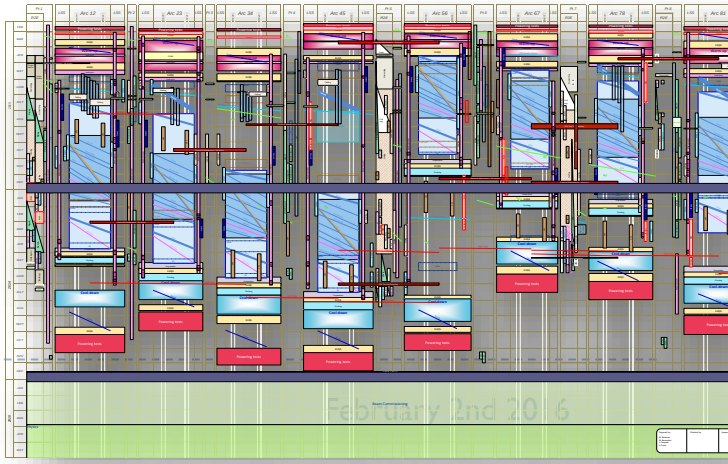
MECHANICS, VACUUM, CABLING, SCAFFOLDING, INTEGRATION, GAS, INSTRUMENTATION, DESIGN, PROTOTYPING, SHIELDING, PLANNING, COORDINATION, SAFETY

ACE : Alignment, Coordination and Engineering Group

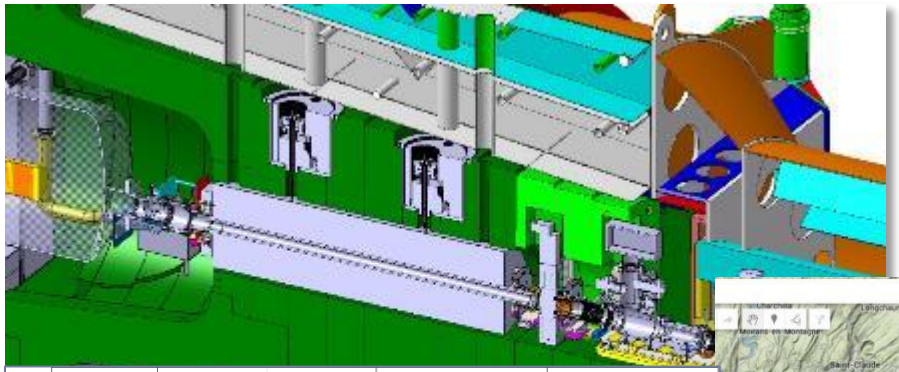
The ACE group is responsible for

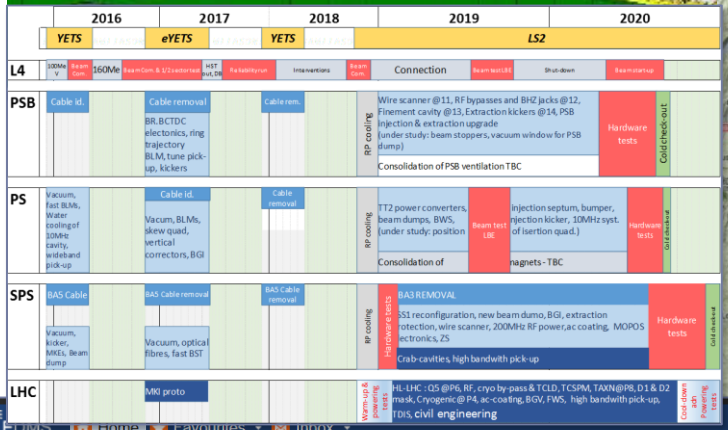
- Providing **overarching project coordination** for the accelerator complex, including layout management, integration, scheduling, work and safety coordination, as well as for different projects.
- Providing **support and expertise in matter of project, risks and quality** management as well as organizational process.
- Developing and supporting the Organization's **engineering, equipment data, maintenance management tools and mechanical CAD systems.**
- The **metrology and alignment** of the accelerators, of their associated beam transfer lines and of the detectors, for the whole CERN site.

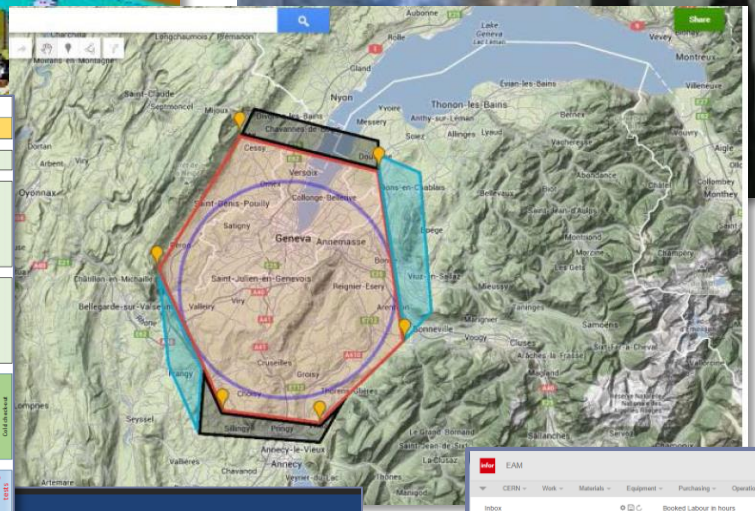
Group Leader
Katy Foraz

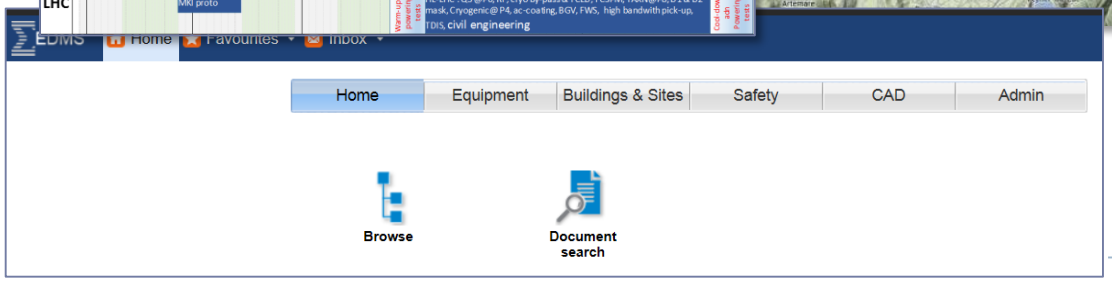


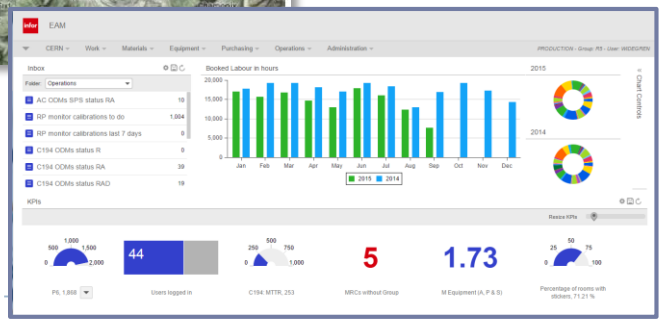
ACE : Alignment, Coordination and Engineering Group









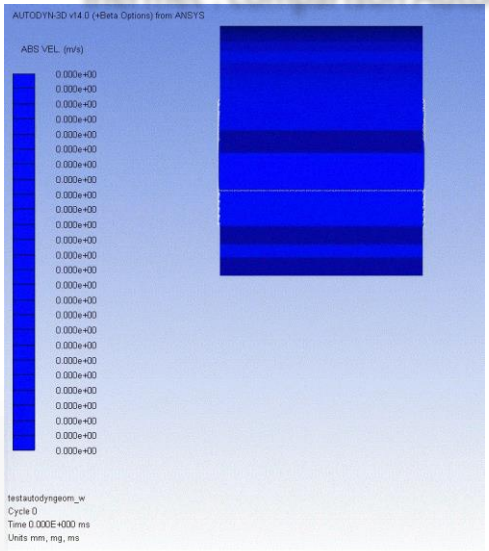


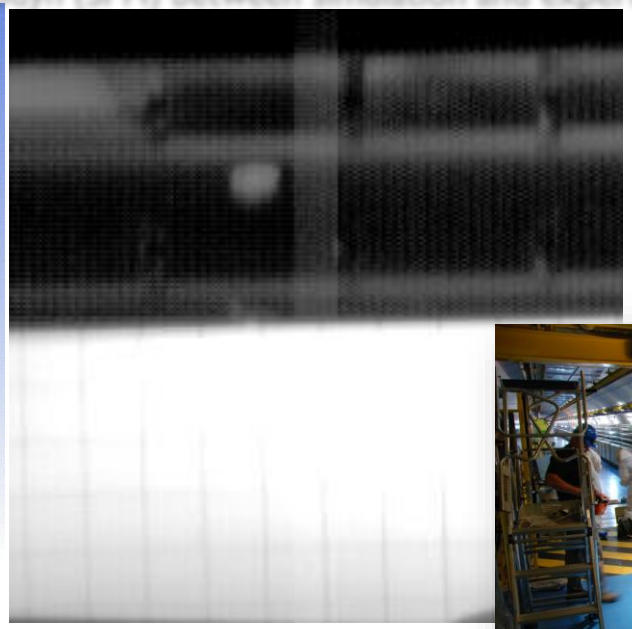
MME : The Mechanical and Materials Engineering Group

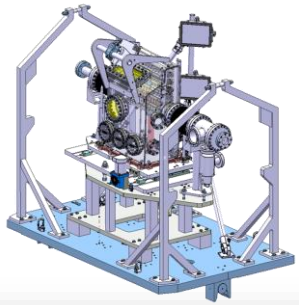
The mandate : provide to the CERN community specific **engineering solutions combining mechanical design, production facilities and material sciences**. This group owns, maintains and develops the know-how on the mechanical constructions in the accelerators and the physics detectors.

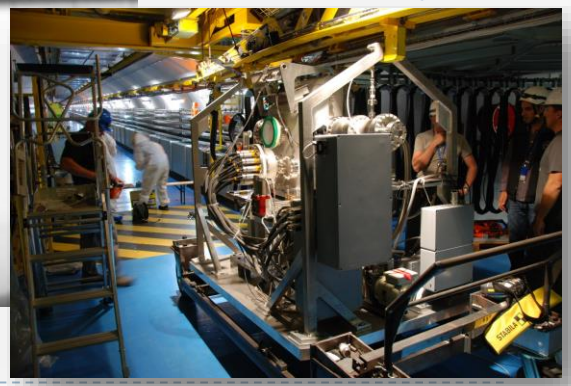
Inermet : comparison Autodyn (SPH) between simulation and experiment

Beam



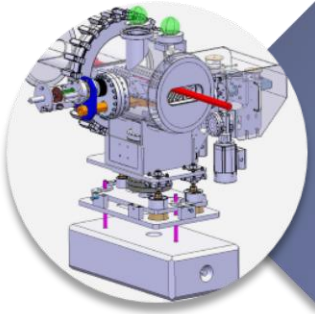






Group Leader
Francesco Bertinelli

MME : domains of activities



Engineering & Design

- Internal Design Office facilities, 40 designers (Staff and Industrial Support)
- CATIA / SmarTeam, ANSYS
- Mechanical measurements lab

Fabrication

- Machining & Maintenance
- Preparation & Subcontracting
- Assembly & Forming

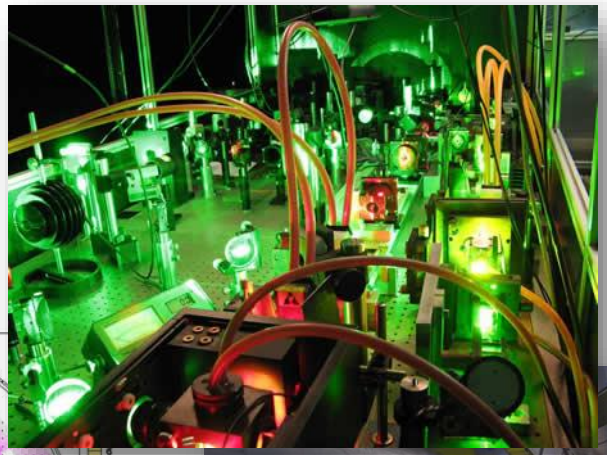
- 4000 m^2 of internal workshop facilities, 50 technicians (Staff and Industrial Support): CNC machining, sheet metal work & welding, electron beam & laser, vacuum brazing
- External subcontracting service
- Free access Users workshop

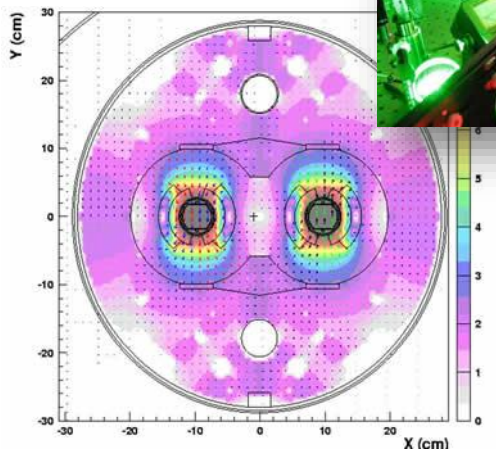
Materials & Metrology

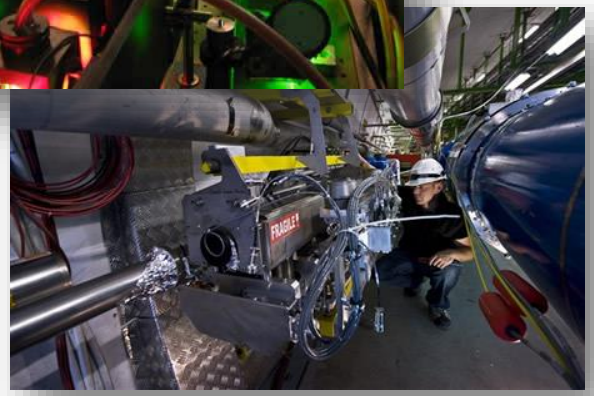
- Material selection, analysis & metallurgy: microscopy, mechanical testing
- NDT: US, radiography, tomography
- 350 m^2 of internal metrology facilities: CMM

STI : The Sources, Targets and Interactions Group

The Sources, Targets and Interactions Group has as common ground the study of **beam interactions with matter**, aiming to apply its know-how to particle generation (ISOLDE Radioactive beam sources, CLIC photoinjectors and polarized e+ e- sources), and to particle interception (collimators, absorbers and dumps).







Group Leader
Simone Gilardoni

Welcome !

Presentation prepared by:

S.Baird, F.Bertinelli, O.Capatina, K.Foraz R.Losito, M.Nonis, J.Pedersen, E.Piemonti Spalazzi, I.Ruehl, G.Richaud, R.Saban, E.Perrin, M. Brugger, S. Gilardoni.