

Welcome to the
Engineering Department
at CERN

Markus Brugger, EA Group Leader, 3rd March 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

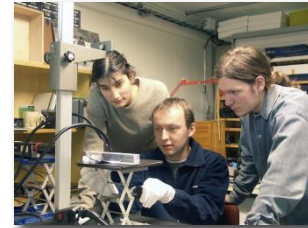
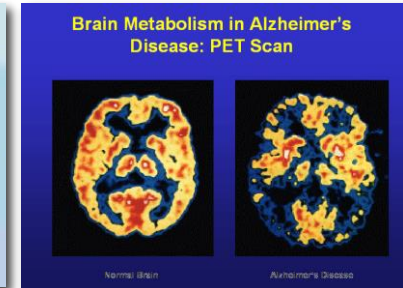
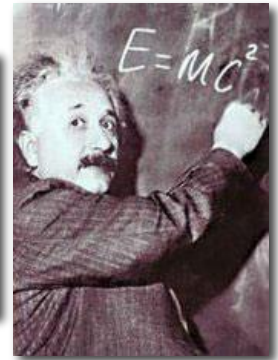
Romania and Serbia

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 :

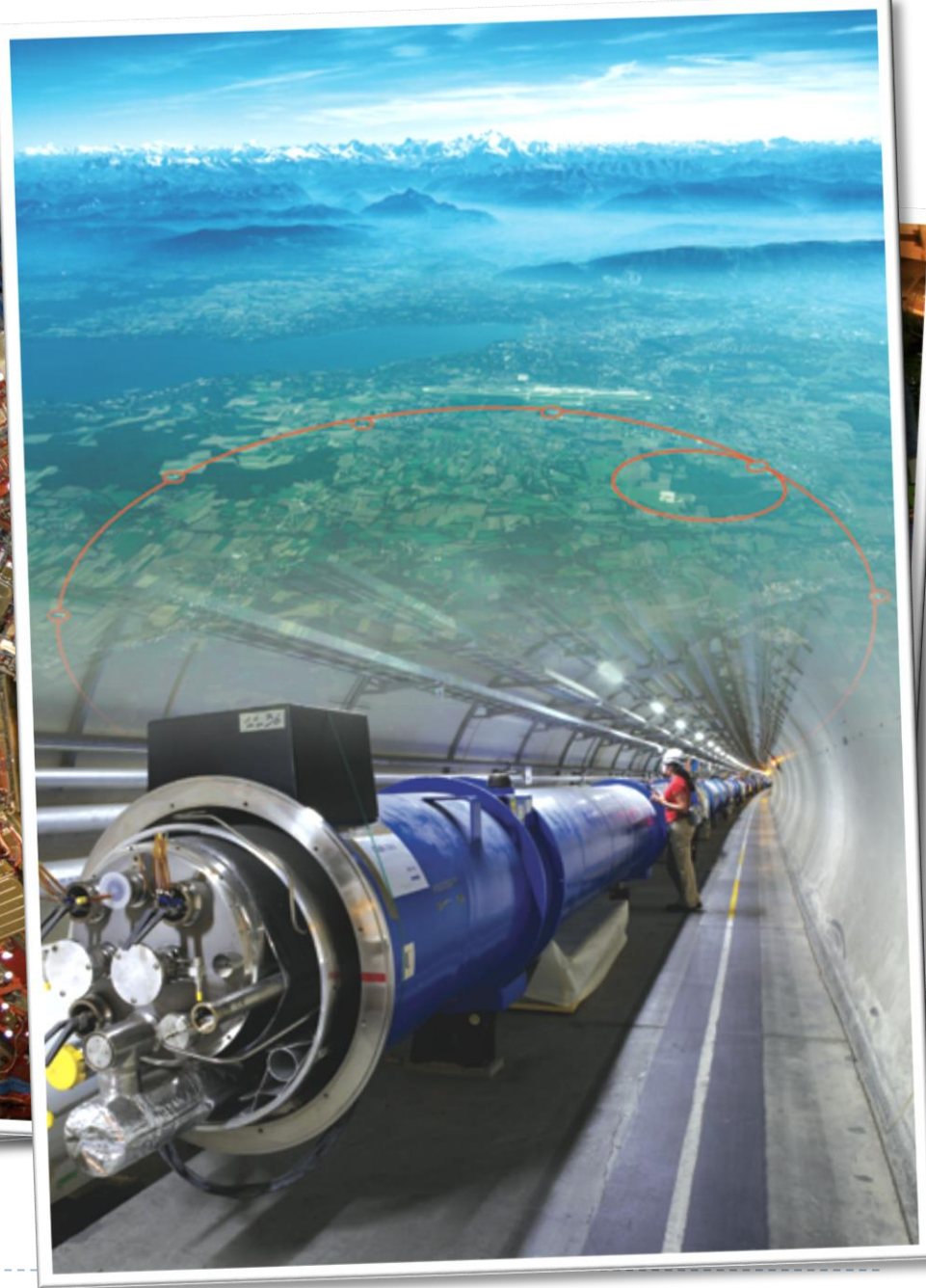
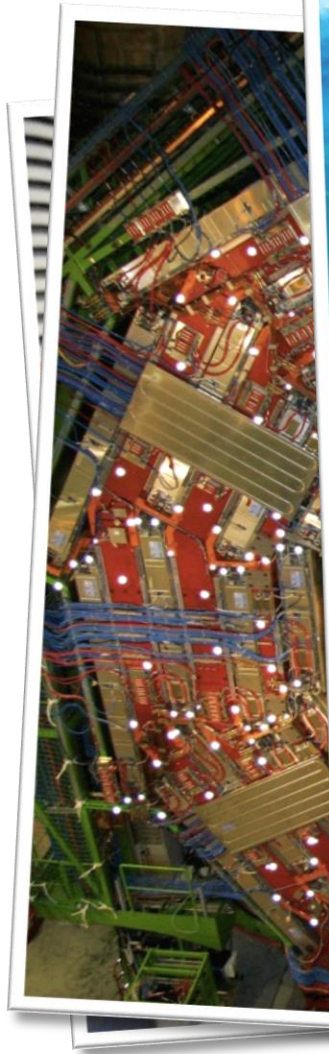
Boost particles to high energies and make them collide

2. Detectors :

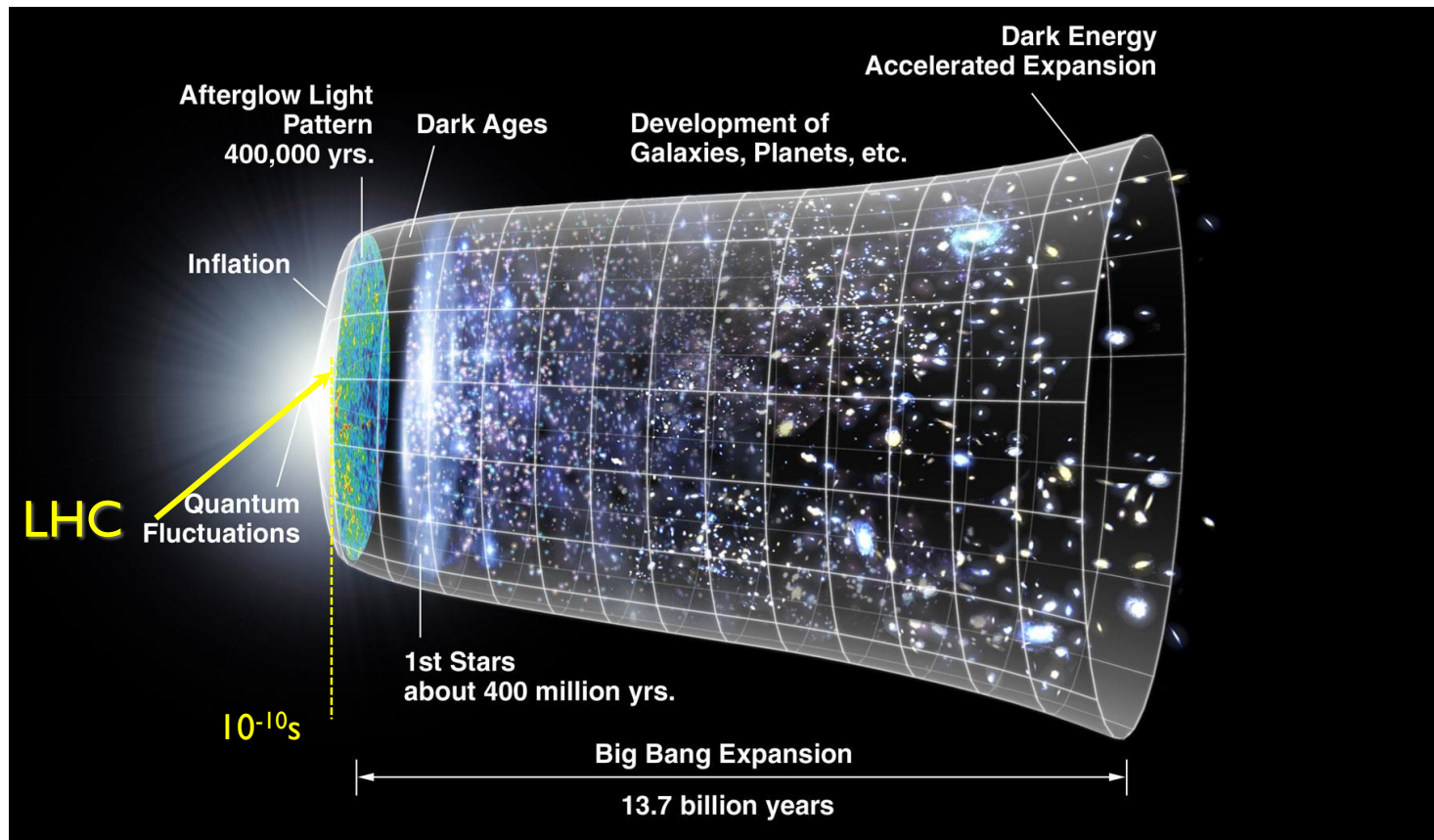
Gigantic instruments that observe and record the results of the collisions (particle trajectories, energy, charge...)

3. Computers :

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

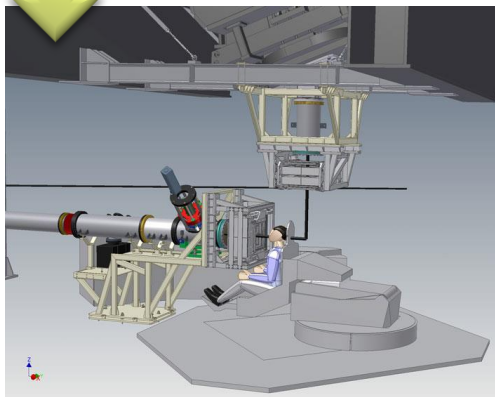
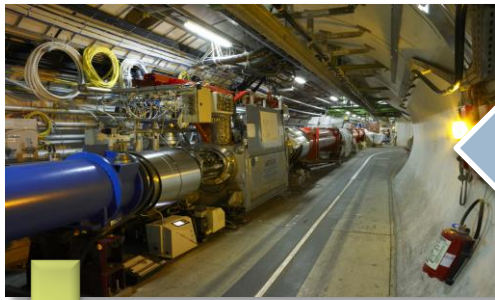


The next scientific challenge is to understand the very first moments of our Universe after the Big Bang

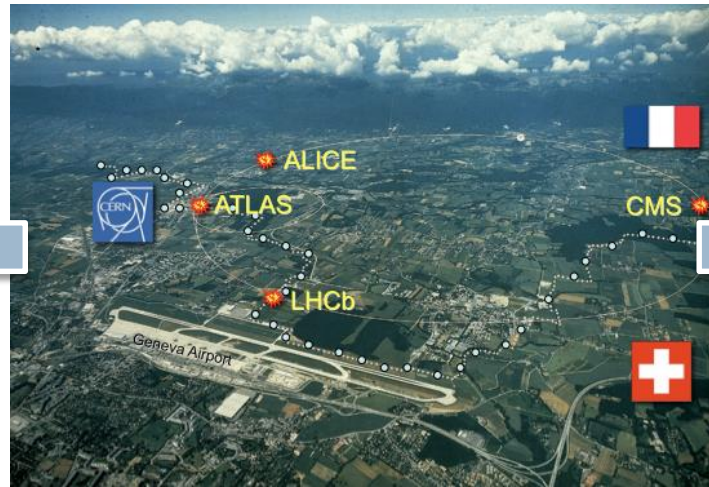


The technologies developed at CERN generate innovation

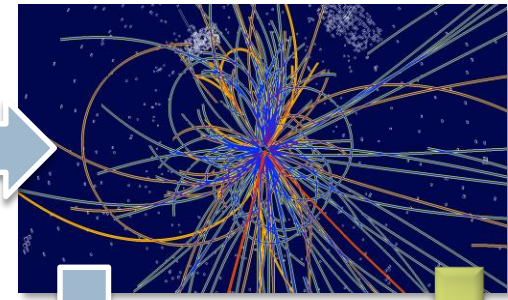
Accelerators



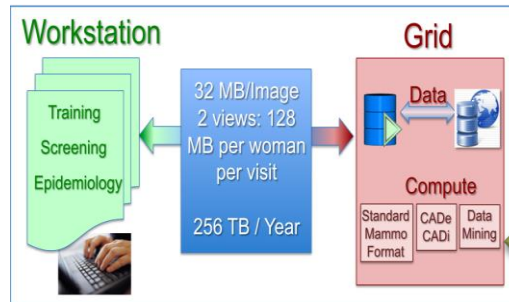
Hadron therapy



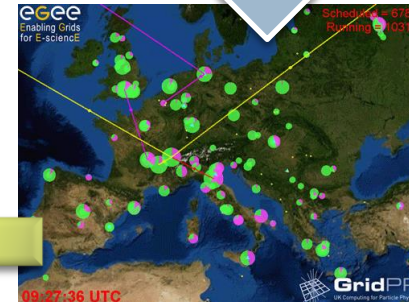
Detectors



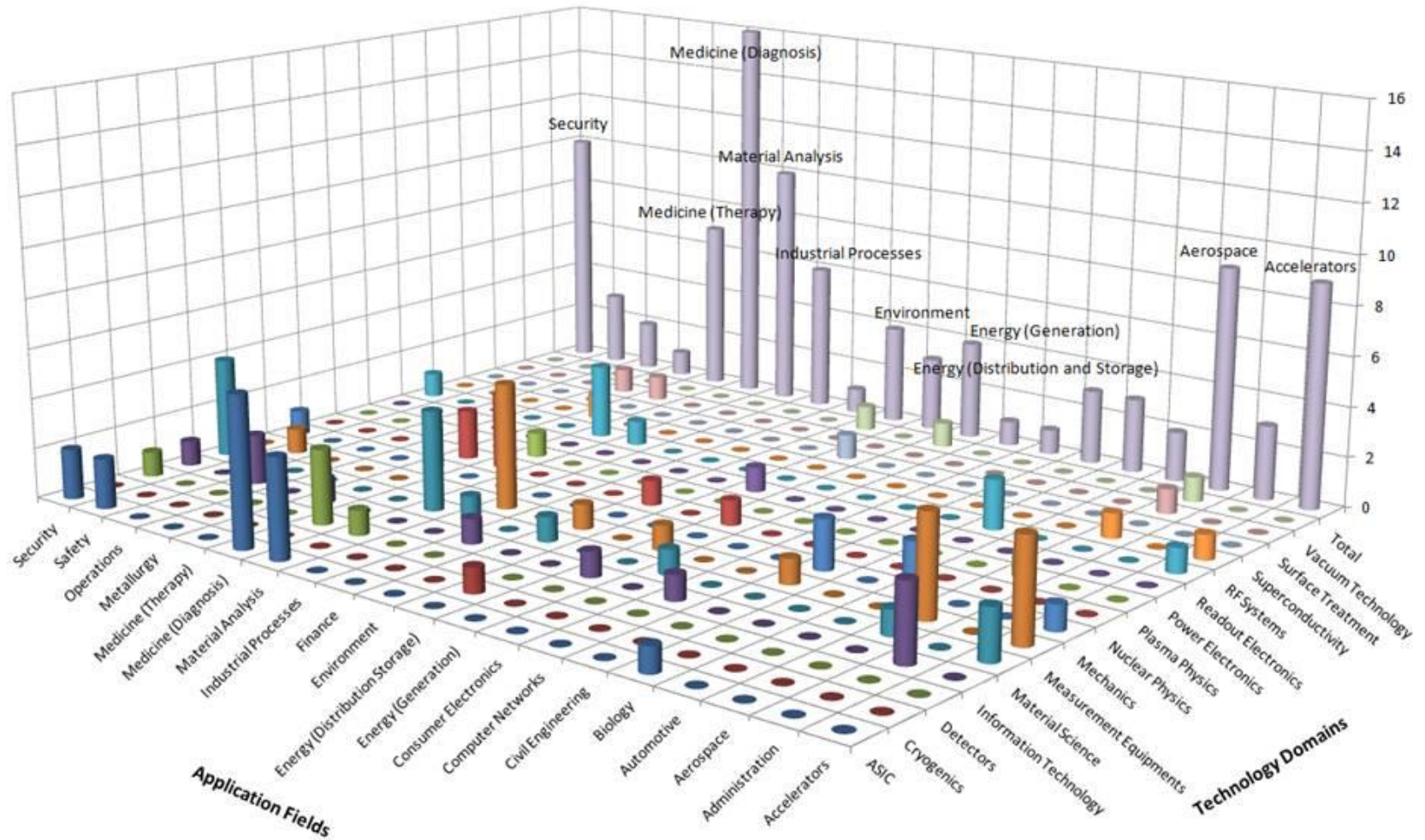
CAT



The Computing Grid

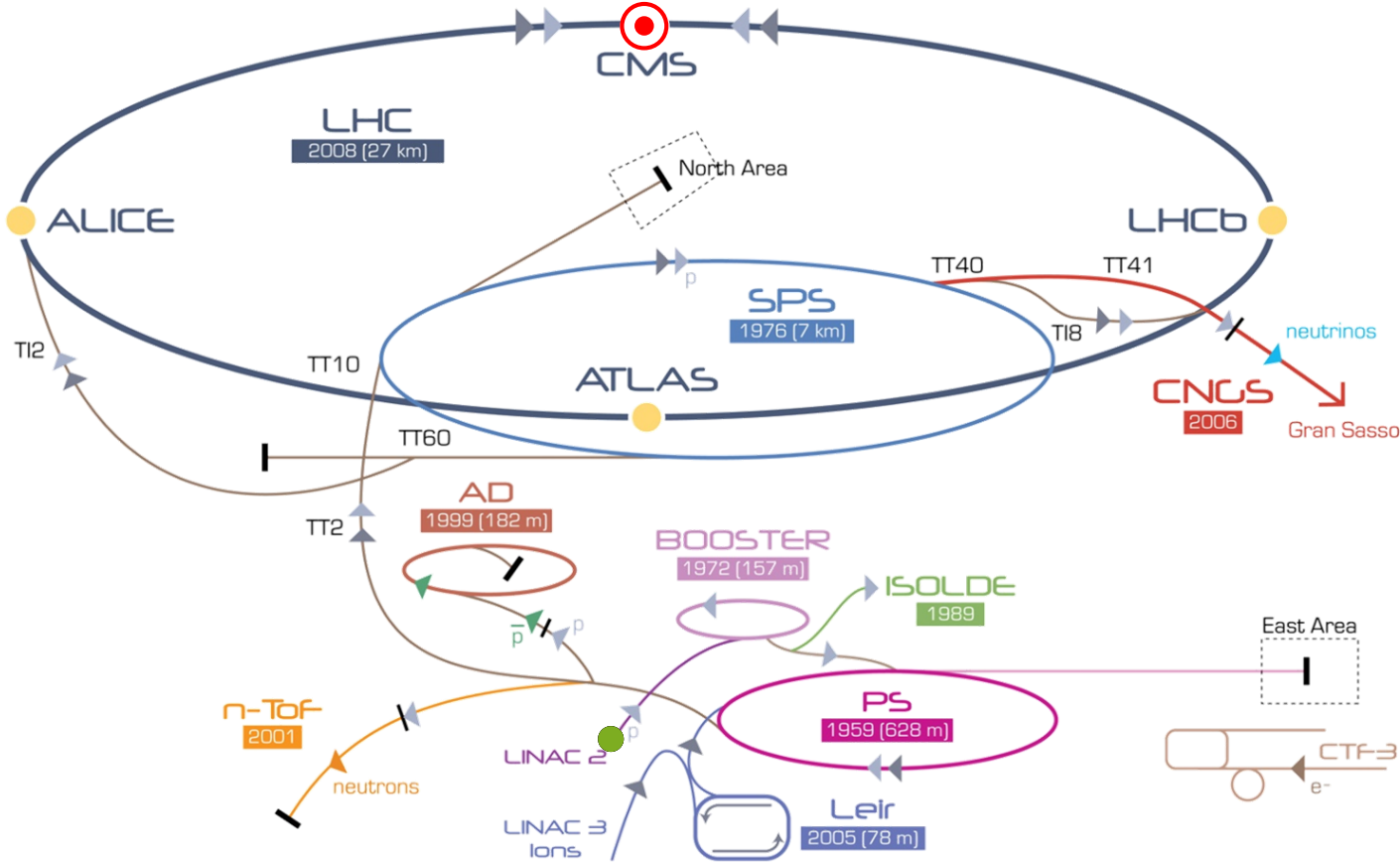


The impact of the technologies developed at CERN



The CERN Accelerator Complex

▶ LHC, A huge machine accelerating tiny particles...



▶ p (proton) ▶ ion ▶ neutrons ▶ \bar{p} (antiproton) \leftrightarrow proton/antiproton conversion ▶ neutrinos ▶ electron

LHC Large Hadron Collider SPS Super Proton Synchrotron PS Proton Synchrotron
 AD Antiproton Decelerator CTF-3 Clic Test Facility CNCS Cern Neutrinos to Gran Sasso ISOLDE Isotope Separator OnLine DEvice
 LEIR Low Energy Ion Ring LINAC LINear ACcelerator n-ToF Neutrons Time Of Flight

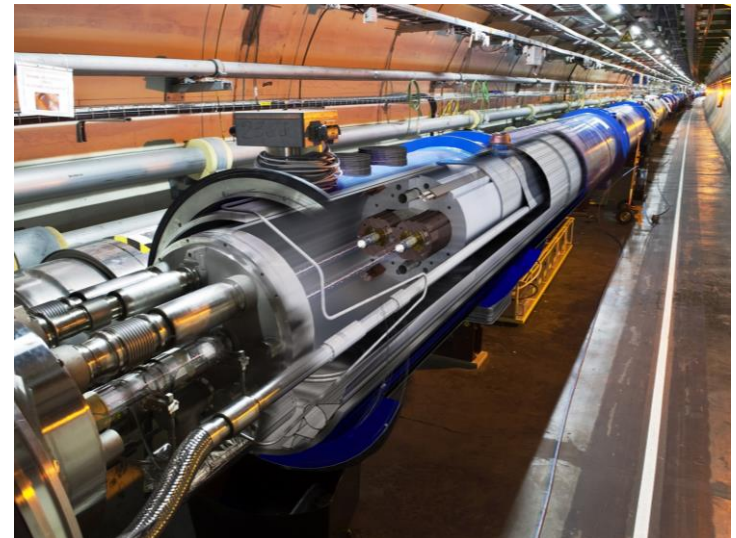
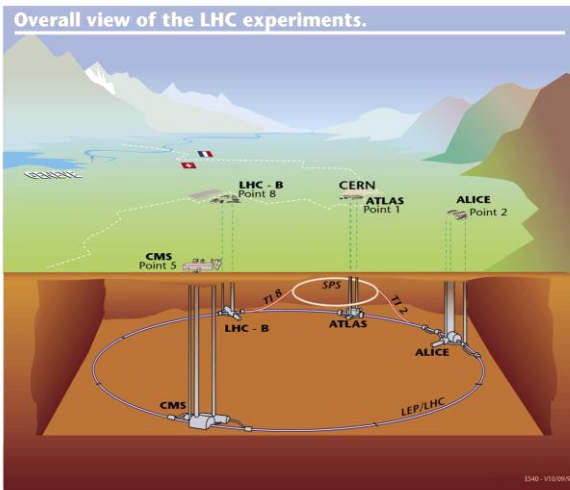


The LHC

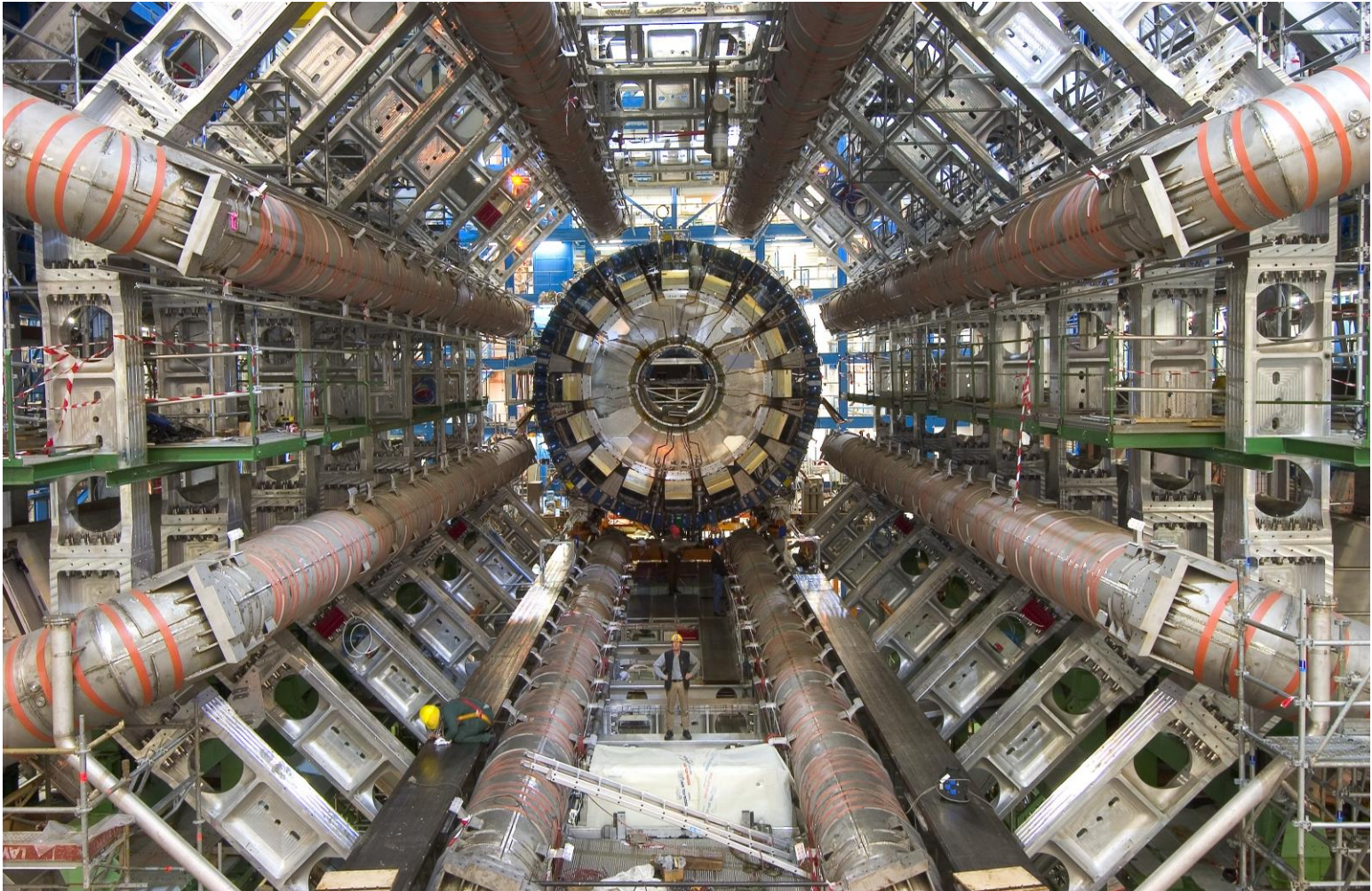
A collider situated in an underground 27 km in an almost circular tunnel designed to accelerate two proton beams to 7 TeV

+ than 25 years

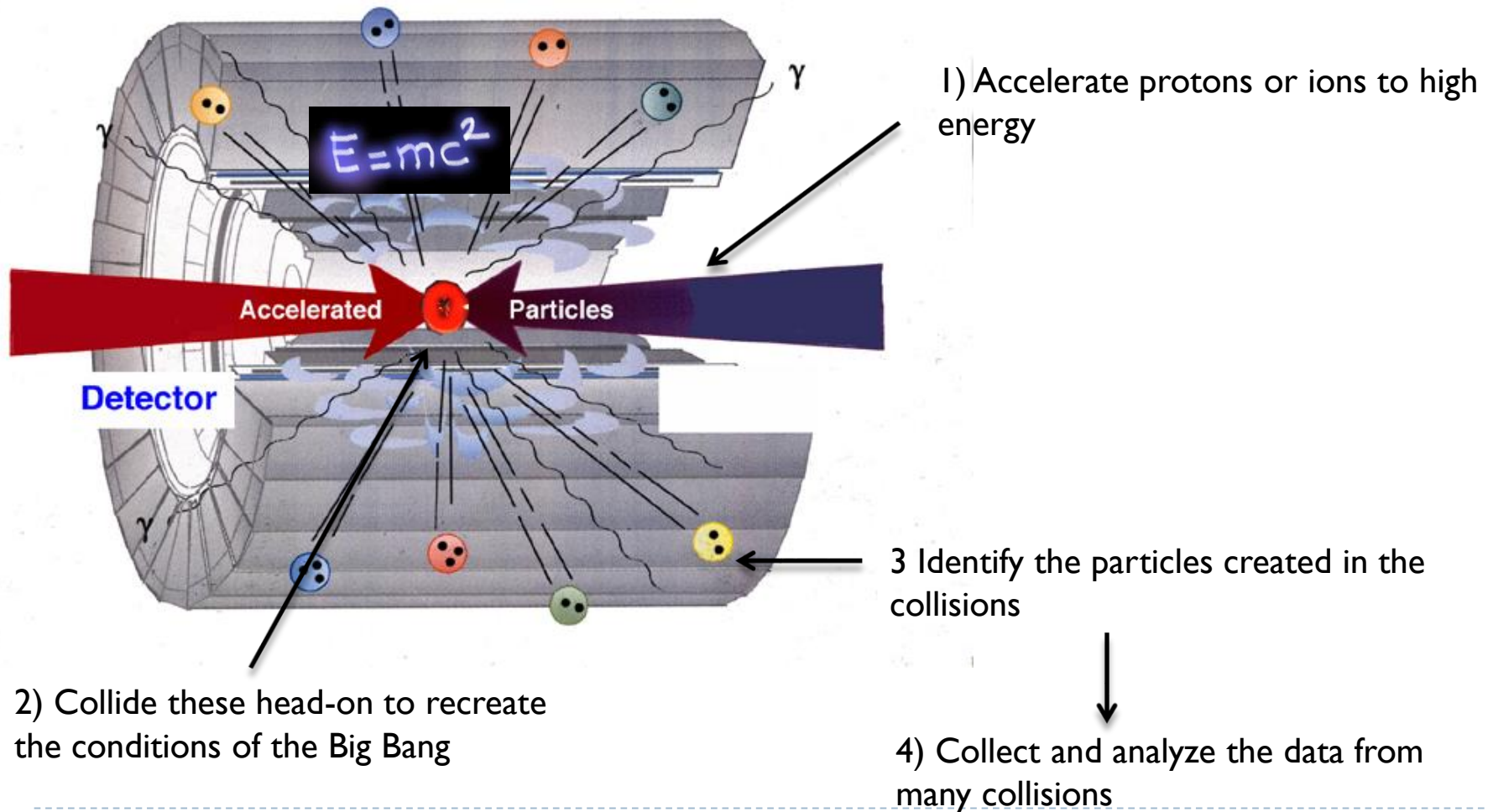
- 1982 : First studies
- 1994 : Project Approved by the CERN Council
- 1996 : Final Decision and start of the construction
- 2004 : Installation Starts
- 2006 : Hardware Commissioning Starts
- 2008 : End of Hardware Commissioning
- 2009-2030: Physics



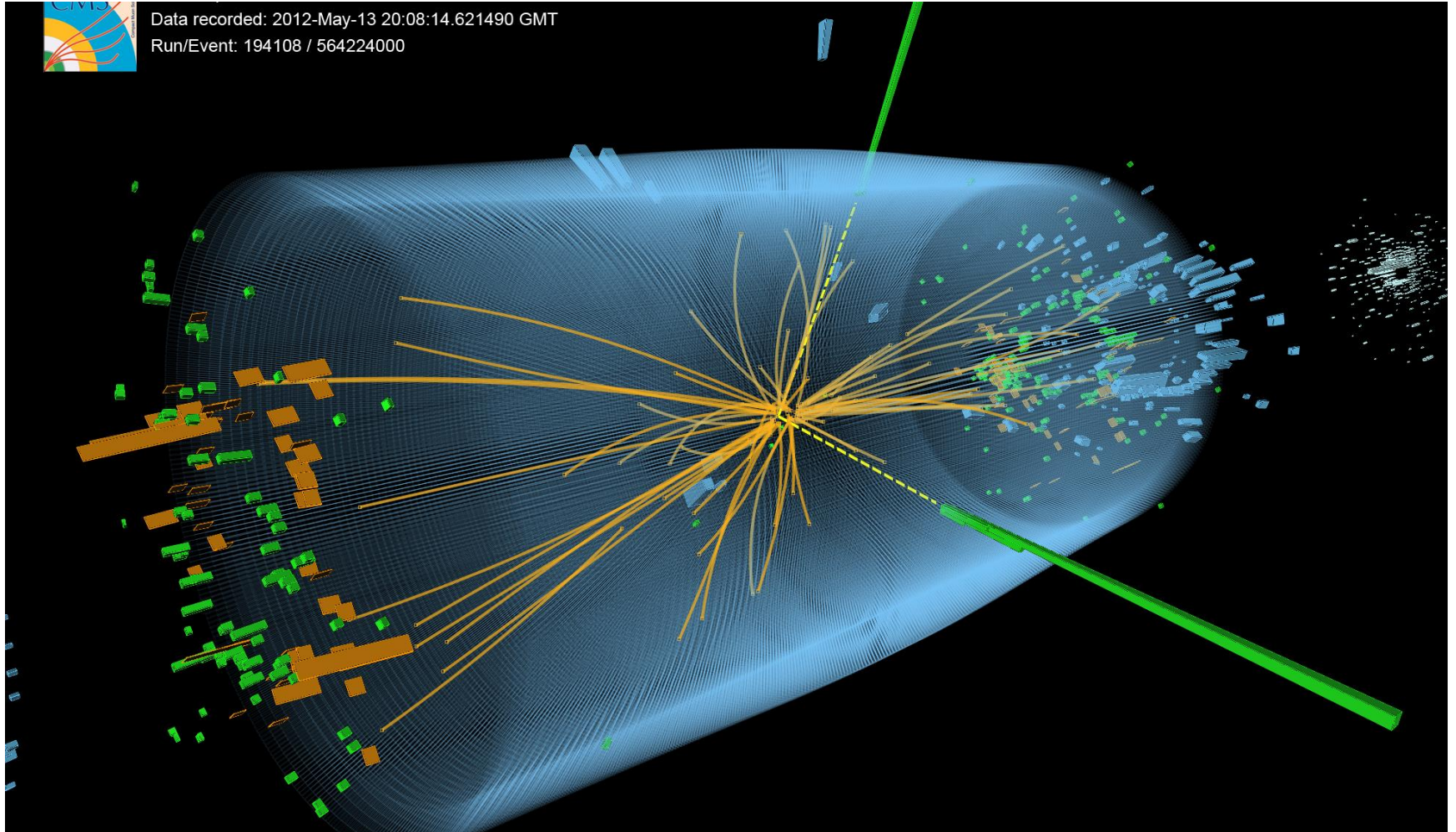
A Big Experiment at the LHC : ATLAS



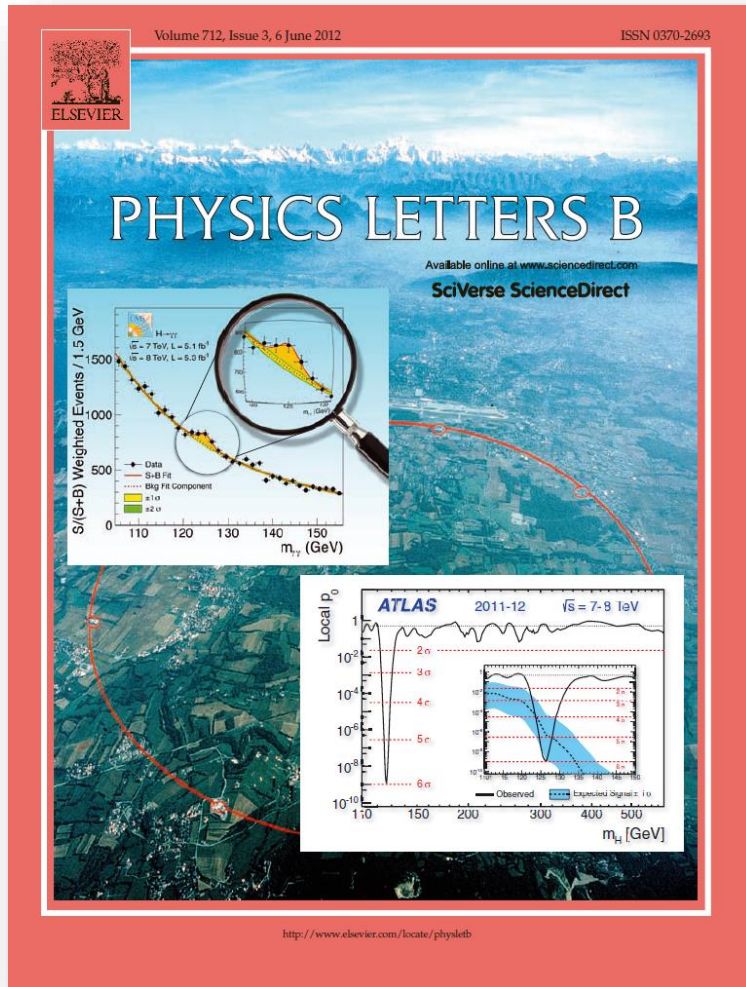
How do we study the elementary particles?



H \rightarrow $\gamma\gamma$



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.

The screenshot shows the SIR - Safety Information Registration application. It features a navigation menu on the left with options like 'Available courses and their current status', 'Course description', 'Your safety contacts', and 'Your access authorizations'. The main content area displays a list of courses with checkboxes indicating their status. A sidebar on the right shows 'Your safety contacts' and 'Your access authorizations'.

Available courses and their current status	Course description	Your safety contacts	Your access authorizations
<input type="checkbox"/> Computer Security		DDO (Dept EN)	
<input type="checkbox"/> CERN Safety Introduction		TSO (Bog 112)	
<input type="checkbox"/> Safety during LSI		First Aiders (Bog 112)	
<input type="checkbox"/> ATLAS Safety (Level 4A)		Bernard HENBEST	
<input type="checkbox"/> LHC Safety (Level 4B)		PATRICK LEPELLE	
<input type="checkbox"/> OHS Safety (Level 4C)		Daniel SCHÖDLING	
<input type="checkbox"/> ALICE Safety (Level 4D)		Jocelyn GIBB CHAURE	
<input type="checkbox"/> Electrical Safety Awareness		HENRIK KOS	
<input type="checkbox"/> ATLAS Run Control		Emmanuel PAULAT	
<input type="checkbox"/> PS Complex (Level 4 PS)		Rachel BRAY	
<input type="checkbox"/> ISOLDE Primary		Ivan ZAREVALOV	
<input type="checkbox"/> TREC: Traceability of Radioactive Equipment		Albert MASSONI	
<input type="checkbox"/> GLHOS training		Sergei PASTOR	
<input type="checkbox"/> ATLASMuon Shifters		Anna SZYDALSKA	
<input type="checkbox"/> SIR course for authors		Alma-Marie PIGUET	
<input type="checkbox"/> Chemical Risk Awareness		Maria BERBERASH MARIN	
<input type="checkbox"/> Site 18 safety awareness and access course		Eric PAGE	
<input type="checkbox"/> IP Training for CERN Supervised Radiation Areas		Luis ALBERTY VIEIRA	
<input type="checkbox"/> Safe bike riding		Sue SPANRODT	
<input type="checkbox"/> Open Days		Serge GELLOT	
		Rossana BONGHI	
		Francoise ZIESLER	
		Benoit LEPOLLITTEVIN	
		Andrea RUSSO	
		Julie COFFARD	
		Daniela MACRÀ	
		Marta BERNARDINI	
		Frank BIAS	
		Maria Teresa SANTOS	
		Colin PATRICK BEDEL	
		Herve RAMBEAU	

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

The list is found in the HR webpage

The screenshot shows the CERN Human Resources Department website. The navigation menu includes 'General Information', 'Recruitment', 'Training', 'Staff Career', 'Services', and 'CERN Official Documents'. The 'Training' link is circled in red. The main content area features a 'General Information' section with a photo of a man, a 'CERN Official Documents (internal)' section with a list of documents, and a 'News' section with a headline about career opportunities.

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 be notified of, an accident or incident, you should immediately notify your DSO of your department. Find out who they are, so you can report the incident to them.

The screenshot shows the CERN EDH website. At the top, there is a navigation bar with 'Home', 'Tasks', 'Search', and 'News'. Below this, there is a 'News' section with a headline: 'In light of the upcoming 2016 CERN reorganization... The EDH team are currently contacting department heads...'. Below the news section, there is a 'Tasks' section with three icons: 'Other Tasks', 'AOC Overview', and 'AOC Overview (TID)'. A red arrow points to the 'AOC Overview' icon.

The screenshot shows the 'Internal Accident Report' form. The form is titled 'Internal Accident Report' and is created by John PEDERSEN (EN-HDO) on 16.11.2015. The applicable administrative procedure is 'Accidents'. The form is divided into several sections: 'What', 'When', 'Where', 'Who', and 'Any other Information'. The 'What' section includes fields for 'Type of Safety Issue' (Accident, Personal Accident, Near miss, Hazardous Situation), 'Short description', and 'Detailed Description'. The 'When' section includes 'Date' and 'Time' fields. The 'Where' section includes 'On CERN site' (No), 'Details about the location', and 'Worksite' (No). The 'Who' section includes a table with columns 'Context', 'Name', and 'Details', and an '+Add' button. The 'Any other Information' section is a large text area.

2016 Injector Accelerator Schedule

Approved by the Research Board - September 2015

	Jan			Feb			Mar							
	Controls maintenance			Start ion source and Linac2			Beam to PSB			Beam to PS		Beam to SPS		Beam to LHC
Wk	1	2	3	4	5	6	7	8	9	10	11	12	13	
Mo	1	2	3	4	5	6	7	8	9	10	11	12	13	
Tu	4	5												
We	6	7												
Th														
Fr														
Sa														
Su														

	Apr			May			June						
	Beam to AD Start NA setup ISOLDE, nTOF, EA setup			Start NA proton physics			Start AD physics			Start physics East Area			
Wk	14	15	16	17	18	19	20	21	22	23	24	25	26
Mo													
Tu													
We													
Th													
Fr													
Sa													
Su													

	July			Aug			Sep						
	Start AWAKE commissioning						Ions to PS			Ions to SPS			
Wk	27	28	29	30	31	32	33	34	35	36	37	38	39
Mo													
Tu													
We													
Th													
Fr													
Sa													
Su													

	Oct			Nov			Dec						
	Start AWAKE physics			End proton physics			Ions to LHC			End of run (06:00)			
Wk	40	41	42	43	44	45	46	47	48	49	50	51	52
Mo													
Tu													
We													
Th													
Fr													
Sa													
Su													



LHC Schedule 2016

Approved by the Research Board, December 2015

	Jan			Feb				Mar					
Wk	1	2	3	4	5	6	7	8	9	10	11	12	13
Mo	4	11	18	25	1	8	15	22	29	7	14	21	28
Tu													
We										Powering tests		Recommissioning with beam	
Th				Year end technical stop									
Fr											Machine check-out	G. Friday	
Sa													
Su													

	Apr			May				June					
Wk	14	15	16	17	18	19	20	21	22	23	24	25	26
Mo	4	11	18	25	1	8	White	15	22	29	6	13	20
Tu													
We										TS1			
Th					Ascension							Special physics run	
Fr					May Day comp				MD 1				
Sa													
Su			1st May										

	July			Aug				Sep					
Wk	27	28	29	30	31	32	33	34	35	36	37	38	39
Mo	4	11	18	25	1	8	15	22	29	6	13	20	27
Tu													
We				MD 2					TS2	MD 3			
Th							MD			Jeune G.		Special physics run	
Fr													
Sa													
Su													

	Oct			Nov			Dec						
Wk	40	41	42	43	44	45	46	47	48	49	50	51	52
Mo	3	10	17	24	31	7	14	21	28	5	12	19	26
Tu													
We						TS3	Ions setup				Extended year end technical stop		
Th									Ion run (p-Pb)			Lab closed	
Fr				MD 4									
Sa													
Su											Xmas	New Year	

Technical Stop

Machine development

Recommissioning with beam

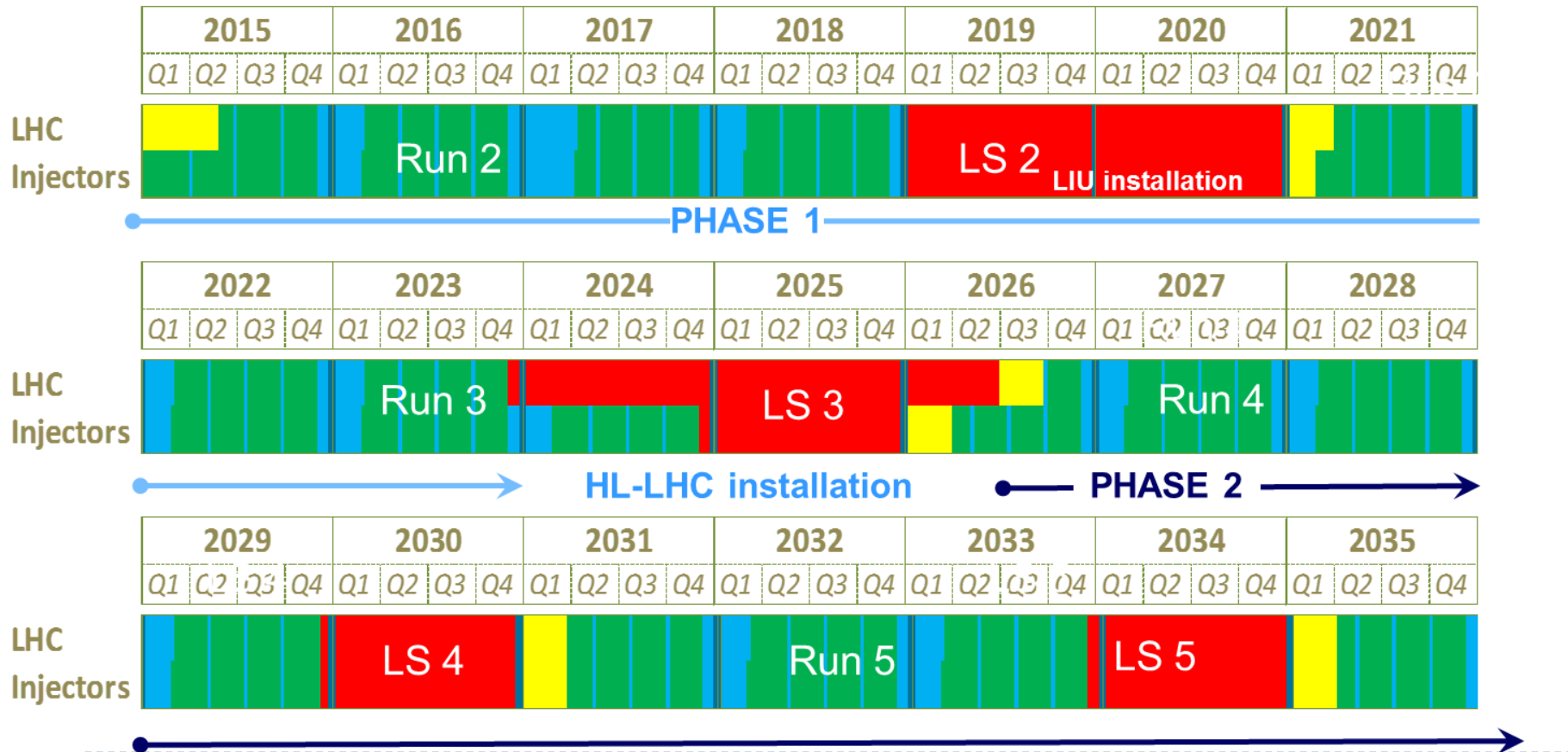
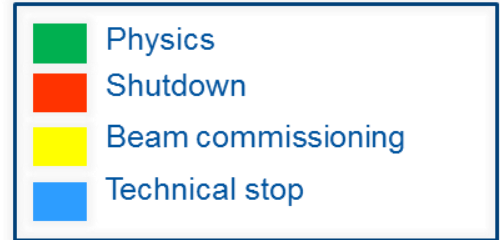
Special physics runs - schedule to be established

Scrubbing (indicative - dates to be established)

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



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

Frédéric Bordry

Director for Finance and Human
Resources

Martin Steinacher

Directorate in 2016

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Eckhard Elsen

Director for Accelerators and
Technology

Frédéric Bordry

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

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

Frédéric Bordry

Director for Finance and Human
Resources

Martin Steinacher

Heads of departments in 2016

Beams – BE

Paul Collier

Technology – TE

José Miguel Jimenez

Engineering – EN

Roberto Losito

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

Frédéric Bordry

Director for Finance and Human
Resources

Martin Steinacher

Heads of departments in 2016

Human Resources

Anne-Sylvie Catherin

Finance and Administrative Process

Florian Sonnemann

Industry, Procurement and Knowledge
Transfer

Thierry Lagrange

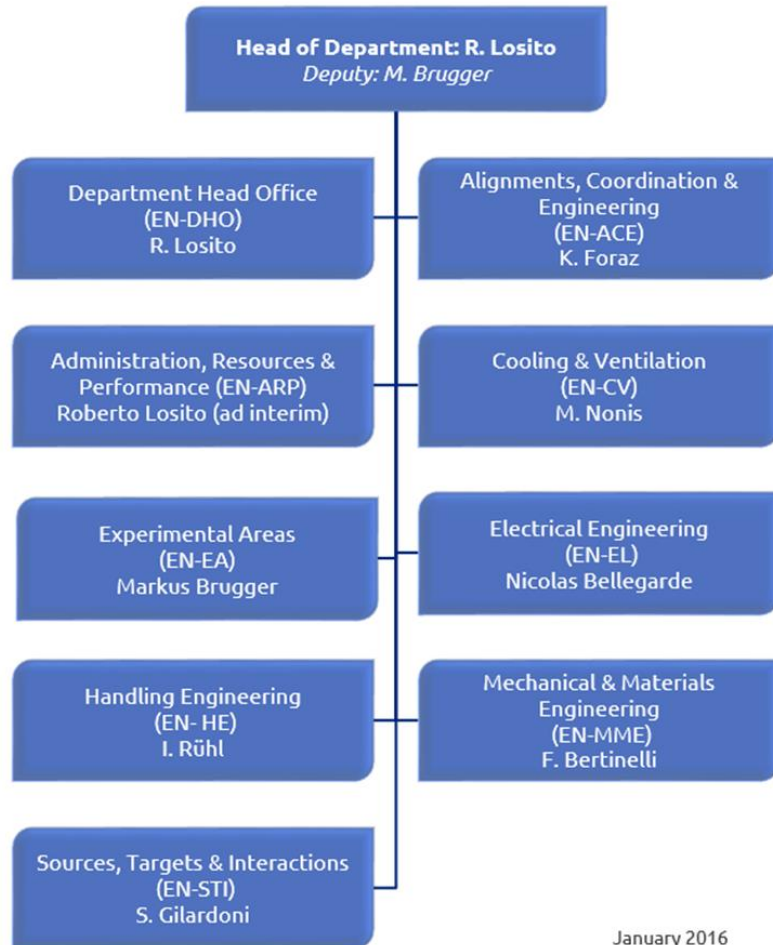
Site Management and Buildings

Lluís Miralles



Head of Department:
Roberto Losito

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



Who are we, in EN?

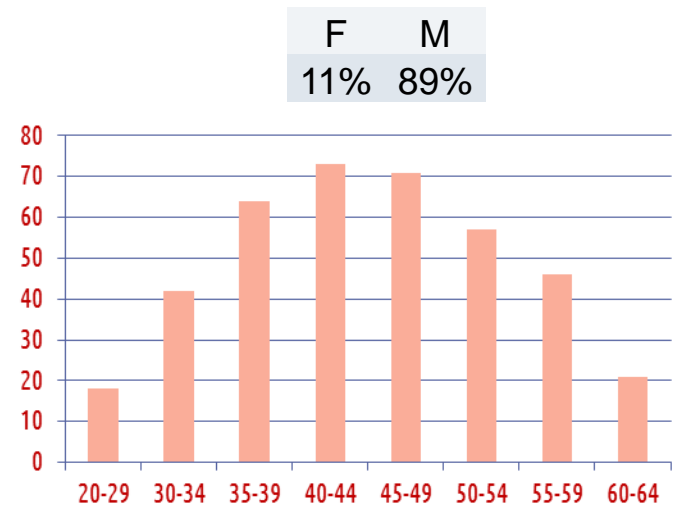
AT	BE	CH	D	DK	ES	FI	FR	GB	GR	IT	NL	NO	PL	PT	SE
4	22	11	17	2	17	3	225	22	3	41	8	2	5	9	3

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

+ 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.



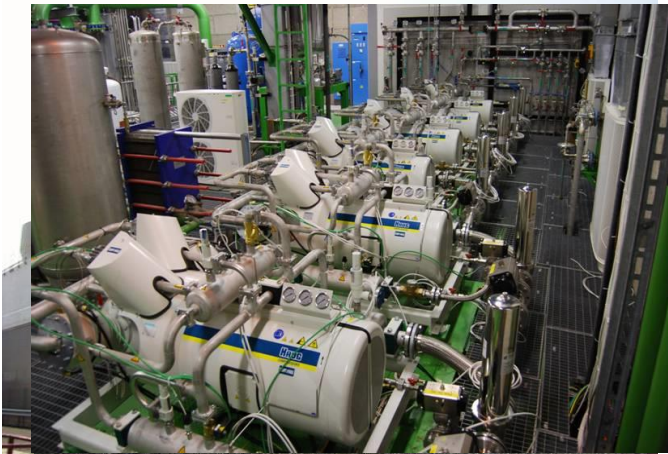
Group Leader
Mauro Nonis



Cooling station

Cooling

Cooling plants (raw, demineralised water, C ₃ F ₈ , C ₆ F 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*

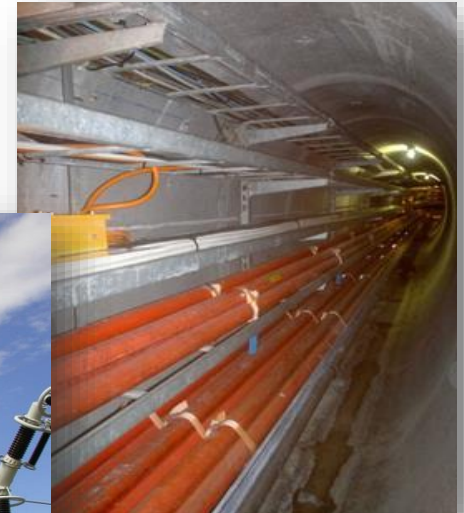
Ventilation

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
<i>Eurotunnel</i>	50	540'000
LHC	27	290'000

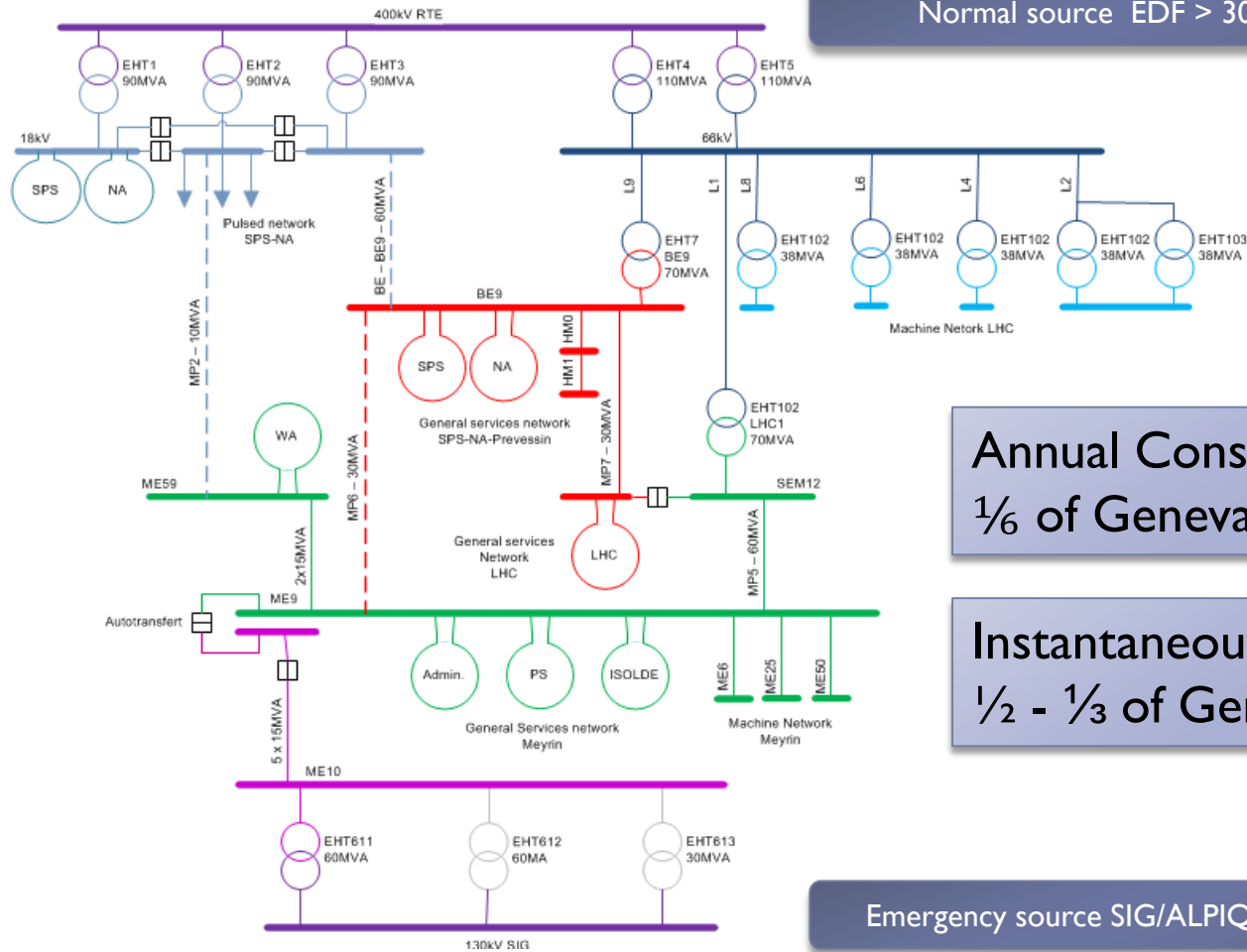


The EL group is responsible for the **CERN electrical distribution network** from 400 kV to 400/230 V. Its main missions are to operate, maintain, extend and renovate the network, analyse and make projections for CERN electrical energy consumption and manage relations with the energy suppliers.



Group Leader
Nicolas Bellegarde

Electricity Distribution



Normal source EDF > 300 MW

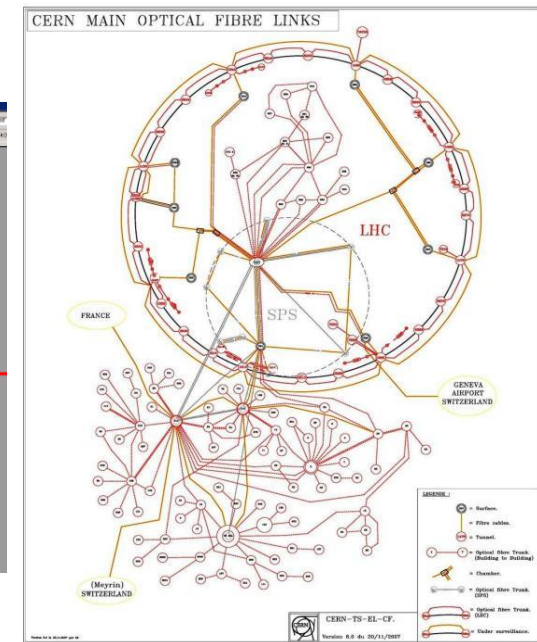
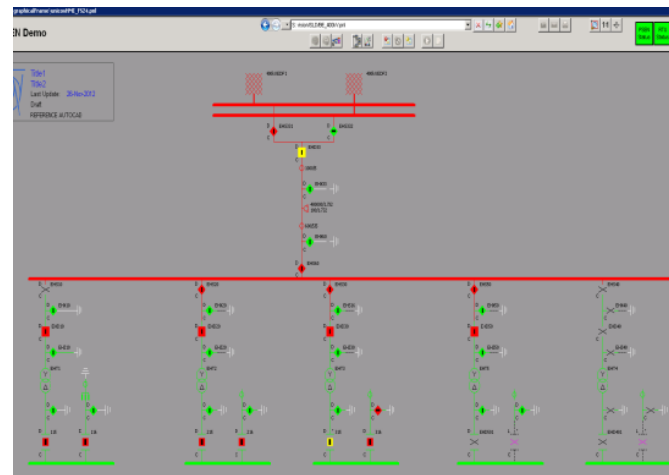
Annual Consumption 1.26 TWh
1/6 of Geneva

Instantaneous Power 180 MW
1/2 - 1/3 of Geneva

Emergency source SIG/ALPIQ ≤ 60 MW

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)

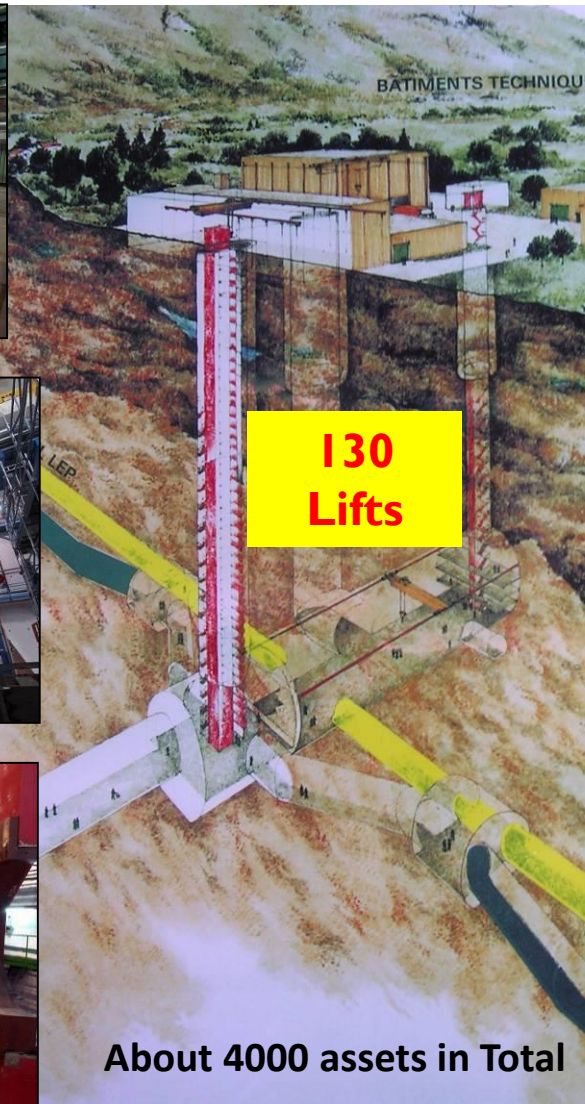
HE : The Transport and Handling Group

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**.



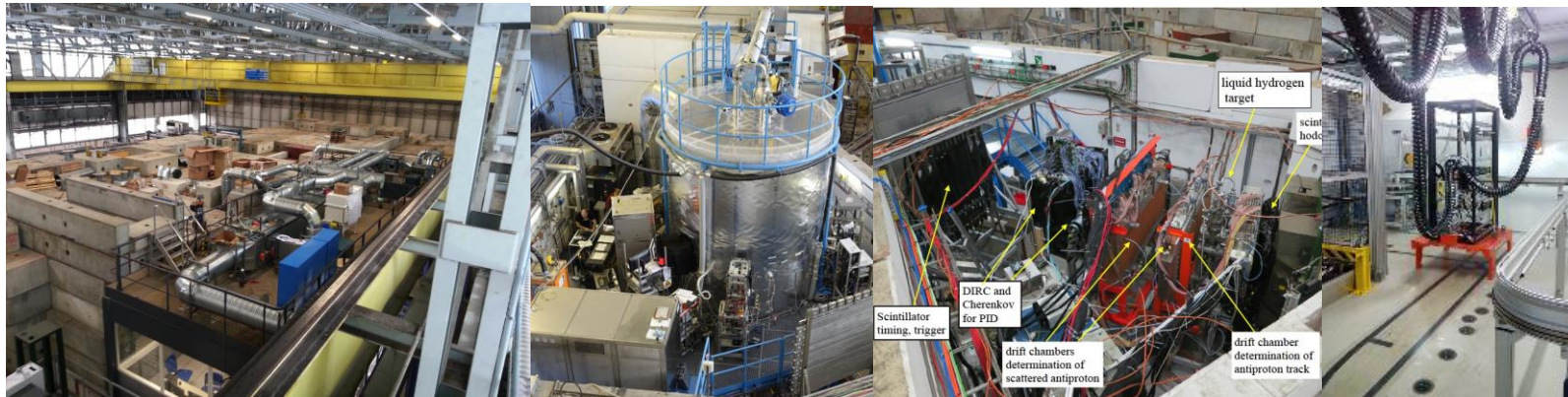
Group Leader
Ingo Ruehl





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

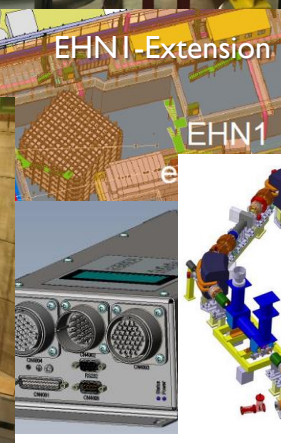
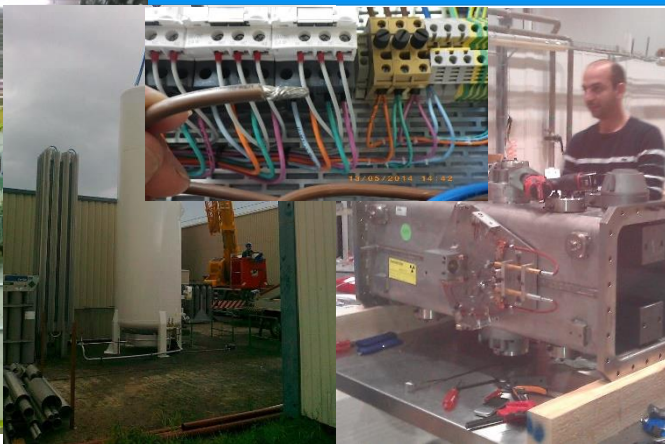
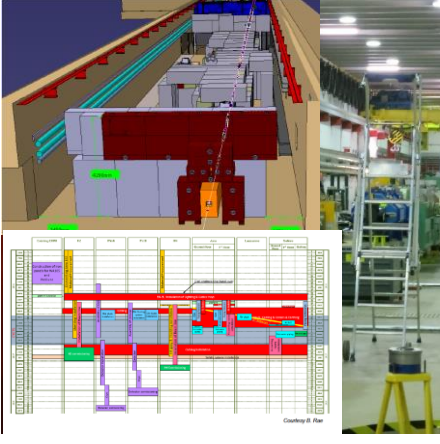
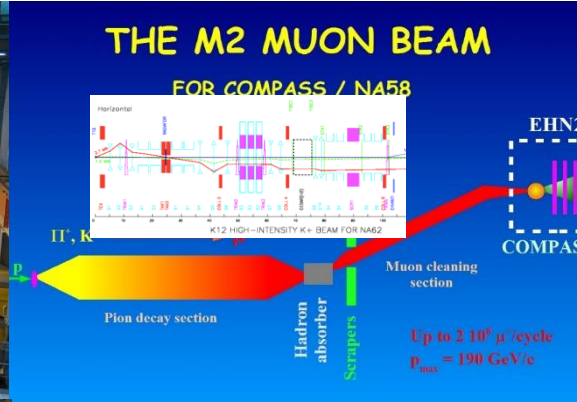


EXPERIMENTAL AREAS

BEAMLINES

FACILITIES

PROJECTS



SUPPORT ACTIVITIES

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

EN Engineering Department ACE : Alignment, Coordination and Engineering Group

The ACE group is responsible for

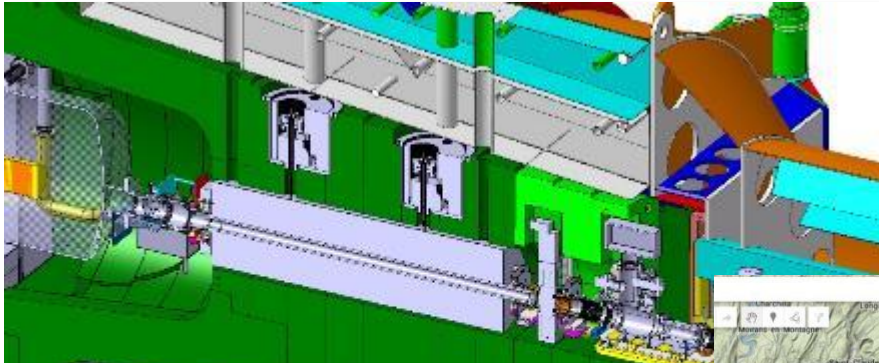
- Providing **overarching project coordination** for the accelerator complex, including layout management, integration, scheduling, work and safety coordination, as well as for different projects.
- Providing **support and expertise in matter of project, risks and quality** management as well as organizational 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.



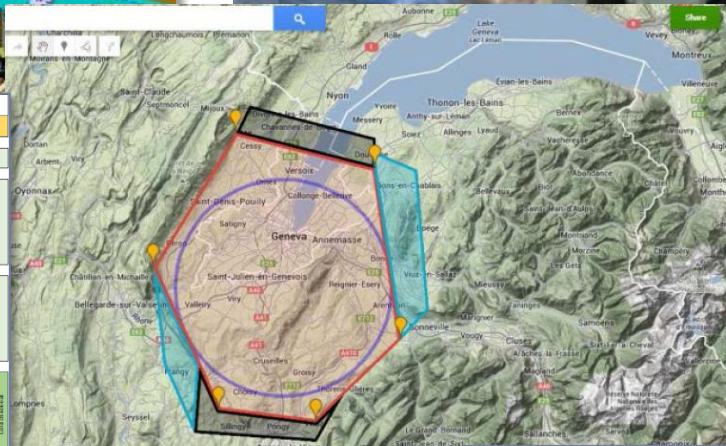
Group Leader
Katy Foraz



EN Engineering Department ACE : Alignment, Coordination and Engineering Group



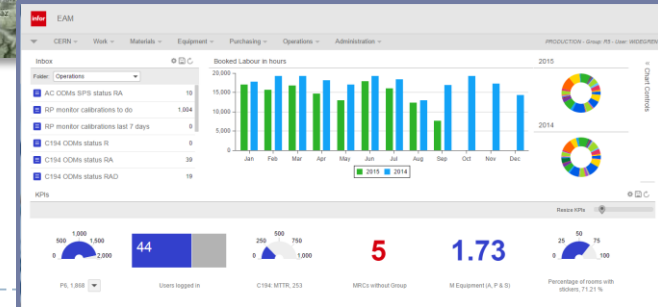
	2016	2017	2018	2019	2020
YETS	YETS	eYETS	YETS	LS2	
L4	300MeV V	160MeV Beam Stop & Extraction HET HLS/LSR	Rehabilitat	Interconnect	Beam dump Connection Beam kicker Shut-down Rehabilitat
PSB	Cable id.	Cable removal BR, BCTDC electronics, ring trajectory BLM, tune pick- up, kickers	Cable rem.	Wire scanner @11, RF bypasses and BHZ jacks @12, Treatment cavity @13, Extraction kickers @14, PSB injection & extraction upgrade (under study: beam stoppers, vacuum window for PSB Rump) Consolidation of PSB ventilation TBC	Hardware tests Cold check-out
PS	Vacuum, fast BLM, Water cooling of 30MHz cavity, windhand pick-up	Cable id.	Cable removal	T2 power converters, beam dumps, BWS, under study: position injection septum, bumper, injection kicker, 10MHz syst. of insertion quad.) Consolidation of magnets- TBC	Hardware tests Cold check-out
SPS	BAS Cable Vacuum, kicker, MPCs, Beam Dump	BAS Cable removal	BAS Cable removal	BAS REMOVAL SSI reconfiguration, new beam dump, BG, extraction retention, wire scanner, 200MHz RF power, ac coating, MOPOS electronics, ZS Crab-cavities, high bandwidth pick-up	Hardware tests Cold check-out
LHC		MKI proto		HL LHC: 125 @16, RF: cryo-by-pass & T.C.D., TCSPM, TAIN@PS, D1 & D2 mask, Cryogenic @ P4, ac-coating, BGV, FWS, high bandwidth pick-up, DIS, civil engineering	Hardware tests Cold check-out



EDIMS Home Favourites Index

Home Equipment Buildings & Sites Safety CAD Admin

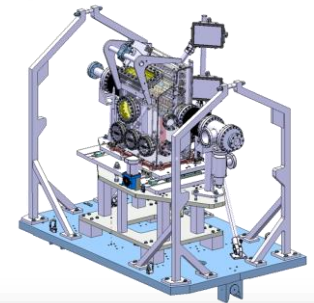
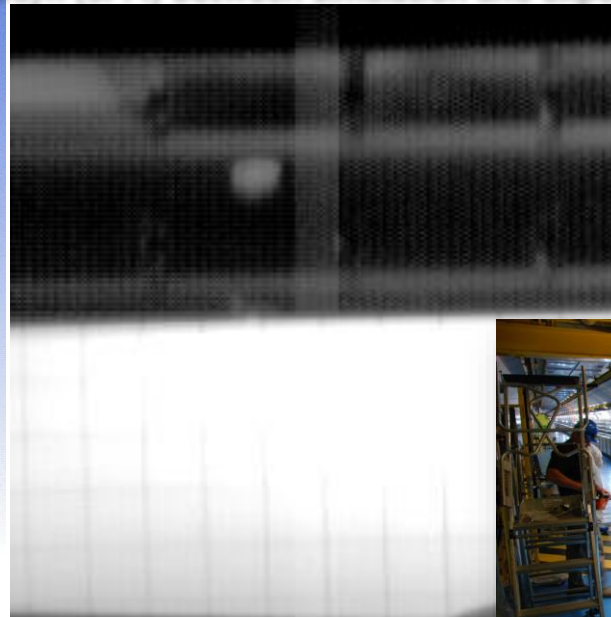
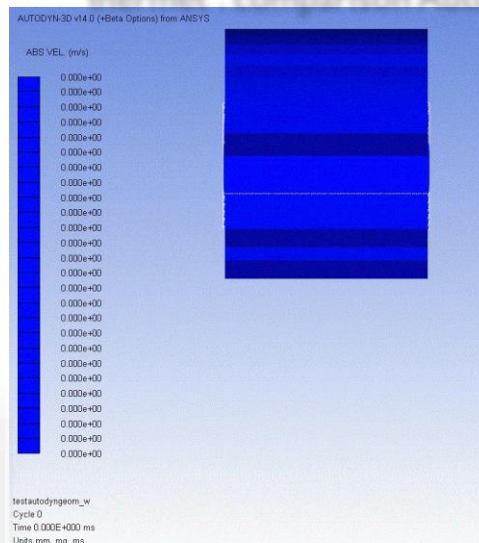
Browse Document search



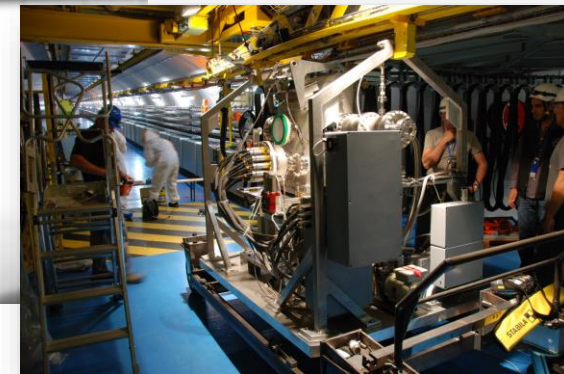
EN Engineering Department MME : The Mechanical and Materials Engineering Group

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.

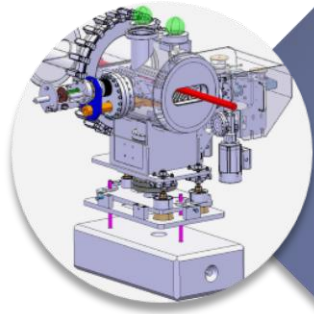
Inernet : comparison Autodyn (SPH) between simulation and experiment



Group Leader
Francesco Bertinelli



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 m² 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

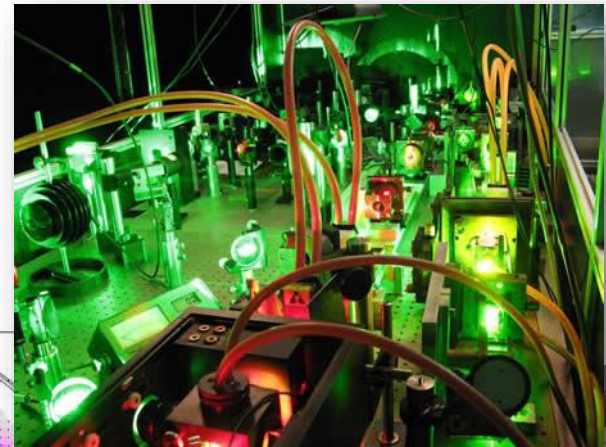
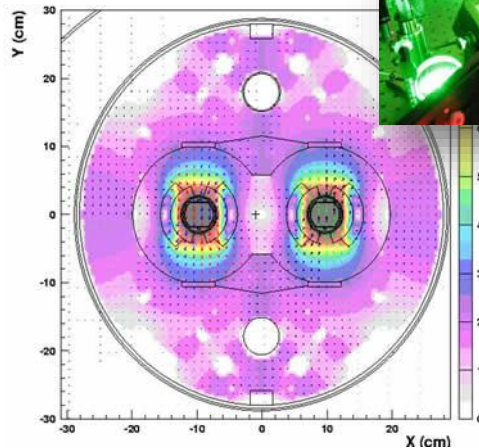
- Material selection, analysis & metallurgy: microscopy, mechanical testing
- NDT: US, radiography, tomography
- 350 m² of internal metrology facilities: CMM

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:

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