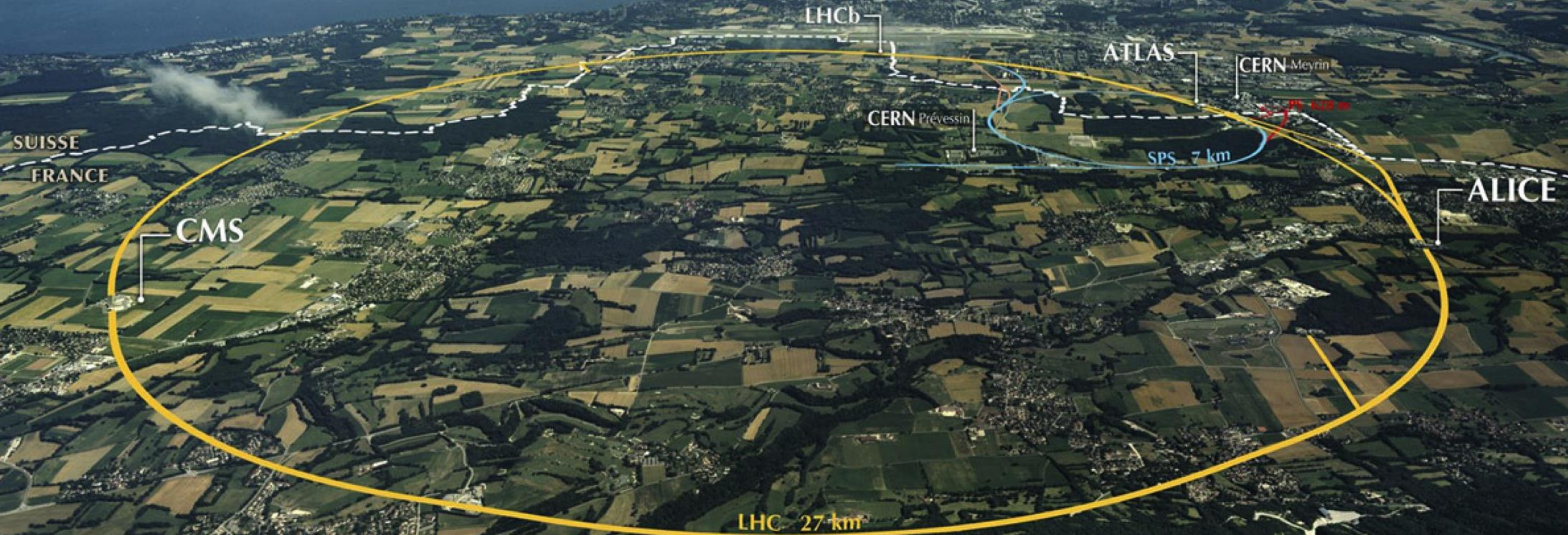


Welcome to the Beams department!

Mike Lamont - DDH



Member States of CERN

Member States (date of accession)

-  Austria (1959)
-  Belgium (1953)
-  Bulgaria (1999)
-  Czech Republic (1993)
-  Denmark (1953)
-  Finland (1991)
-  France (1953)
-  Germany (1953)
-  Greece (1953)
-  Hungary (1992)
-  Israel (2014)
-  Italy (1953)
-  Netherlands (1953)
-  Norway (1953)
-  Poland (1991)
-  Portugal (1986)
-  Romania (2016)
-  Slovakia (1993)
-  Spain (1961-1968, 1983-)
-  Sweden (1953)

-  Switzerland (1953)
-  United Kingdom (1953)

States in accession to Membership and Associate Members

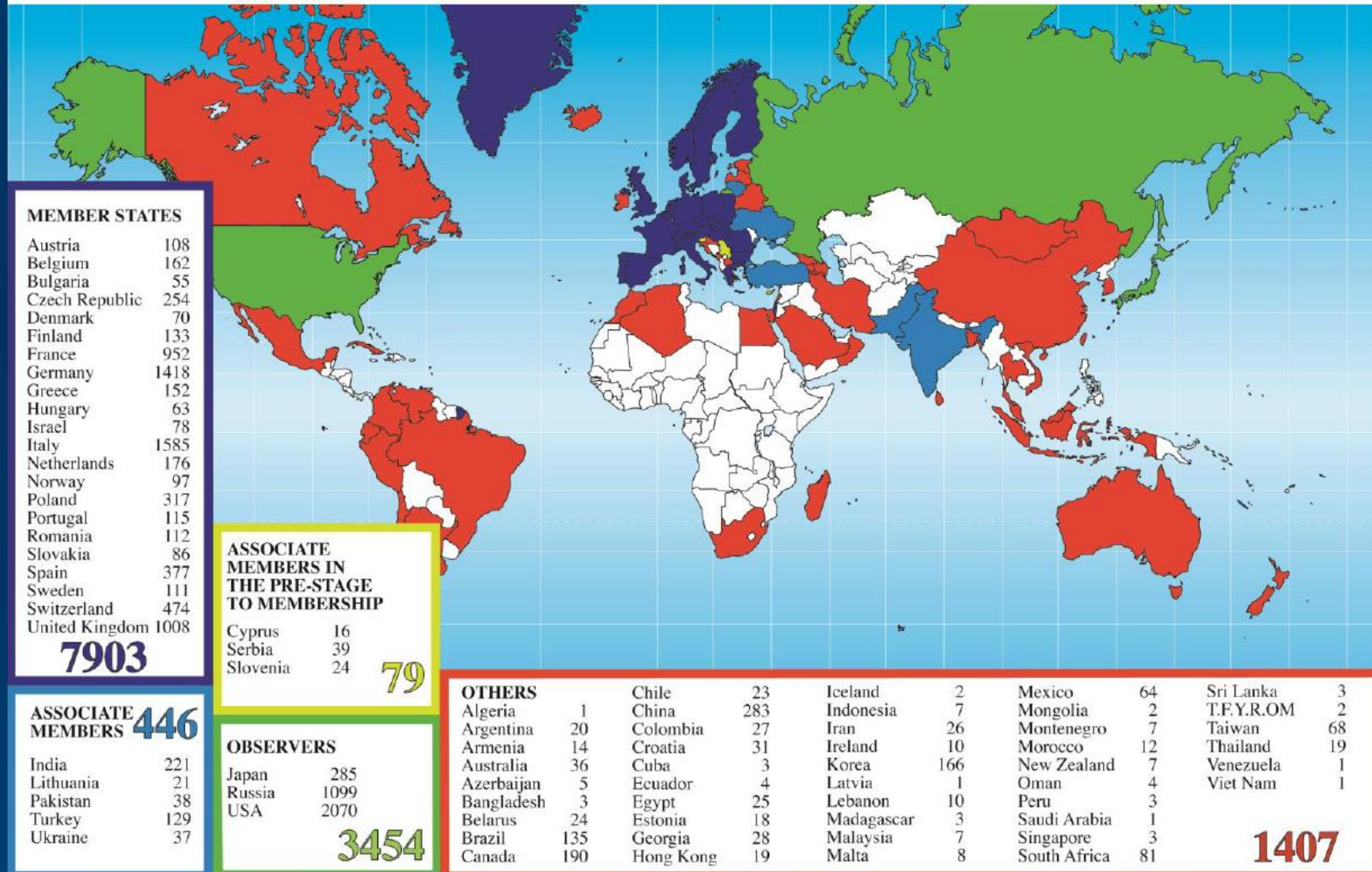
-  Cyprus (2016)
-  India (2017)
-  Lithuania (2018)
-  Pakistan (2015)
-  Serbia (2012)
-  Slovenia (2017)
-  Turkey (2015)
-  Ukraine (2016)



Plus Serbia!

Science is getting more and more Global

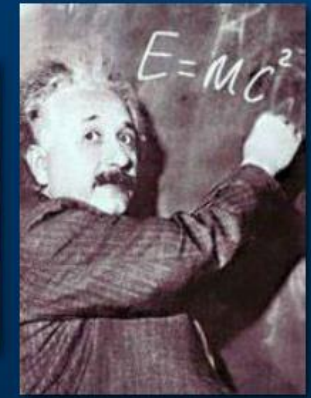
Distribution of All CERN Users by Location of Institute on 24 January 2018



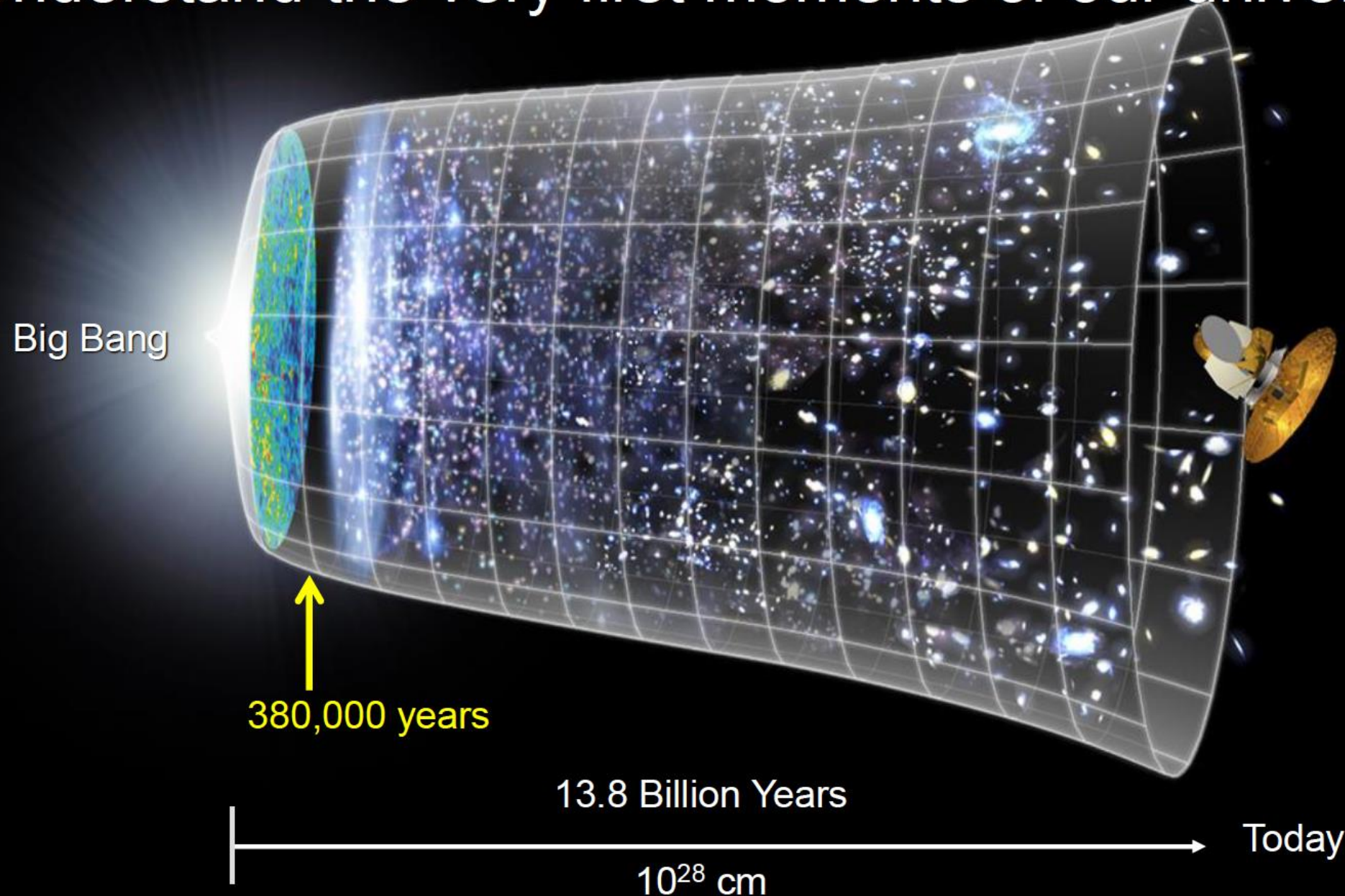
The Mission of CERN

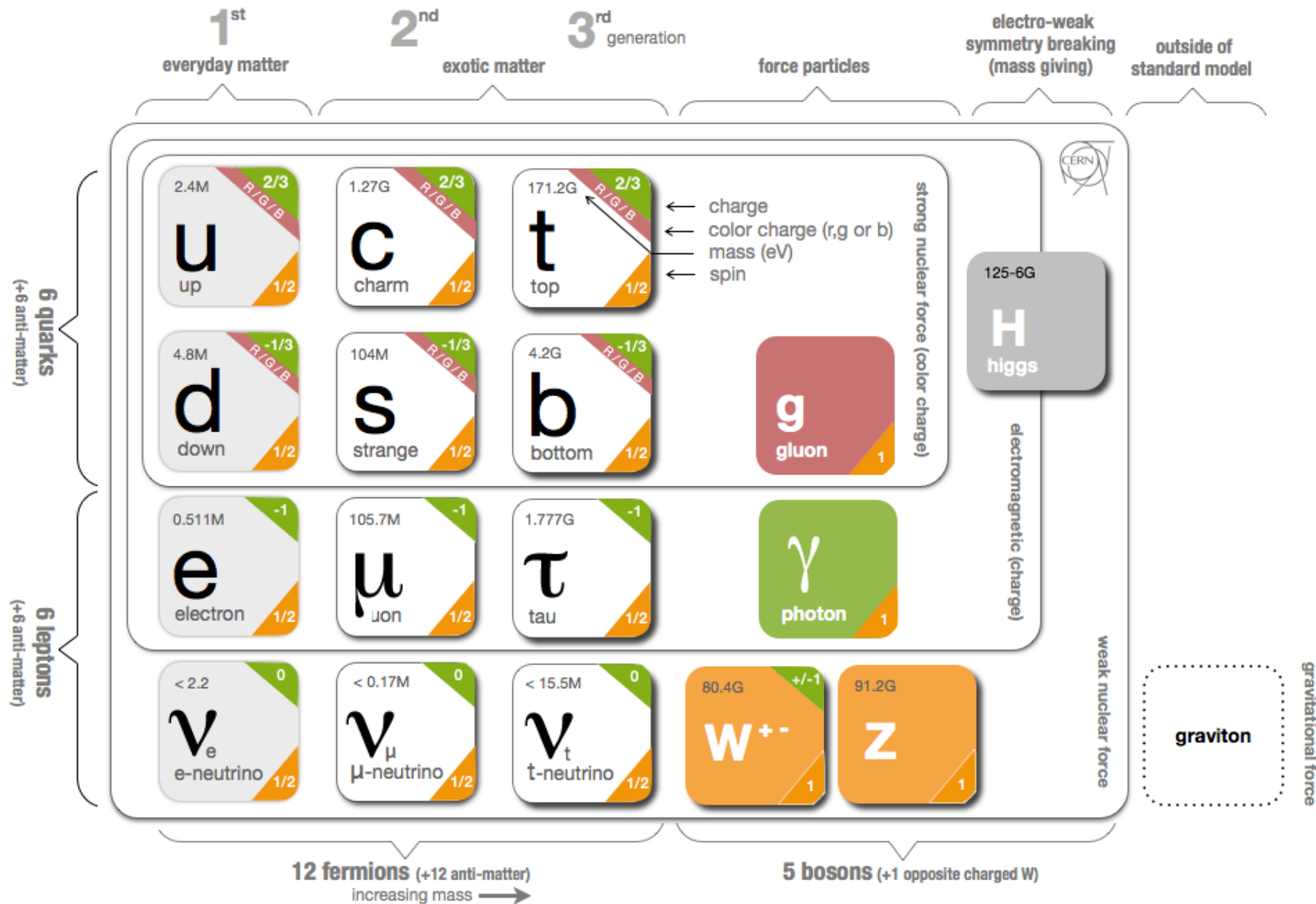


- **Push back** the frontiers of knowledge
- **Develop** new technologies for accelerators and detectors
- **Train** scientists and engineers of tomorrow
- **Unite** people from different countries and cultures

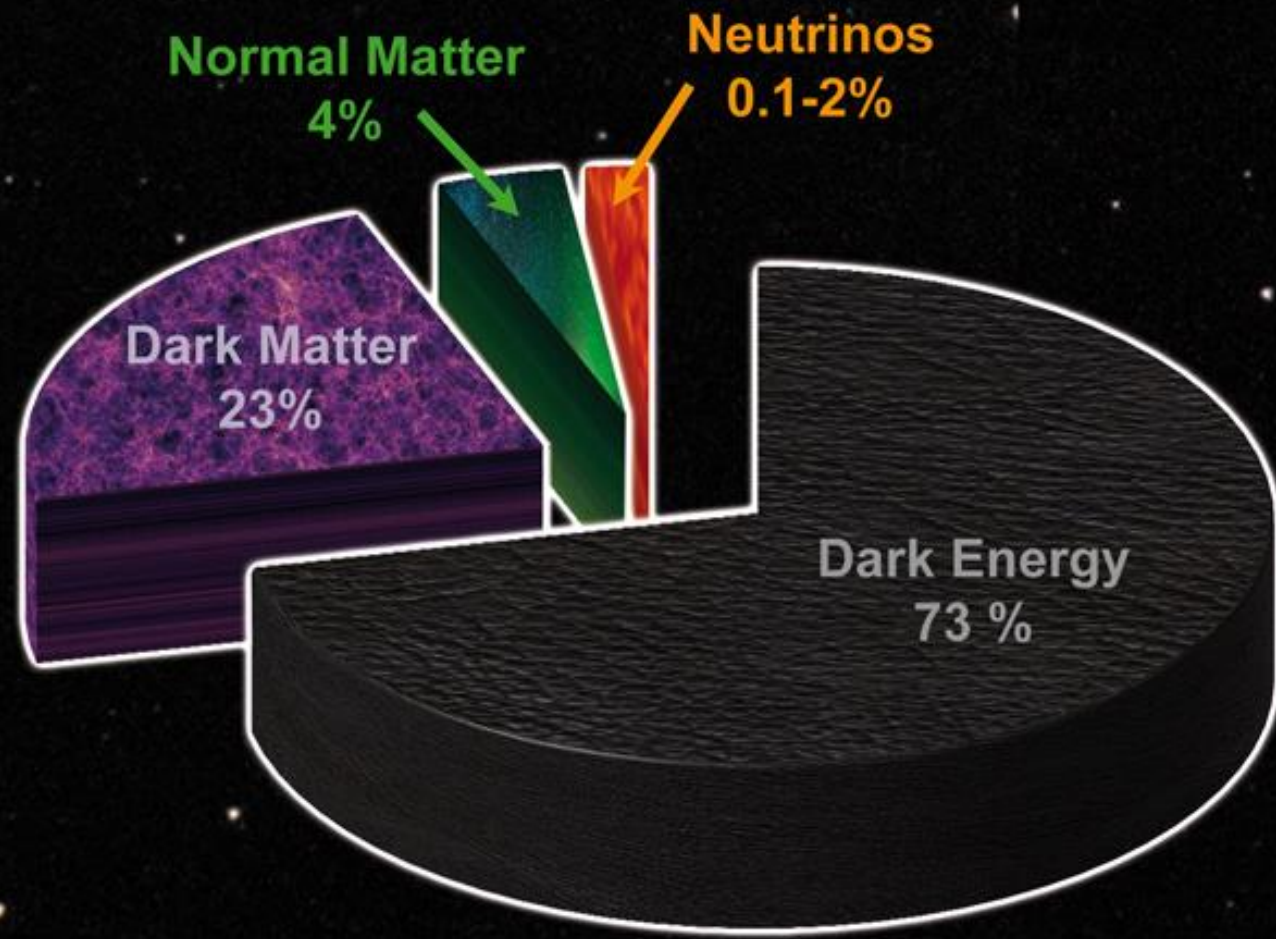


Understand the very first moments of our universe





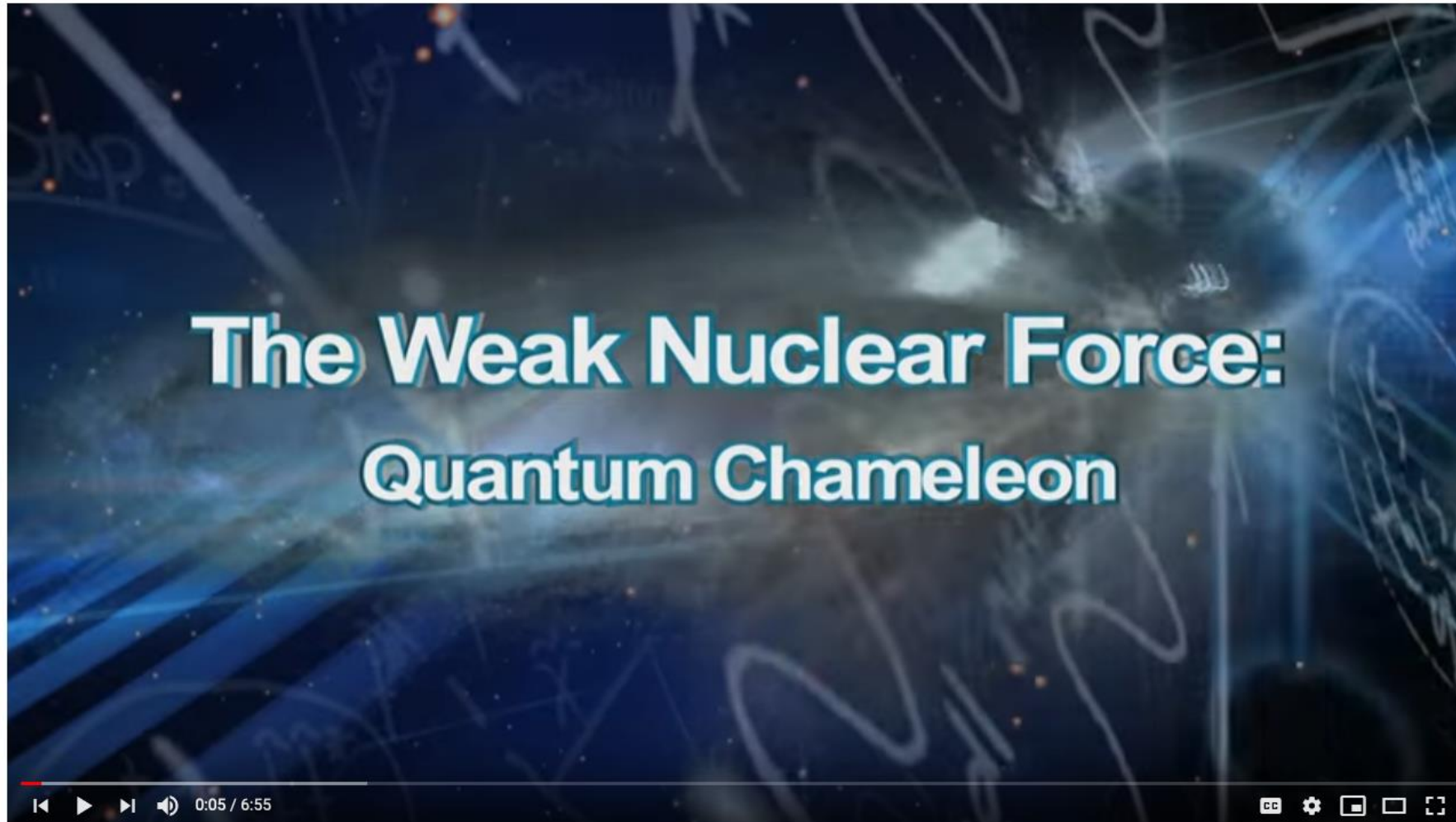
The Standard Model



Content of the Universe

Lot of resources out there...

Don Lincoln of Fermilab on YouTube



The Weak Nuclear Force: Quantum Chameleon

75,830 views

1.7K 22 SHARE SAVE ...

Videos by Don Lincoln

Fermilab - 32 / 88

- ▶ **The Weak Nuclear Force: Quantum Chameleon**
Fermilab 6:56
- 33 **The Weak Nuclear Force: Through the looking glass**
Fermilab 9:18
- 34 **Future Circular Colliders**
Fermilab 7:37
- 35 **Fermions and Bosons**
Fermilab 6:12
- 36 **Accelerator Science: Why RF?**
Fermilab 8:18
- 37 **Higgs Boson 2016**
Fermilab 7:53
- 38 **Accelerator Science: Circular vs. Linear**
Fermilab 7:51
- 39 **Accelerator Science: Proton vs. Electron**
Fermilab 9:17
- 40 **Accelerator Science: Luminosity vs. Energy**
Fermilab 8:42
- 41 **Accelerator Science: Collider vs. Fixed Target**
Fermilab 7:15
- 42 **Quantum Color**
Fermilab 6:30

CERN...

World première research facility for high-energy physics; Supported by its 20 European member states; With 2500 full-time employees CERN hosts about 10,000 visiting scientists from 113 different countries. CERN, among its accomplishments:

- ▶ Found the neutral currents of the electroweak theory,
- ▶ Used neutrinos to confirm the quark hypothesis,
- ▶ Discovered the W and Z bosons.
- ▶ Counted the number of neutrino species,
- ▶ Created the first anti-atoms and
- ▶ Discovered the long sought Higgs Boson last year!

None of these triumphs are likely to contribute anything at all to human health or wealth. Useless Science?

Sheldon Lee Glashow

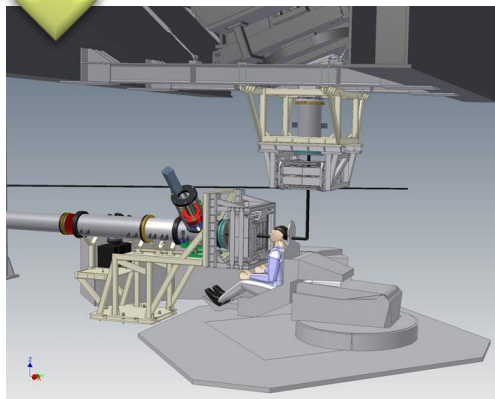
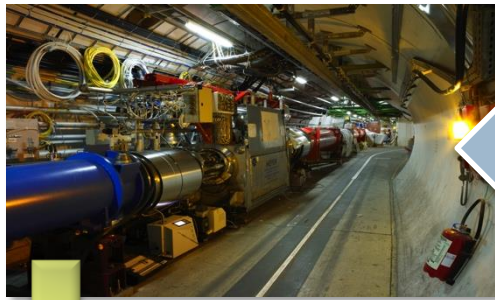
Harvard University, emeritus

Boston University

CERN technologies generate innovation

For example: Medical Applications

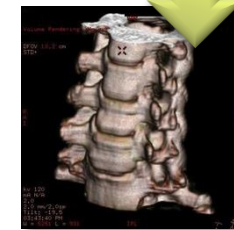
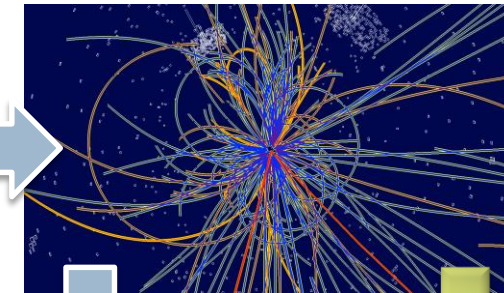
Accelerators



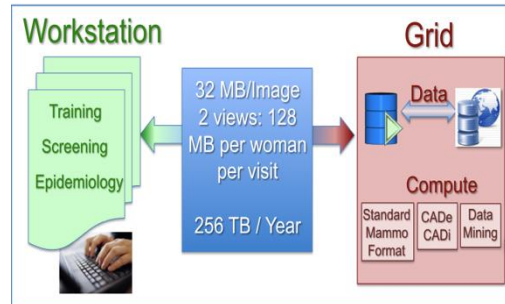
Hadron therapy



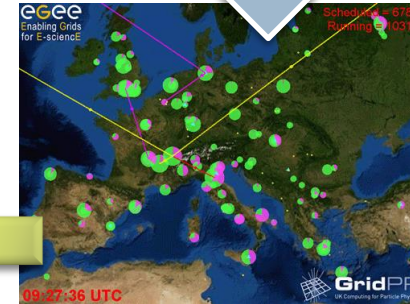
Detectors



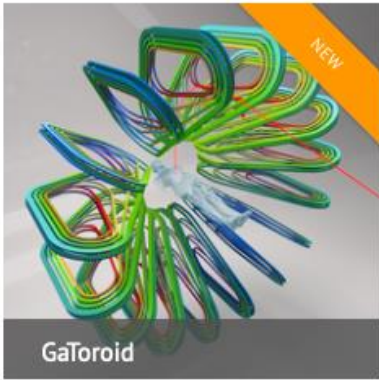
CAT
PET



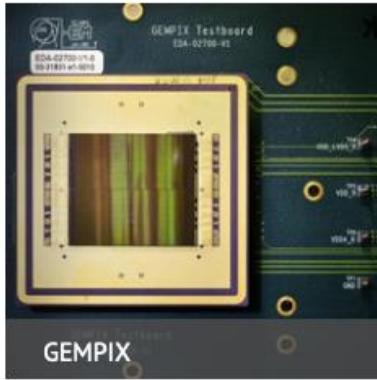
The Computing Grid



Knowledge Transfer – see their website...



GaToroid



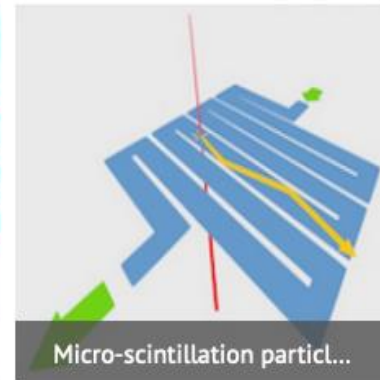
GEMPIX



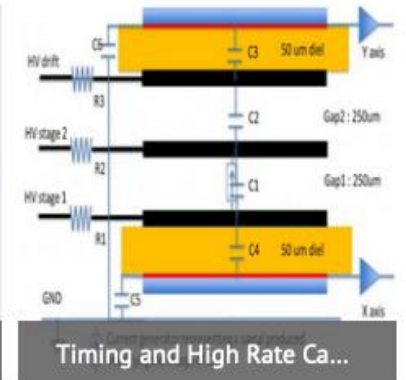
Magnet Power Supplies



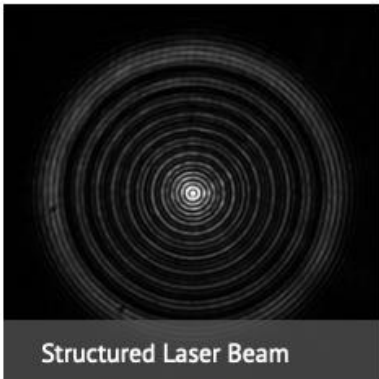
Resistive MicroMegas



Micro-scintillation particle...



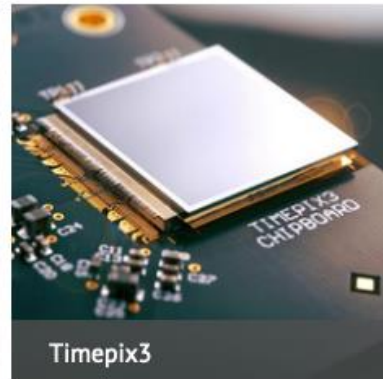
Timing and High Rate Ca...



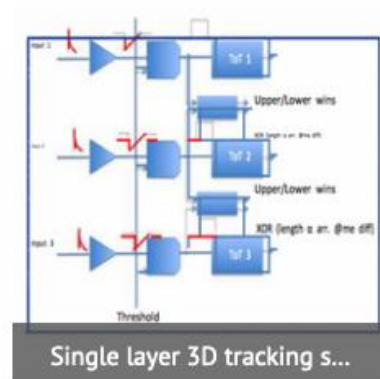
Structured Laser Beam



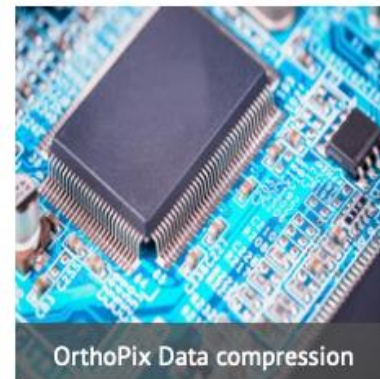
MEDICIS



Timepix3



Single layer 3D tracking s...



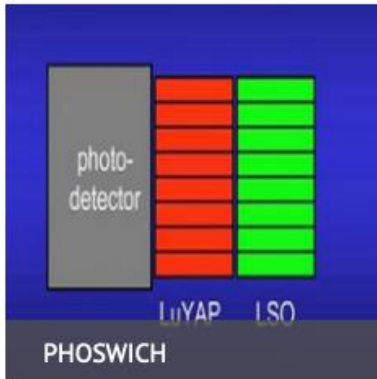
OrthoPix Data compression



Gas electron multiplier



Medipix3



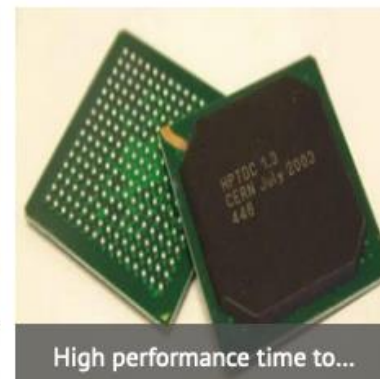
PHOSWICH



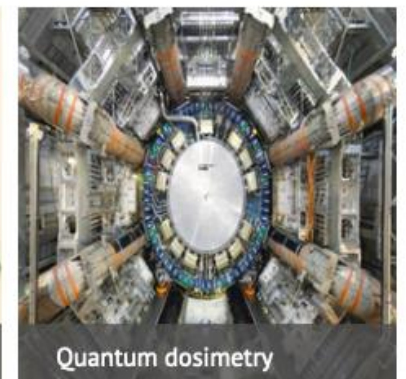
Geant4



ROOT



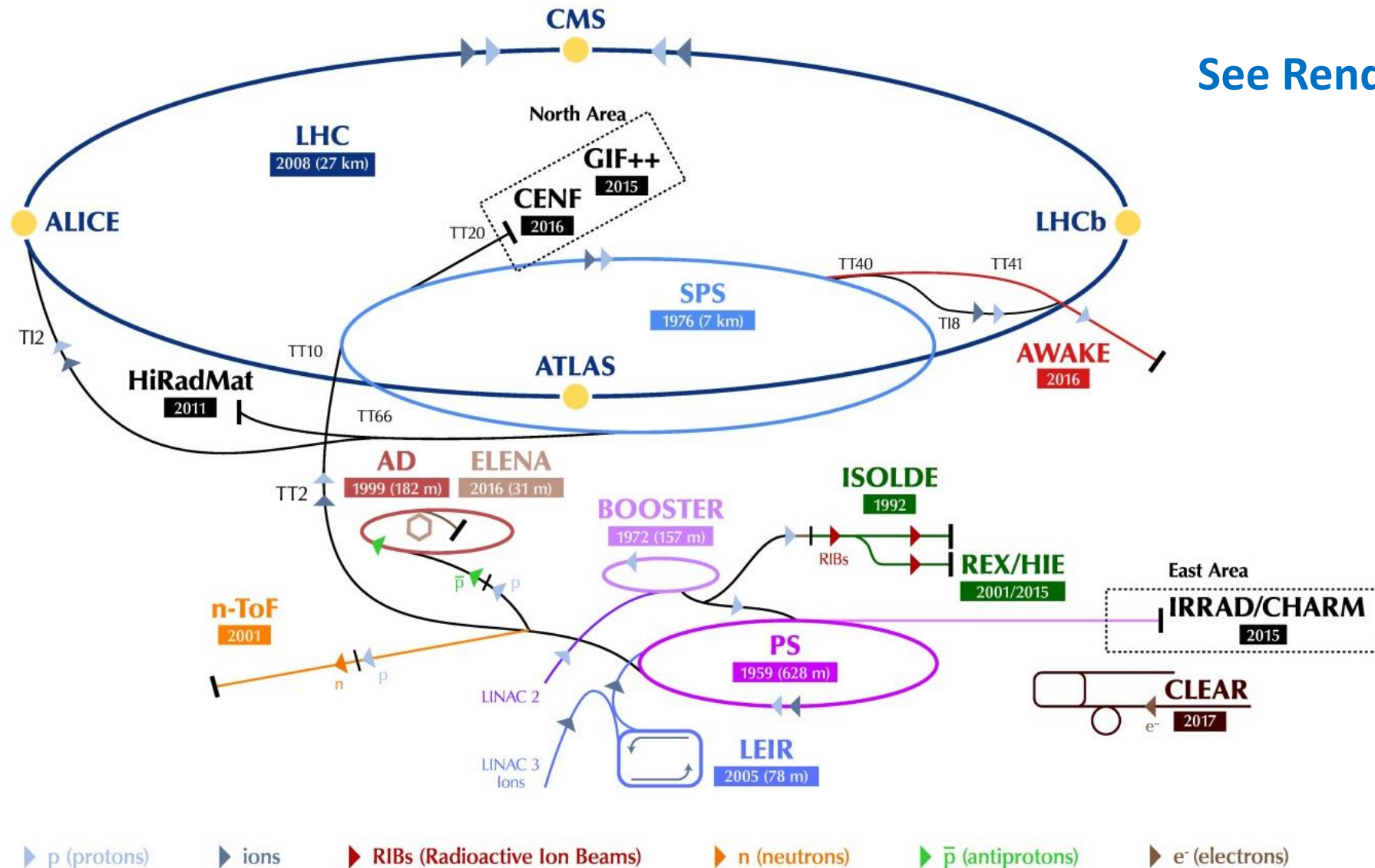
High performance time to...



Quantum dosimetry

The CERN Accelerator Complex

See Rende...



Accelerator schedules - LHC

	Jan				Feb				Mar		Apr		May		
Wk	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mo	1	8	15	22	29	5	12	19	26	↓	5	12	19	26	↓
Tu		Controls Maintenance													
We															
Th															
Fr															
Sa															
Su															

Start powering tests (Mar 9-10), LHC to OP (Mar 10), LHC, T12, T18 closed (Mar 11-12), Experiments valves open (Mar 13), T12 & T18 Beam tests (Mar 14-15), Start Beam Commissioning (Mar 16).

	Apr		May		June								
Wk	14	15	16	17	18	19	20	21	22	23	24	25	26
Mo	Easter 2	9	16	Scrubbing 23	30	7	14	Whitsun 21	28	4	11	18	25
Tu					1st May							TS1	
We													
Th	Recommissioning with beam										MD 1		
Fr						Ascension							$\beta^* = 90$ m run
Sa												VdM program	
Su													

Collisions with 1200 bunches (May 18), First Stable beams (Apr 16), Interleaved commissioning & intensity ramp up (Apr 16-17), Recommissioning with beam (Apr 14-15).

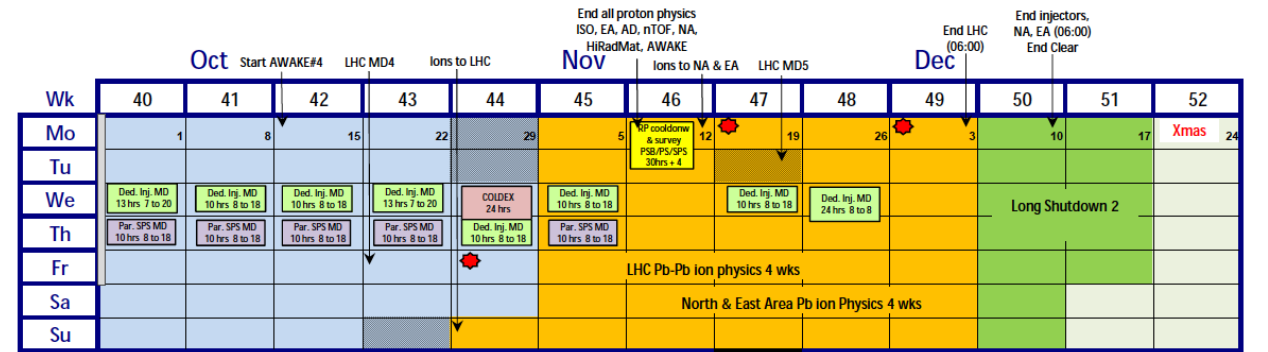
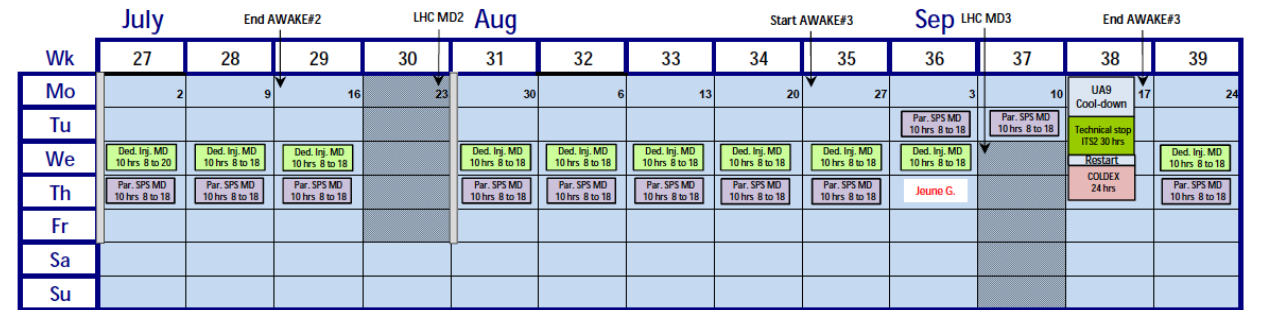
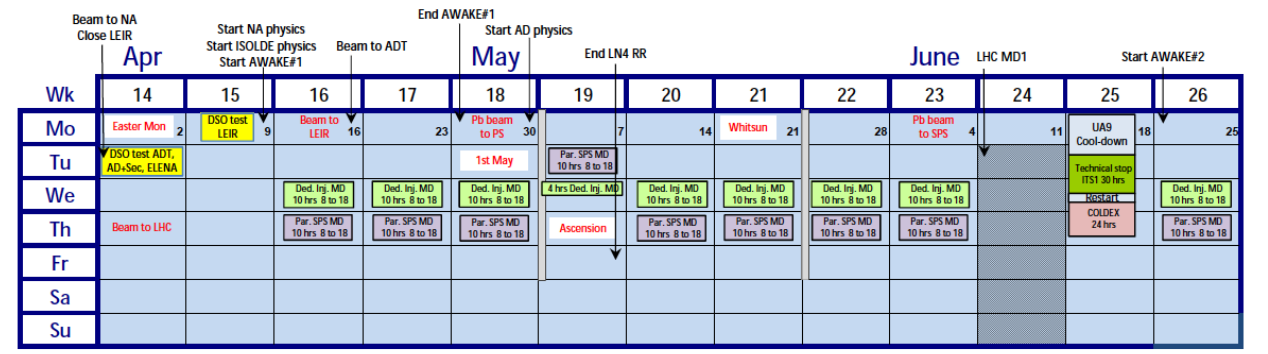
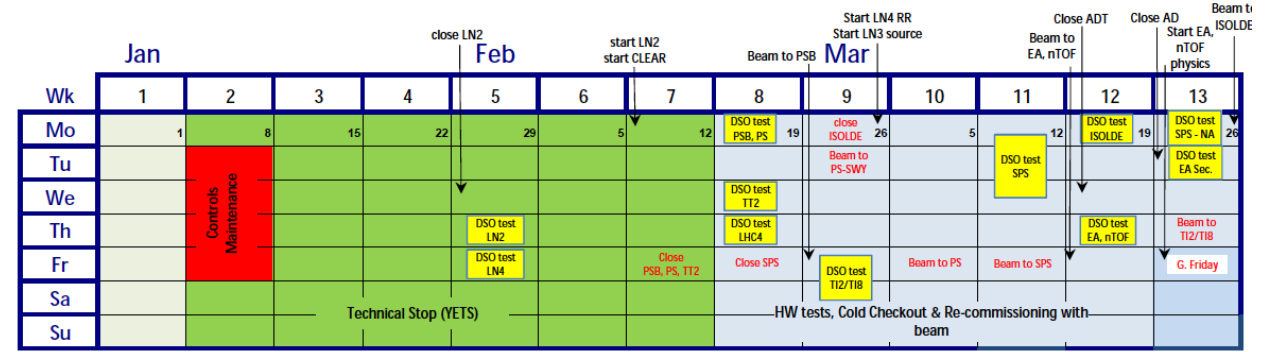
	July		Aug				Sep						
Wk	27	28	29	30	31	32	33	34	35	36	37	38	39
Mo	$\beta^* = 90$ m run	9	16	23	30	6	13	20	27	3	10	17	24
Tu													
We				MD 2								TS2	
Th										Jeune G.			
Fr											MD 3		
Sa													
Su													

	Oct		Nov				Dec						
Wk	40	41	42	43	44	45	46	47	48	49	50	51	52
Mo	1	8	15	22	MD 4 29	5	12	19	26	3	10	17	Xmas 24
Tu						Ion setting up		MD 5					
We													
Th		Special physics run			TS3								
Fr							LHC Pb- Pb Ion run						
Sa													
Su				MD 4									

End of run (106:00) (Dec 49), Powering Tests Magnet Training (Dec 49-50), Long Shutdown 2 (Dec 50-51).

- Technical Stop
- Powering tests
- Machine check out
- Recommissioning with beam
- Interleaved commissioning & intensity ramp up
- Proton physics run
- Special physics runs (indicative - schedule to be established)
- Machine development
- Scrubbing (indicative - dates to be established)
- Pb - Pb Ion physics run
- Pb Ion Setting up
- LINAC 3 Pb oven re-fill

Accelerator schedules - Injectors

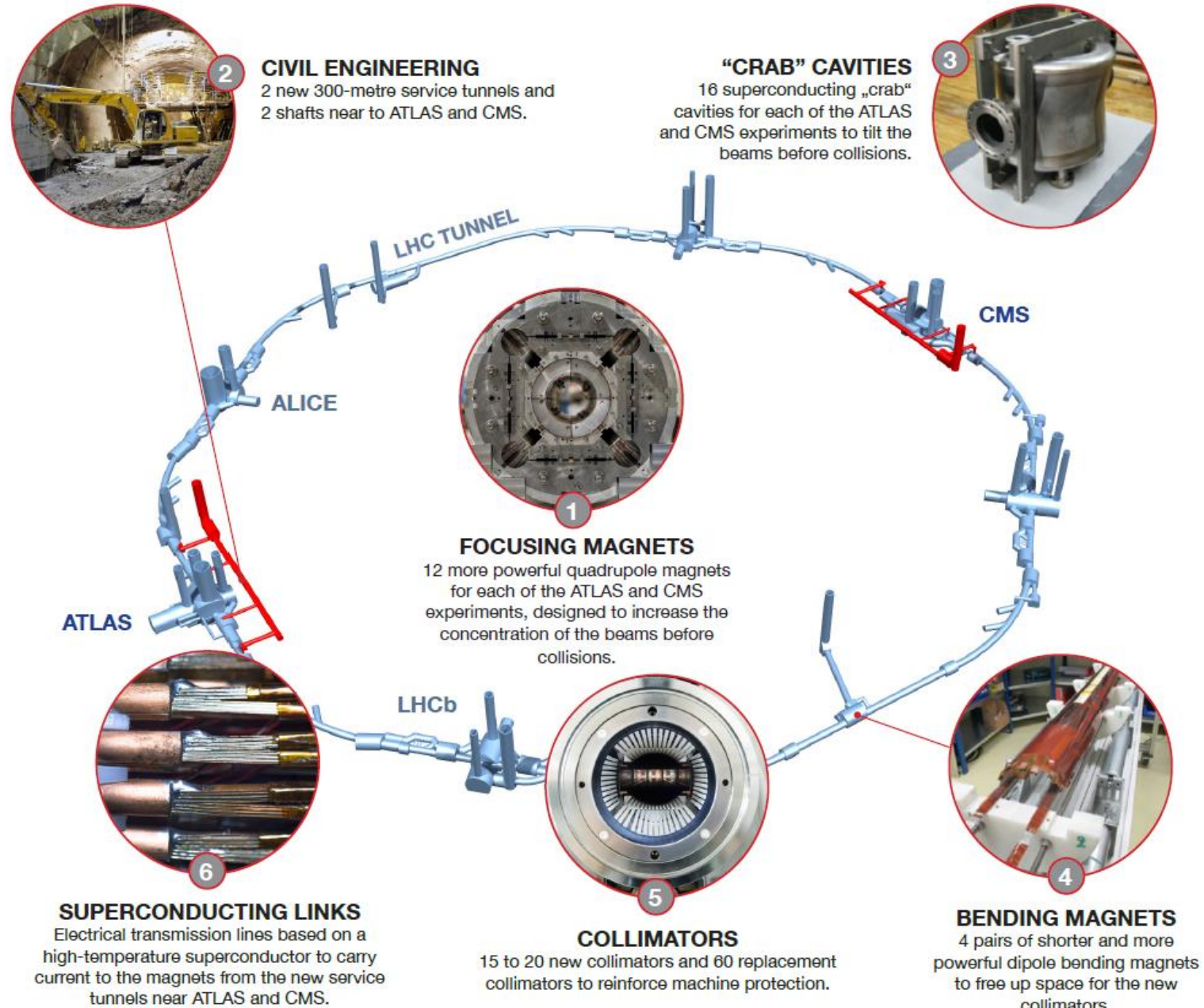


- Injector Complex MD Block
- Technical stop for the Injector Chain
- Indication of LHC MD blocks proton period
- Special (physics) runs
- LINAC 3 Pb oven re-fill
- HiRadMat: possible beam request
- Ions to NA and/or LHC
- Indication of LHC MD blocks ion period
- Parallel SPS MD, reduced duty cycle for NA

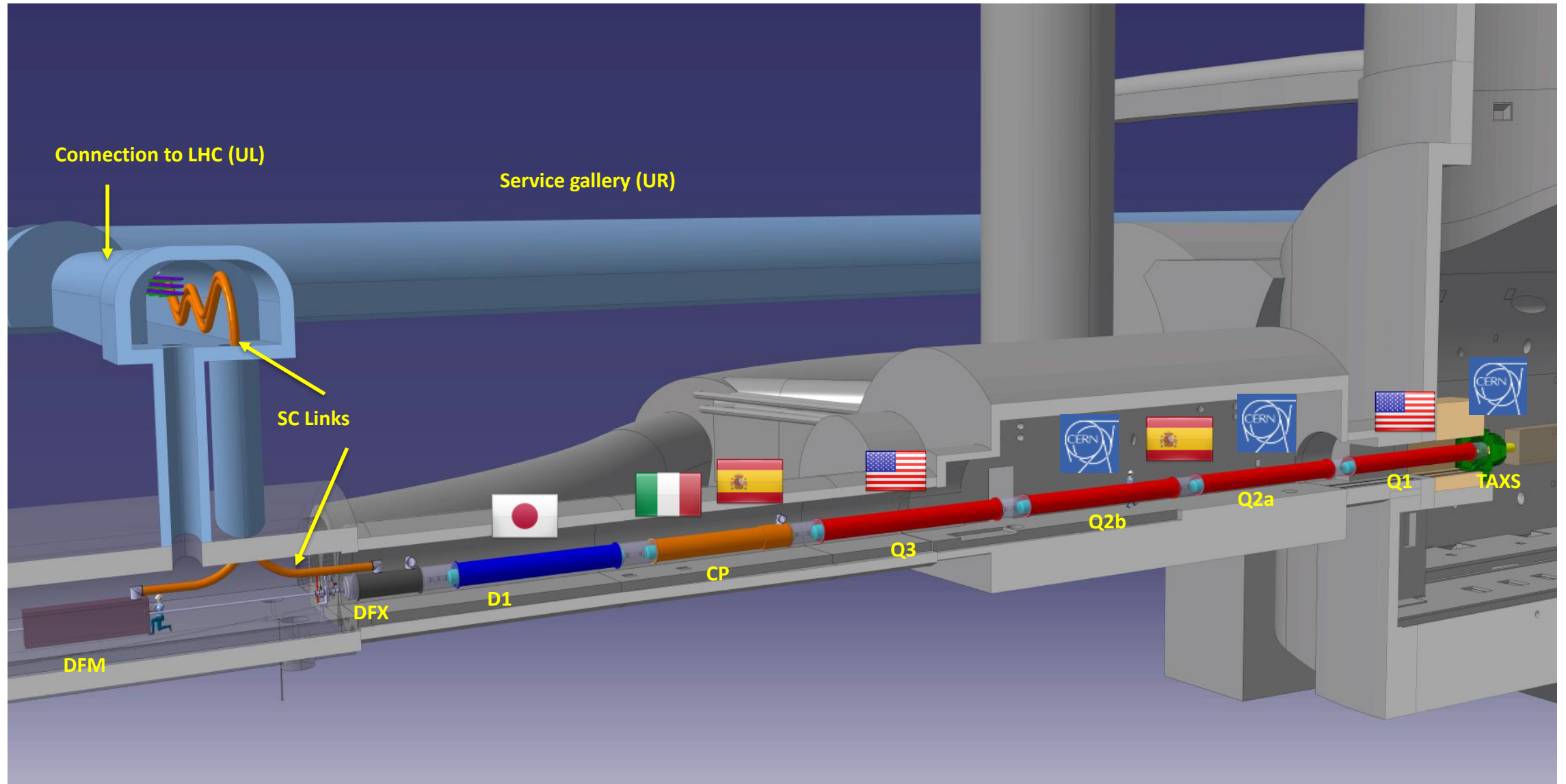
HL-LHC

$5 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$
and 250 fb^{-1} per year

- Smaller beam size at interaction point
- Crossing angle compensation
- Beam from injectors
- Dealing with the regime



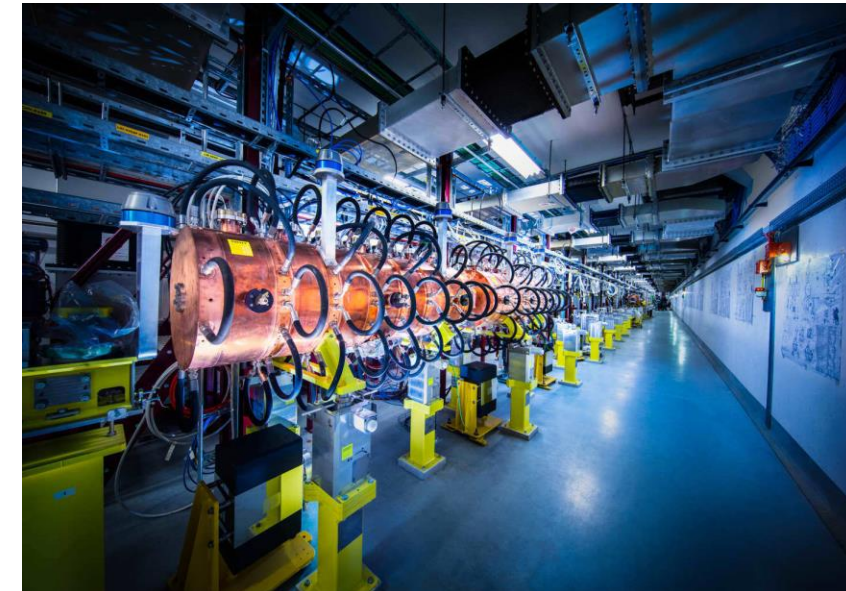
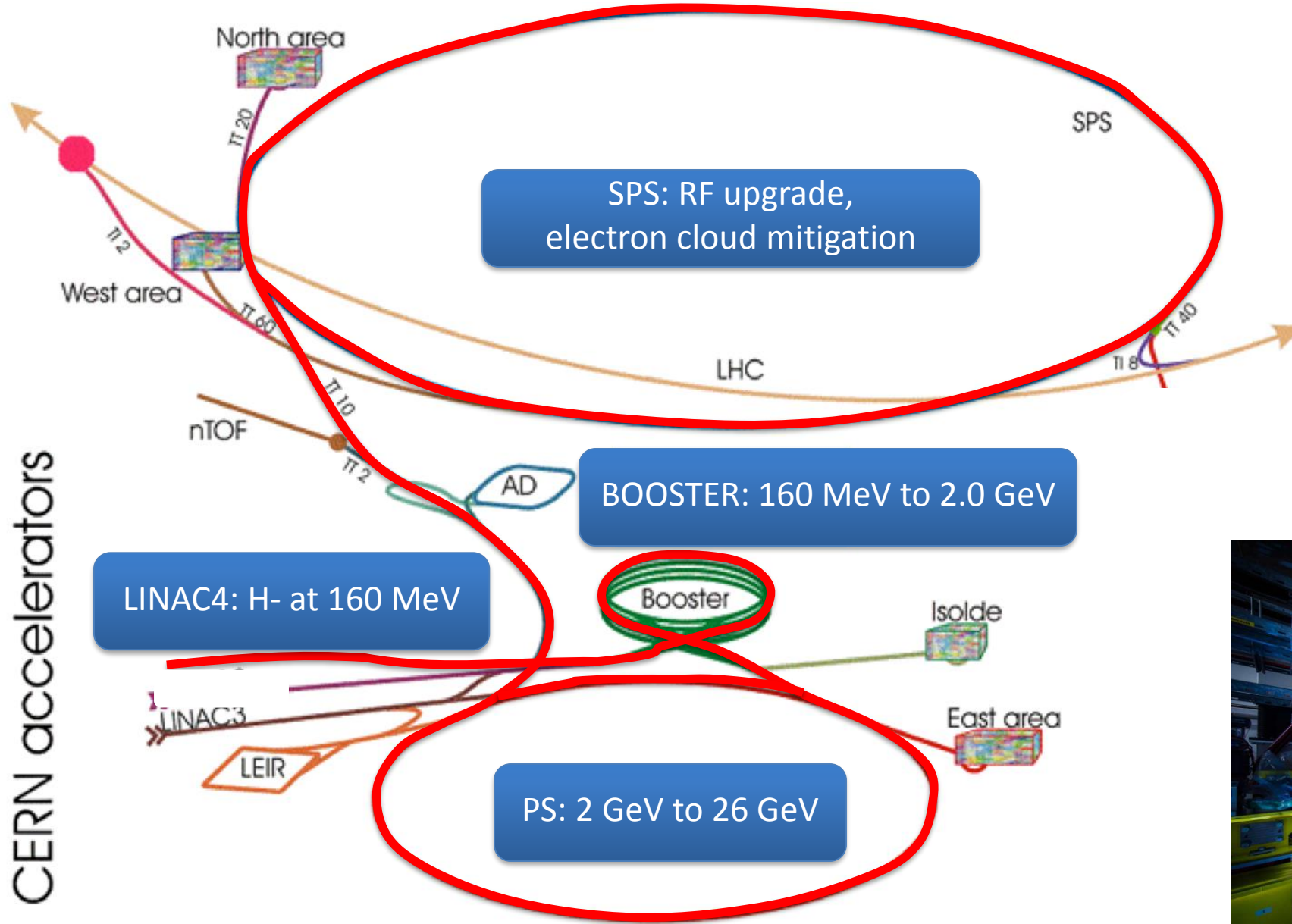
HL-LHC





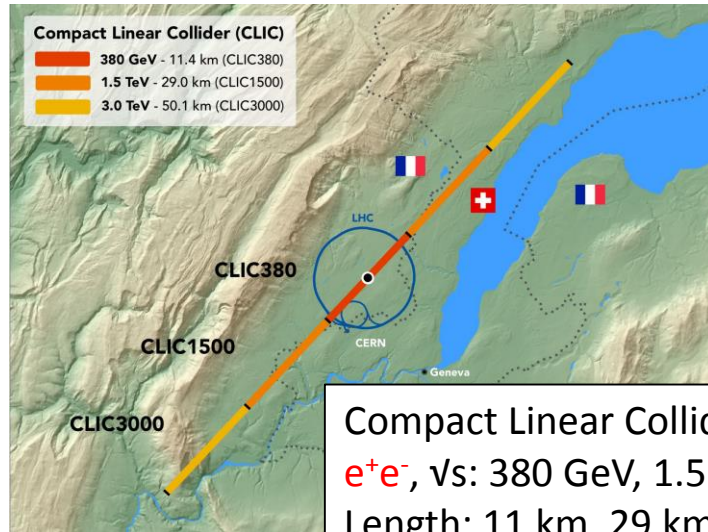
Civil Engineering at points 1 & 5 well underway

LHC Injector Upgrade (LIU)

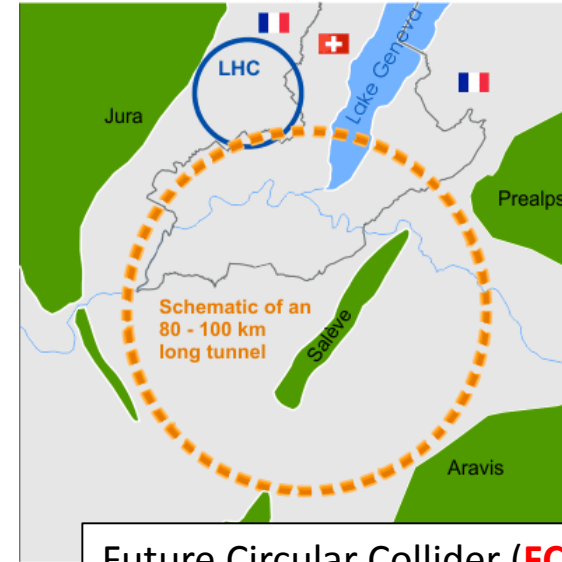


Targeting $\sim 2.3 \times 10^{11}$ protons per bunch

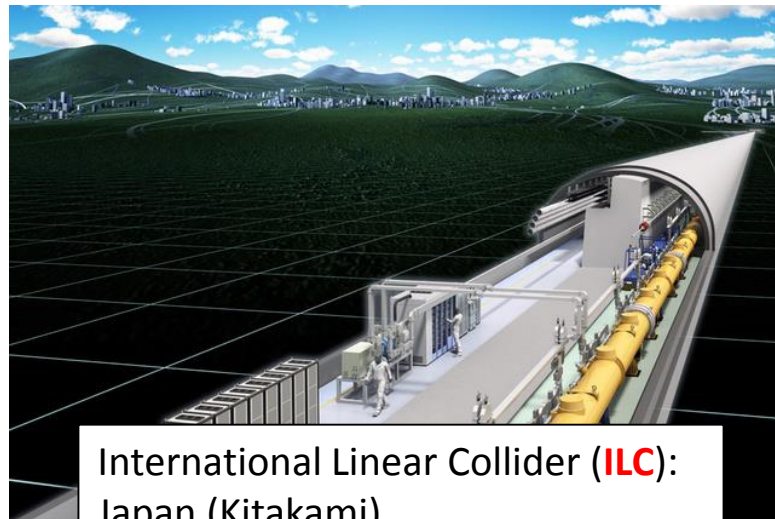
High-energy e^+e^- collider studies



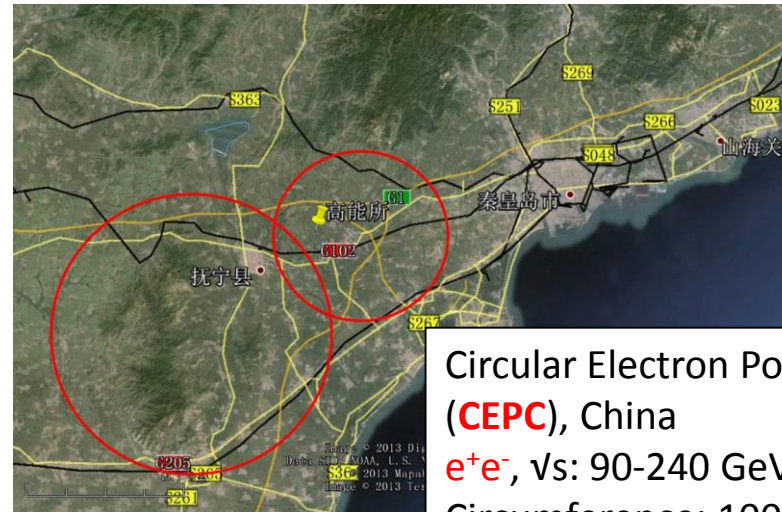
Compact Linear Collider (**CLIC**): CERN
 e^+e^- , \sqrt{s} : 380 GeV, 1.5 TeV, 3 TeV
 Length: 11 km, 29 km, 50 km



Future Circular Collider (**FCC-ee**): CERN
 e^+e^- , \sqrt{s} : 90 - 350 (365) GeV; FCC-hh pp
 Circumference: 97.75 km

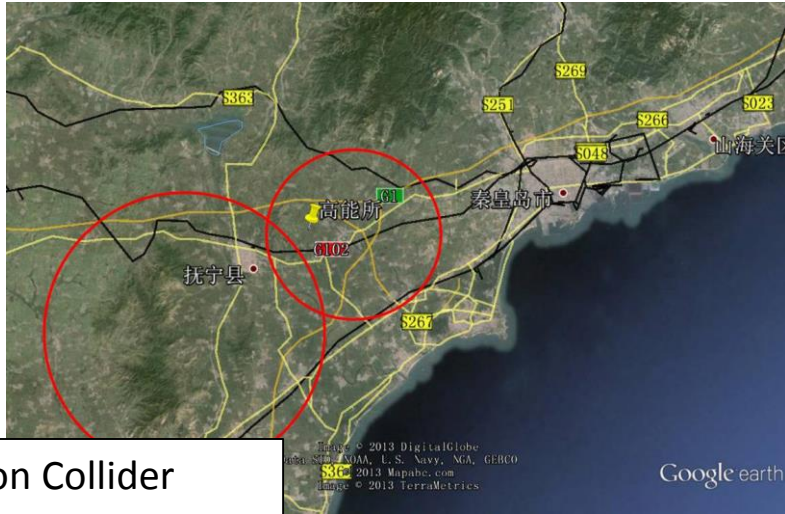


International Linear Collider (**ILC**):
 Japan (Kitakami)
 e^+e^- , \sqrt{s} : 250 – 500 GeV (1 TeV)
 Length: 17 km, 31 km (50 km)

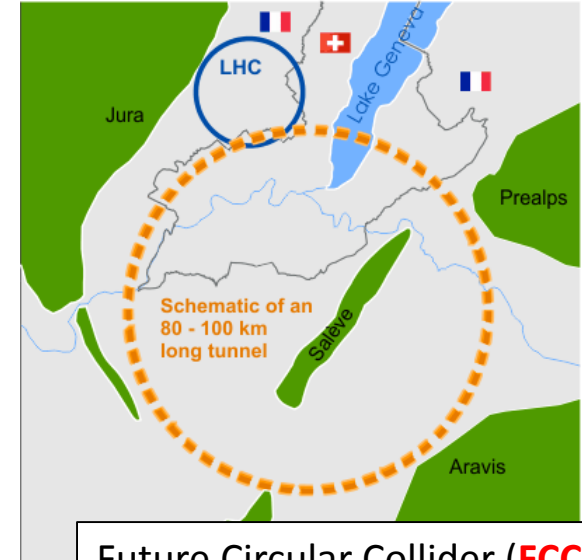


Circular Electron Positron Collider (**CEPC**), China
 e^+e^- , \sqrt{s} : 90-240 GeV; SPPC pp,
 Circumference: 100 km

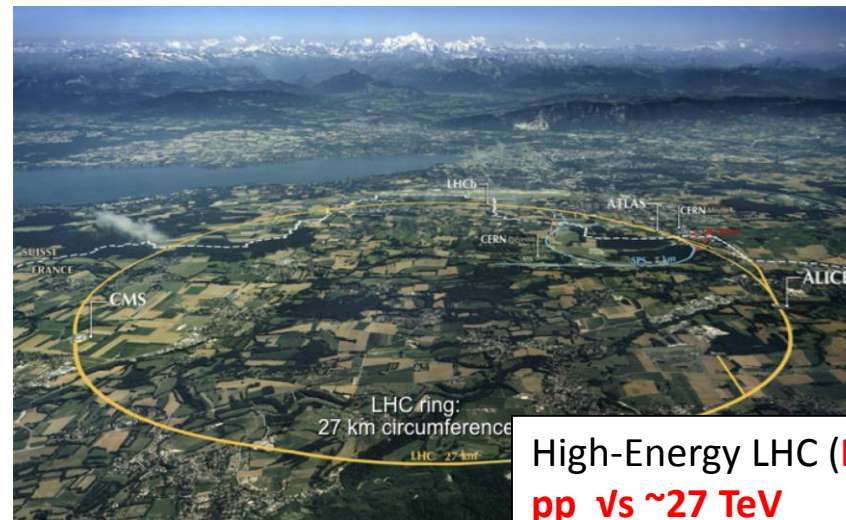
High-energy **pp** collider studies



Super proton proton Collider (**SppC**), China
CEPC; **SPPC vs >70 TeV**
Circumference: 100 km



Future Circular Collider (**FCC-hh**): CERN
FCC-ee; **FCC-hh vs ~100 TeV**
Circumference: 97.75 km



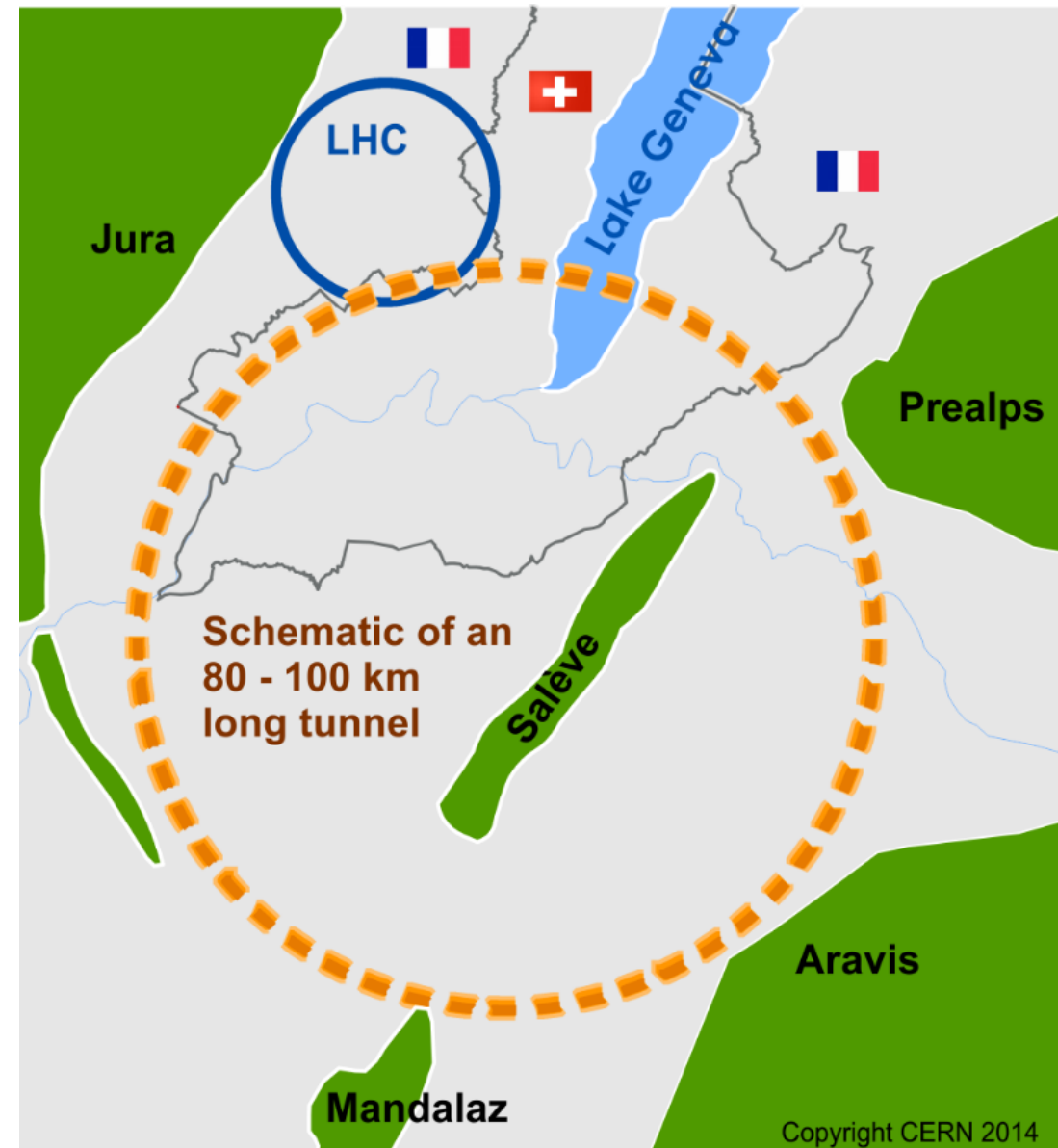
High-Energy LHC (**HE-LHC**): CERN
pp vs ~27 TeV
Circumference: 27 km

Future Circular Collider Study

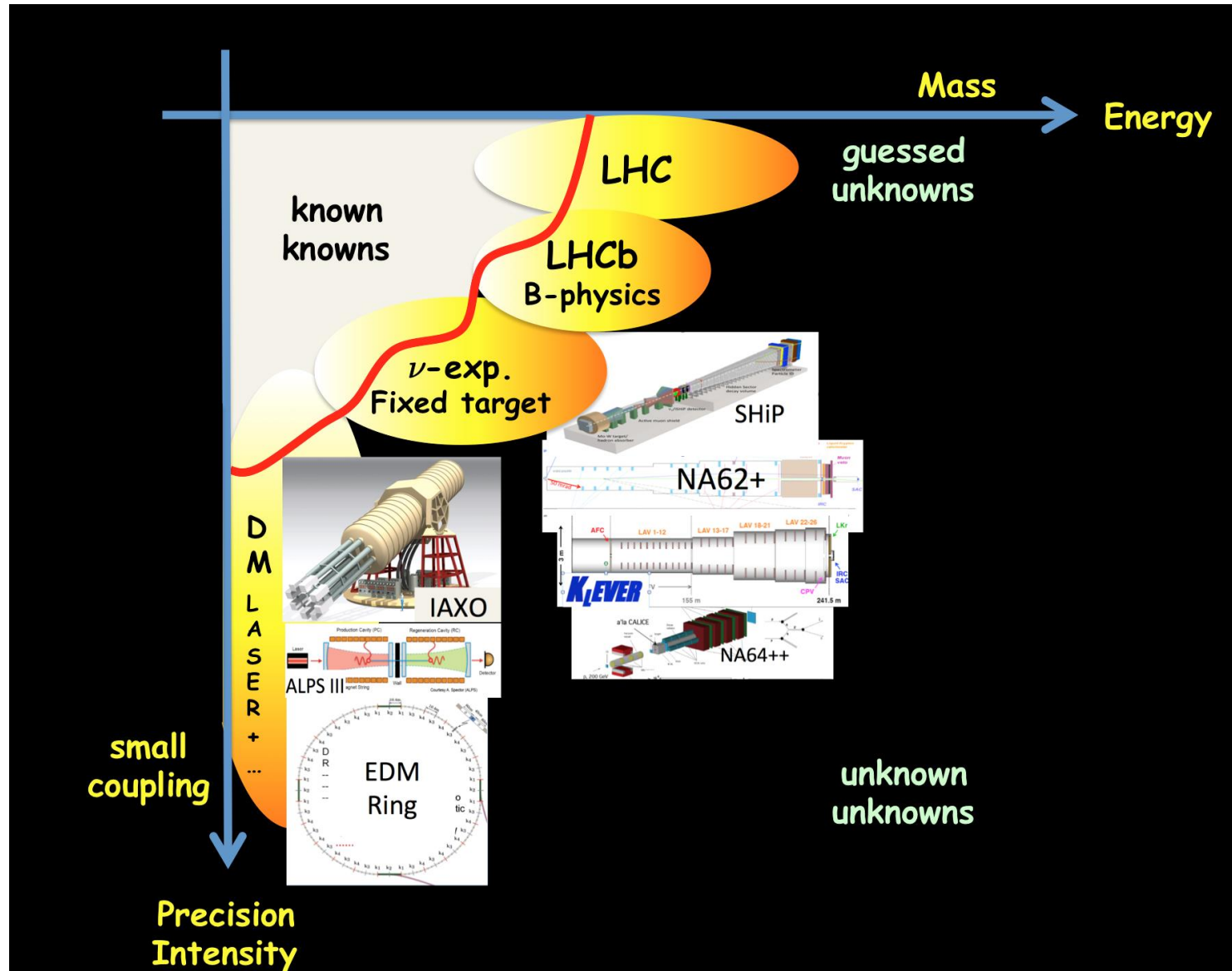
International FCC collaboration
(CERN as host lab) to study:

- **pp -collider (*FCC-hh*)** →
main emphasis, defining infrastructure requirements

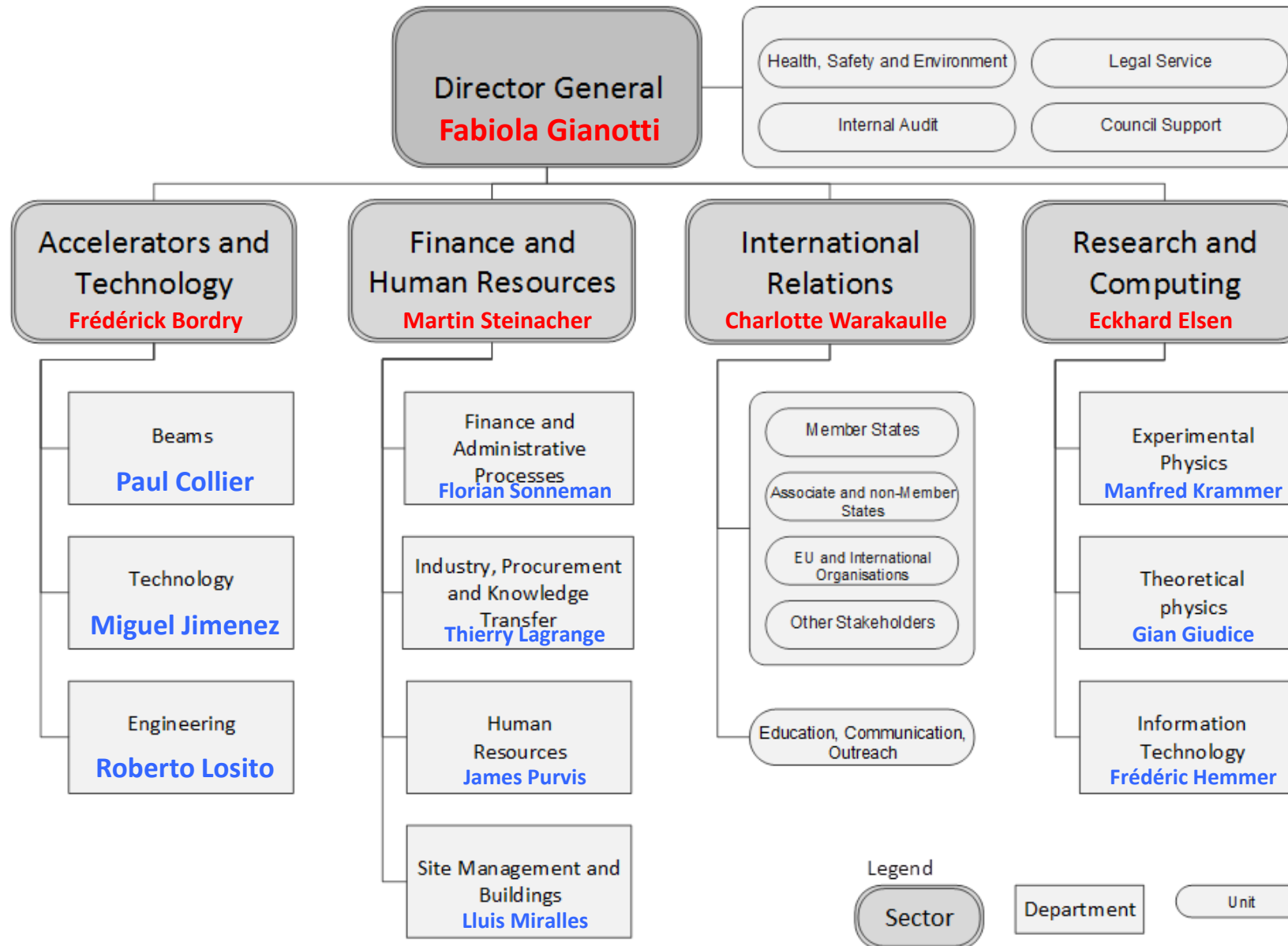
~16 T \Rightarrow 100 TeV pp in 100 km
- ~100 km tunnel infrastructure in Geneva area, site specific
- **e^+e^- collider (*FCC-ee*)**, as potential first step
- **$p-e$ (*FCC-he*) option**, integration one IP, FCC-hh & ERL
- **HE-LHC** with *FCC-hh* technology

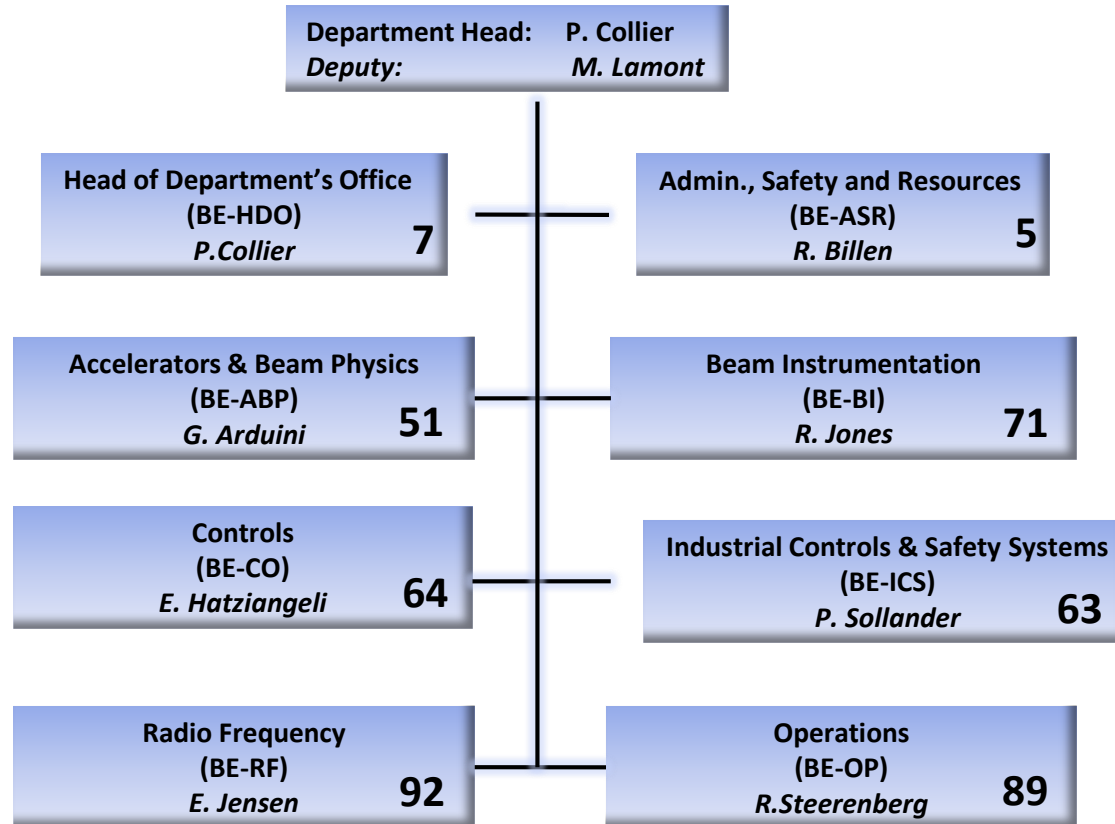


Physics Beyond Colliders!



CERN Management Structure





DAO : J. Kotzian
 DPO : R. Billen
 DSO : M. Tavlet
 DTO : E. Montesinos
 RSO : F. Pirotte
 HRA : S. Bott (HR)

443 Staff
 (31st December 2018)



Activities

Operation/Exploitation:

- Machines,
- Technical Infrastructure
- Experimental Areas
- Site Access & Safety Systems

Projects:

- Consolidation
- Upgrades
- Approved Projects

Studies:

- New Facilities and machines

	Staff	%
Scientific and Engineering	250	56
Technical and Technical Engineering	181	41
Office and Admin	12	3
Total	443	100

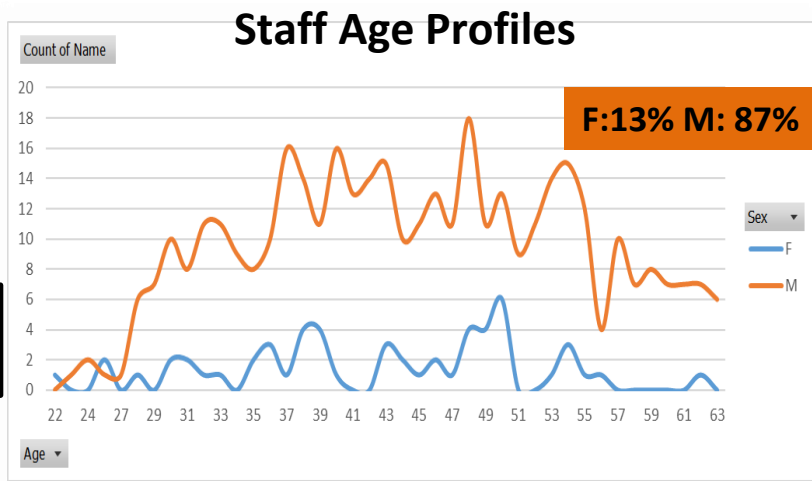
Staff :
 301 on IC contracts, 68 %
 142 on LD contracts, 32 %

Nationality	Number
FR	151
IT	110
GB	78
DE	75
ES	63
CH	50
PL	49
GR	46
RU	38
BE	19
AT	18
SE	17
NL	12
PT	12
US	11
HU	10
FI	9
NO	9
DK	8
JP	8
CN	7
TR	7
UA	6
BG	4
CZ	4
MX	4
AU	3
CY	3
IN	3
IR	3
MT	3
SK	3
PK	2
AL	1
AM	1
BY	1
CA	1
IL	1
LT	1
MG	1
KR	1
RO	1
RS	1
LK	1
TN	1

45 Nationalities

		%
Staff	443	50
Fellows & Trainees	116	13
Doctoral Students	58	7
Technical Students	40	5
Project Associates	41	5
Other Associates	174	20
Total	872	100

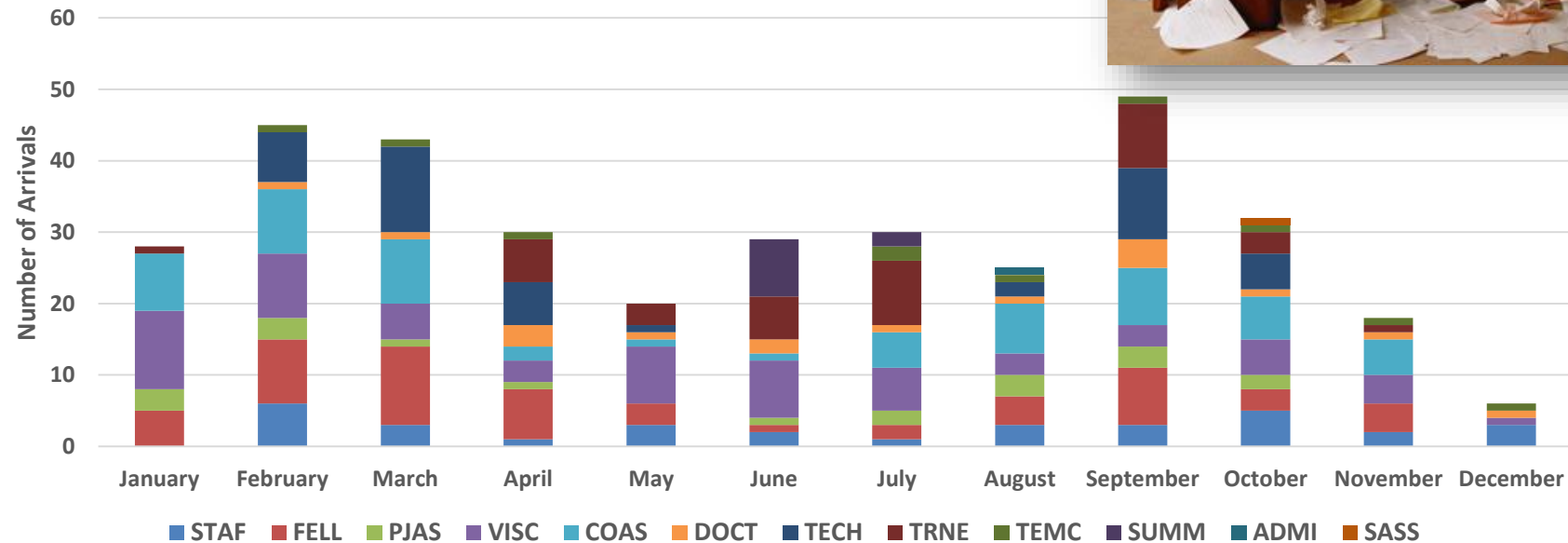
+ 246 colleagues in Industrial support contracts
 + 90 colleagues in a partnership contract (ADAM)



Only *half* of all people working in BE are *staff members* – the other types of personnel are a vital resource to allow the department to fulfil its mandate

HDO: Head of Department Office

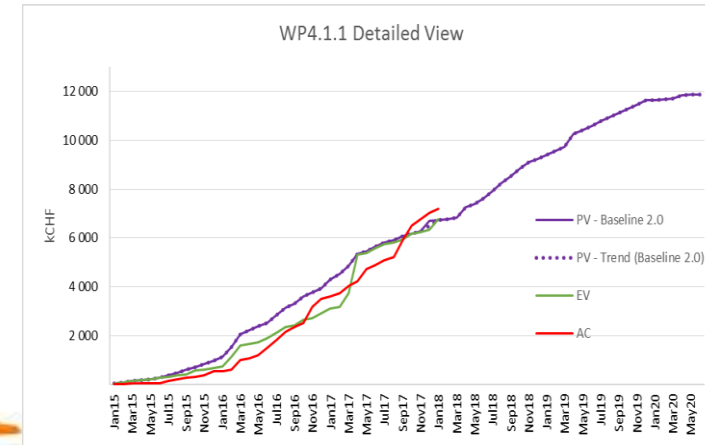
HDO Looks after the general administration of the department



ASR: Administration, Resources & Safety Group

The ASR group is responsible for:

- The overall management and planning of departmental resources
- Safety in the beams Department and safety during operation of all beam facilities at CERN

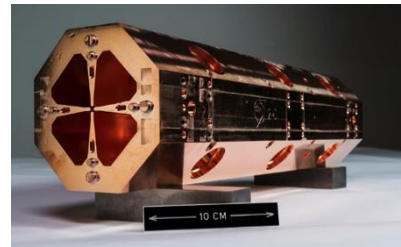


Group Leader
Ronny Billen



ABP: Accelerators and Beam Physics Group

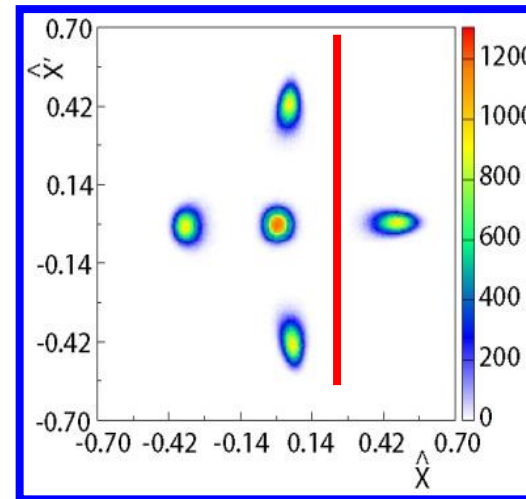
- Accelerator Physics & beam dynamics studies over the complete CERN accelerator complex with the aim of improving accelerator performance.
- Providing operational support for the exploitation of the complex.
- Operation, maintenance and development of hadron sources and Linacs,
- Development and maintenance of accelerator physics computer codes
- Beam and machine parameters and beam dynamics studies for the LHC and Injector Upgrades
- Studies for future accelerators, New Acceleration Techniques and Medical Accelerators.
- Teaching accelerator physics in international schools



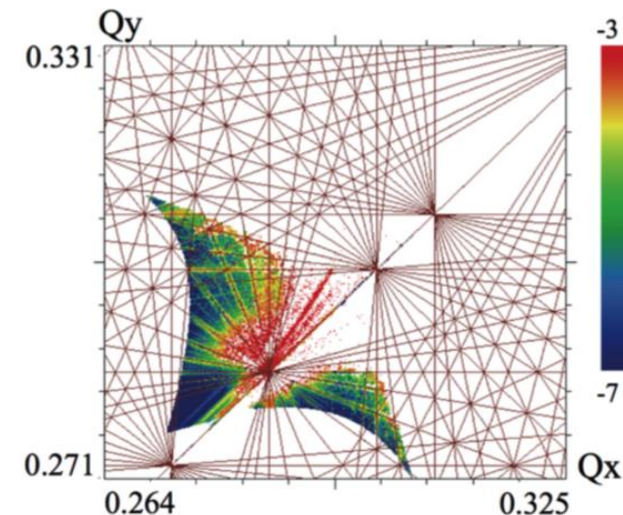
750 MHz RFQ



Group Leader
Gianluigi Arduini



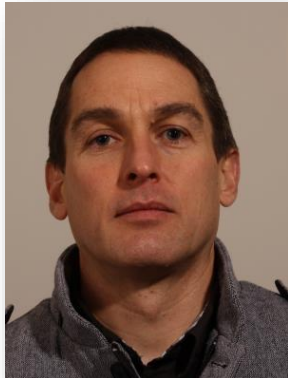
PS Multi-turn Extraction
Scheme



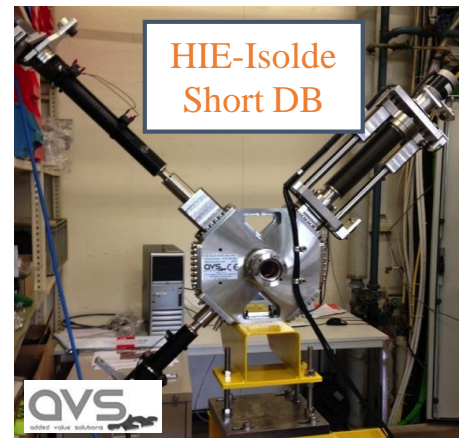
Uncompensated Beam-Beam
Footprint in HL-LHC

BI: Beam Instrumentation Group

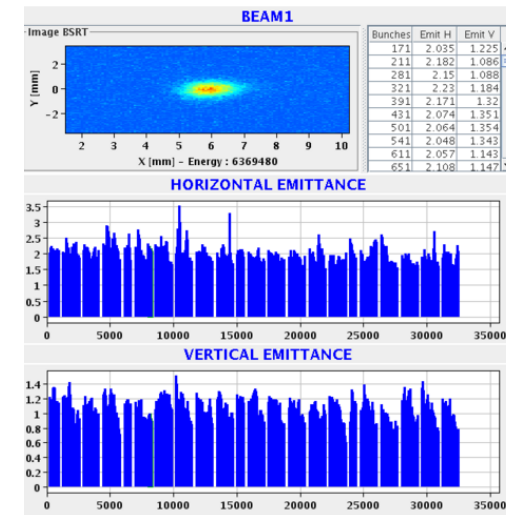
- Responsible for designing, building and maintaining the instruments that allow observation of the particle beams and the measurement of related parameters for all CERN accelerators and transfer lines.
- It is also engaged in research and development to improve existing detection techniques and explore new avenues to allow further optimization of the current machines and to meet the challenges associated with future accelerators.
- Activities include: accelerator physics, detector technology, custom built electronics, mechanical and vacuum engineering for detector housings and software engineering.



Group Leader
Rhodri Jones

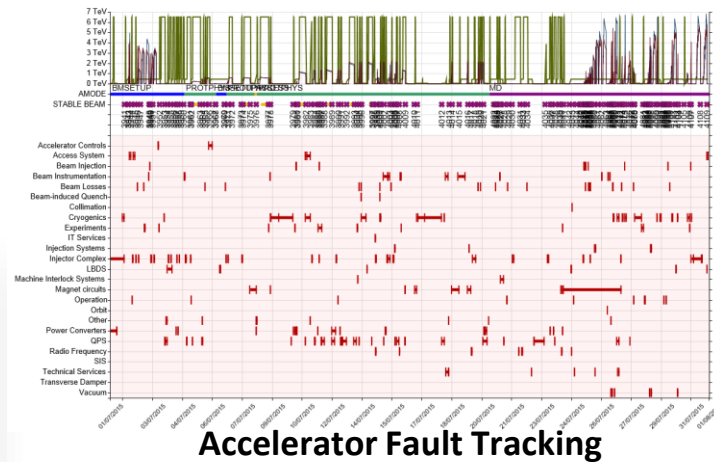


AD Cryogenic Current Comparator

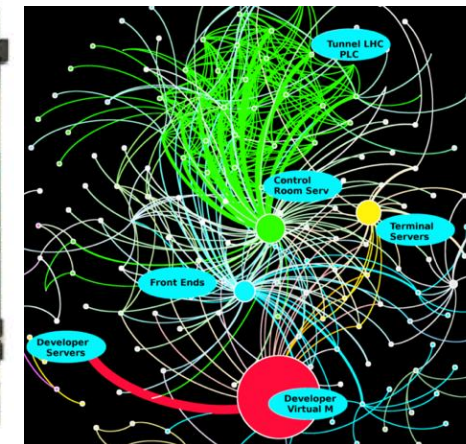


CO : Controls Group

- Responsible for the controls infrastructure for all CERN accelerators, transfer lines and experimental areas
- Covers from embedded front end controllers up to the applications software
- Provides standardised hardware and software services and frameworks as well as timing distribution, signal observation, alarms, surveillance, logging and data management
- Also provides desktop support to the department as well as security policy and electronic instrument repair and calibration



Group Leader
Eugenia Hatziangeli

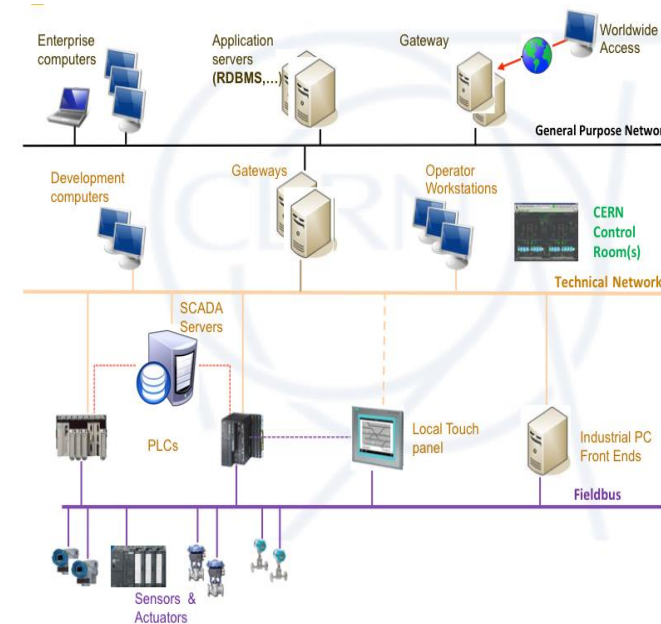
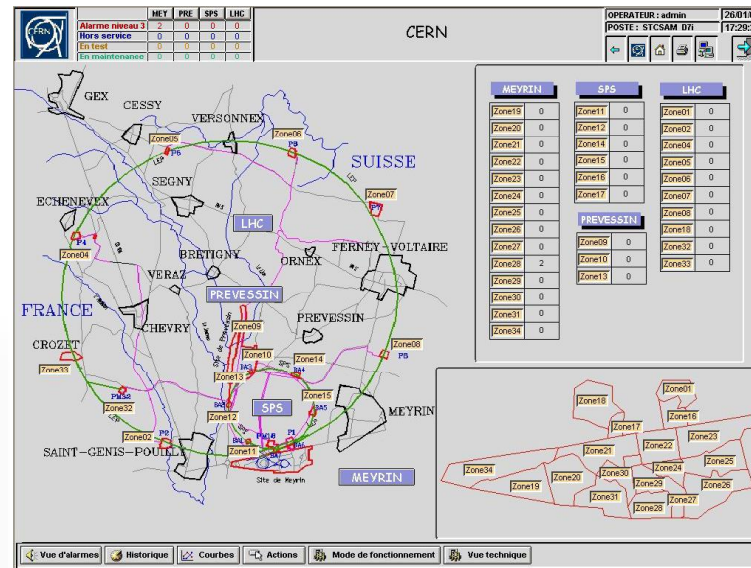


ICS: Industrial Controls and Safety Systems Group

- Design, implement, install, maintain and support
 - ✓ CERN's safety and access control systems (site and machines)
 - ✓ Industrial control systems for experiments, technical infrastructure, accelerator interlocks and other equipment
- Evaluate, select and support related tools and technologies
- Provide the necessary tools, frameworks and interfaces to integrate these systems in the CERN environment

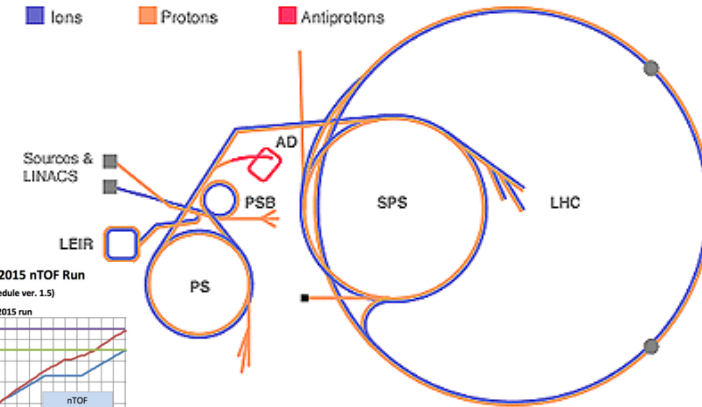
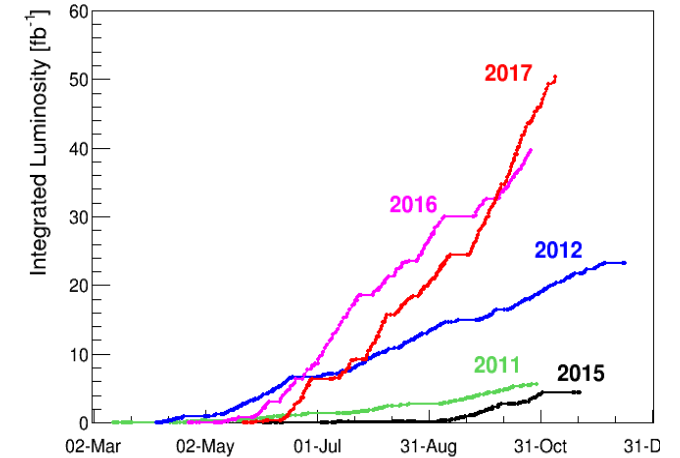
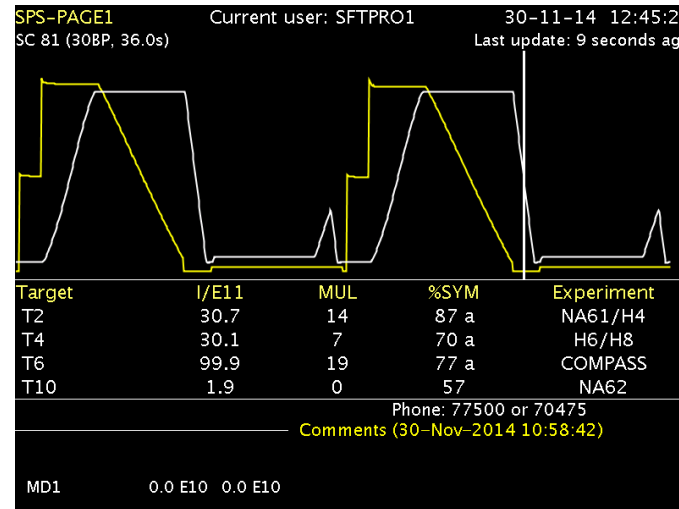


Group Leader
Peter Sollander

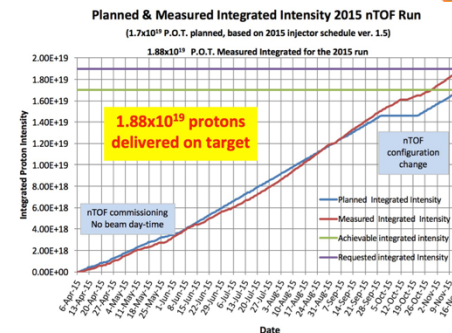


OP: Operations Group

- Responsible for the co-ordination & operation of all CERN accelerators and experimental areas including safety and access in the installations
- Monitoring of the technical infrastructure for the whole CERN site
- Wide range of additional activities including machine studies, application software, operational procedures & statistics

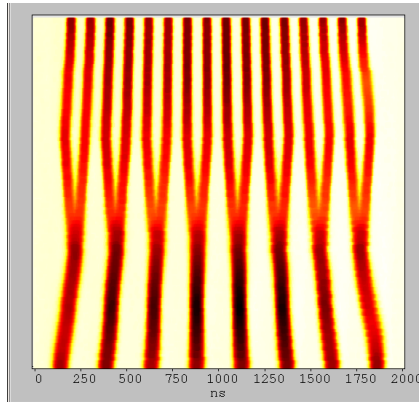


Group Leader
Rende Steerenberg

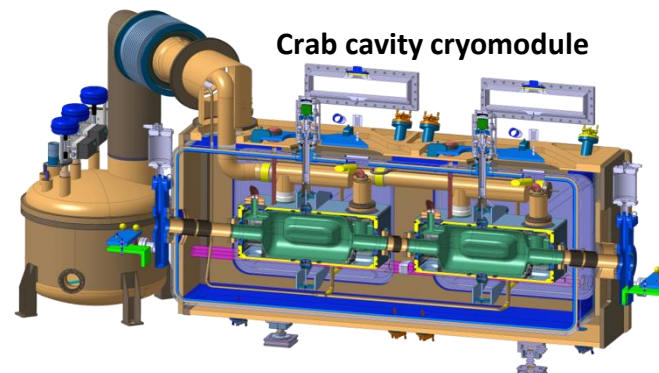


RF: Radio Frequency Group

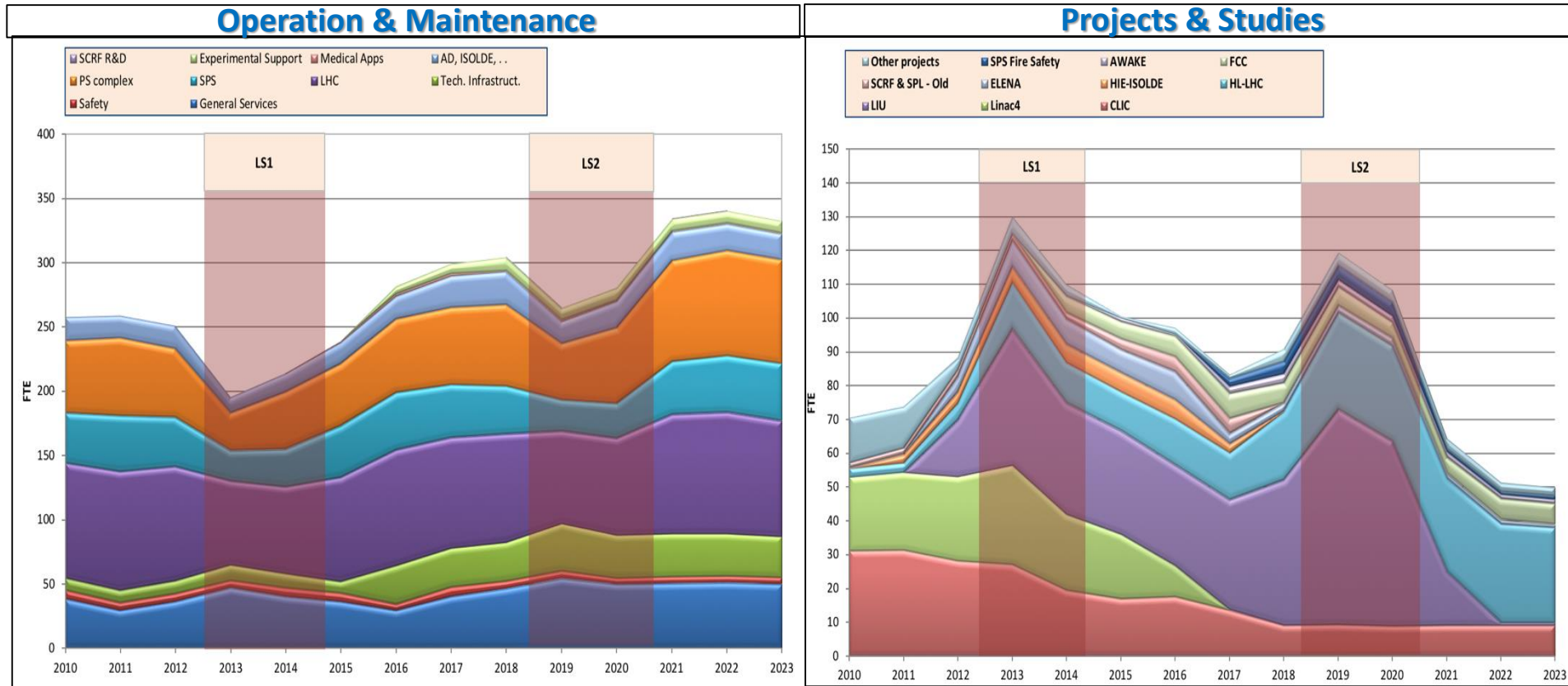
- Responsible for the accelerating and damping systems for all accelerators at CERN, including:
 - Operation, maintenance and upgrades of these systems in all existing machines
 - Design and construction for new approved machines ;
 - Research & development and design studies for future machines
- RF parameters and longitudinal dynamics in present and future accelerators



Group Leader
Erk Jensen



Staff plan: projects and operations



The manpower of the department changes activities to match the rhythm of our machines!

This flexibility is vital to meeting our (& CERN's) overall goals

It also, we hope, makes life even more interesting and stimulating for all of us!

Safety at CERN and in BE

Safety =

- ✓ Health and safety of all persons possibly impacted by CERN activities
- ✓ Operational safety
- ✓ Impact on the environment

The responsibilities in matters of safety follow the hierarchical line.

→ YOU are responsible for all safety aspects related to your activities!

→ Your supervisor is the first person to consult in case of doubt.

Please be aware of the safety rules and apply them.

Hazards and Risks in BE

The main hazard you are probably thinking of when you come to CERN is **radiation**.

Indeed, the operation of particle accelerators produce radiation.

Operation of accelerators also requires **electricity, produces RF waves, magnetic fields, may include operation of powerful lasers...**

The equipment groups, with the help of the BE Safety Unit manage these risks.

Be aware of the risks you are exposed to when doing your job.

→ Fill-in carefully your OHS-0-0-3 form with your supervisor.

+ Follow the appropriate safety training.

Hazards and Risks at CERN and in BE

Accident statistics show that the main hazard you are exposed to when coming to CERN and working on the sites is...

Road traffic !

Especially (but not only) if you are a cyclist.

- Be aware of the traffic rules (same as in cities in France or Switzerland)
- Respect the traffic rules
- Respect other road users
- If you are a cyclist, wear appropriate protections and high-visibility clothing ...
(that you can get from the CERN stores with your Group budget)



Who can help you?

Marc Tavlet
Chef section
DSO



Christelle
Gaignant
DDSO

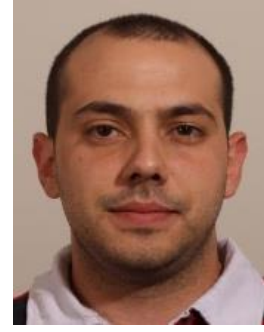


Florence
Pirotte
RSO



+ Safety Officers for the A&T Sector
CSO LSO FGSO

Olivier Pirotte Bruce Marsh David Jaillet



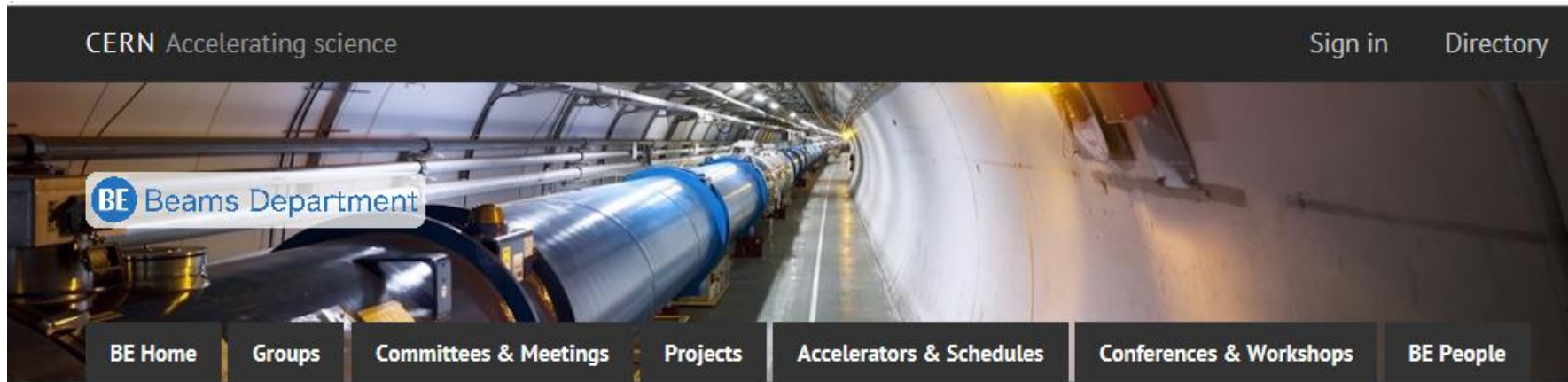
You are not left on your own; look for help in case of doubt:

- Your supervisor ; he/she is responsible
- Your colleagues ; they may have the knowledge
- **The Safety Officers in the BE Safety Unit**
- The Safety Link Persons and Radiation Support Officers in your Group
- **The Territorial Safety Officer (TSO) of your building**
- The HSE Unit

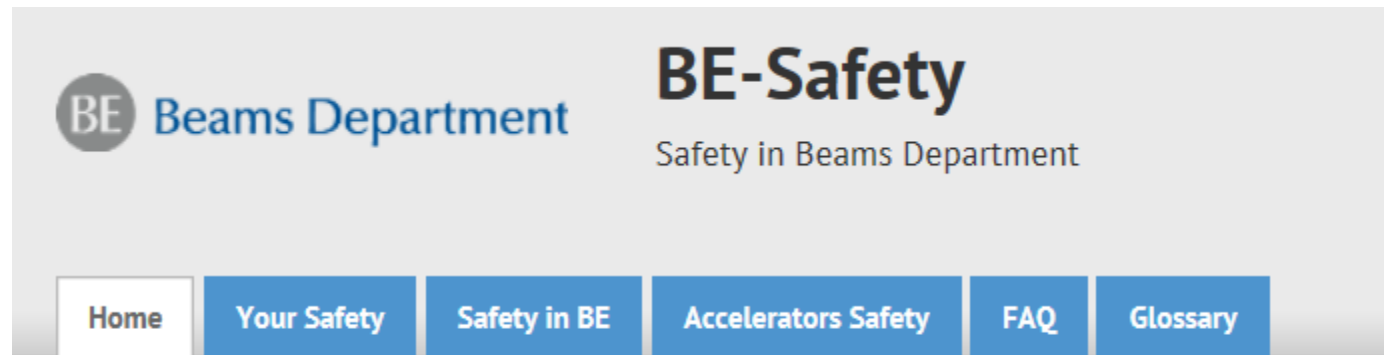
**For your building TSO
See the BE Safety
Web Pages**

Safety in BE: More Information?

Consult the BE Safety website



[Mandate](#) [Organigram](#) [Roles & Representatives](#) [Administration](#) [Safety](#) [Services](#) [Training](#) [BE Annual Reports](#)



[Safety Unit](#) [Safety Officers in BE](#)

SECURITY is not complete without U

CERN is targeted. YOU are a target!

From: Evelyn [mailto:evelyn@cern.com]
Sent: 11 January 2016 15:29
To: [REDACTED]
Subject: Congratulations David

Dear colleagues,

Some of you might know David as the kind man he is. It has been 20 years ago since he first joined the financial department. To celebrate his anniversary, we have prepared a video for David. Click here<<http://support.x10.bz/?c=8gf3&u=01f4e8c8>> to view this video.

With kind regards,
Head administration
Evelyn



Don't let them in:

- **Stop --- Think --- Don't open dubious links & attachment!**
- **Don't share your password!**

Let us help you: Computer.Security@cern.ch

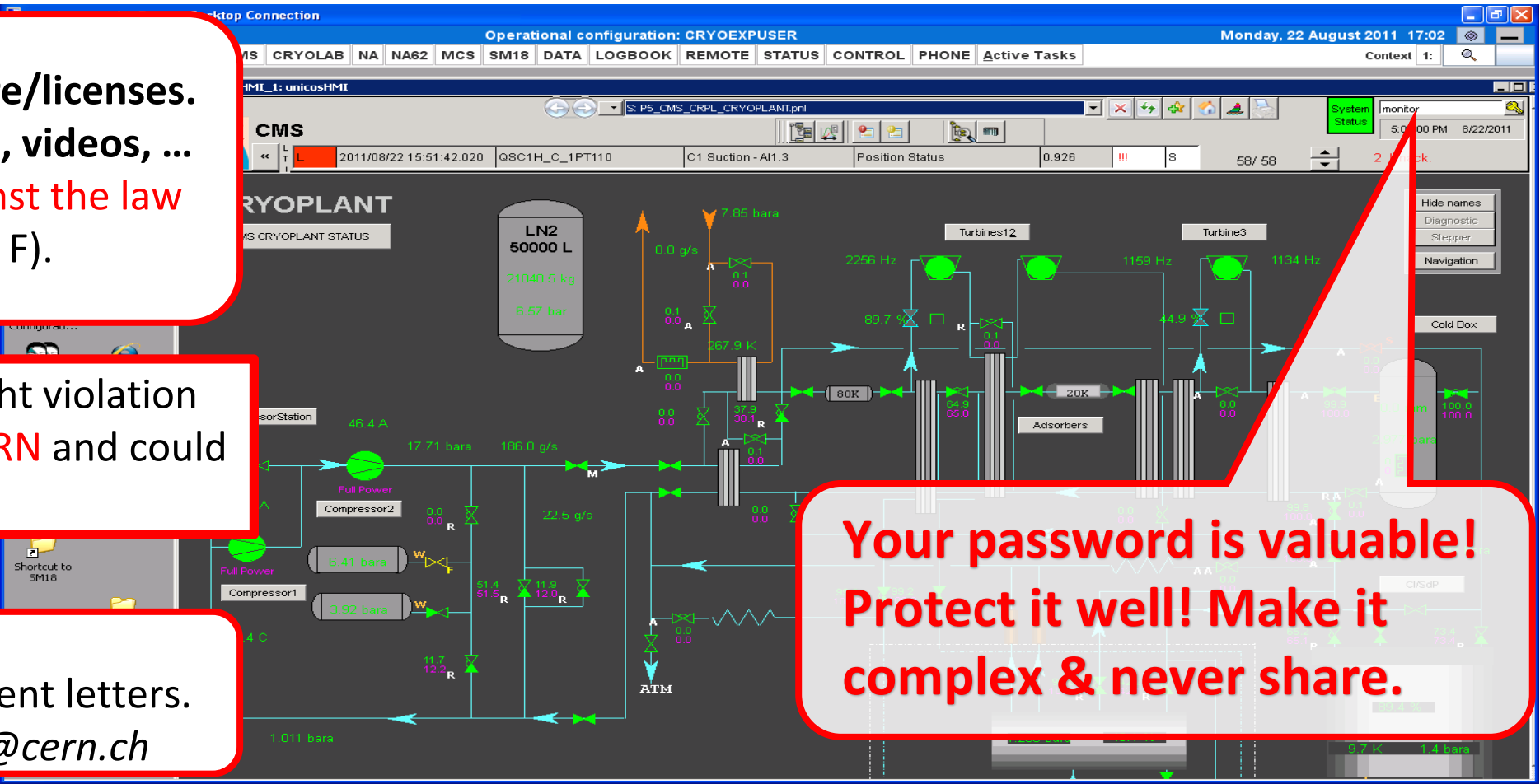


It is the responsibility of all of us to improve CERN's computer security!

Do not use pirated software/licenses.
Respect copyright of music, videos, ...
Violating copyrights is **against the law**
in many countries (incl. CH, F).

Software piracy and copyright violation
will **reflect negatively on CERN** and could
harm its reputation.

Let us help you.
Do not answer to infringement letters.
Contact Computer.Security@cern.ch



Your password is valuable!
Protect it well! Make it
complex & never share.

Contact us and let us help you: Computer.Security@cern.ch

Help!

HR FRONTLINE, provides services in the following areas:

- o Day-to-day work and career concerns of CERN contributors
- o Support to supervisors in their HR and people activities
- o Putting into operation the HR Strategy
- o Support to change management activities

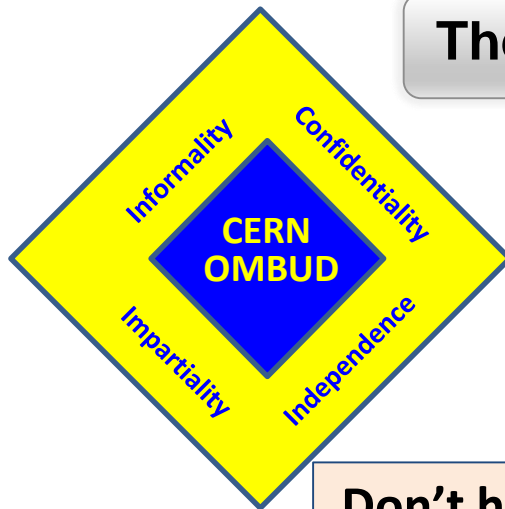


Sebastian Bott

Human Resources Advisor for **BE**
Member of the HR **Frontline** team

Permanance 865/1-012 Monday & Friday mornings

The CERN Ombuds – There to help!



Pierre Gildermyn

Office: Bldg 500-1-004
eMail: Ombuds@cern.ch



Don't hesitate to contact them for help, or advice!

Training

CERN's centrally defined training and BE policy

If you do not speak French at all

Mandatory for ALL newcomers

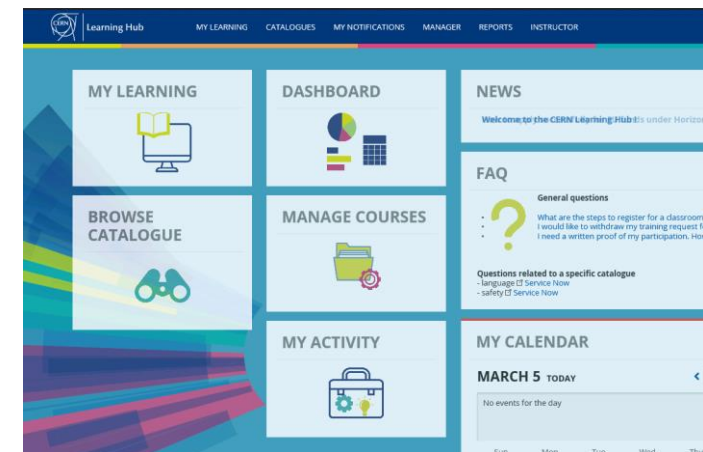
Training	Duration	Who	Before
Language Integration	60 hours 10 weeks	MPE MPA contract > 6 months	Month 3
Communication 1+2 (Newcomers)	2 x one day	Once per career Staff (Fellows + MPA) on request	Month 2 Month 6

For **you** and **your supervisor** to define your training needs, regarding your function and your role



DTO:
Eric Montesinos

In BE, any training request shall be linked to functions and roles



Finally...

- **BE Seminars:**
 - Friday Afternoon, every ~4 weeks,
 - Alternate between Meyrin (6) and Preveessin (774) Auditorium
 - Organized by Efthymia Laderi
- **ATS Seminars:**
 - Thursday Afternoons, Similar frequency
 - Jointly organized by the departments. For BE its Helmut Burkhardt
- **BE Newsletter:**
 - Published every ~3 months
 - Editor-in Chief: Lars Jensen

Your input and contributions are very welcome!

...and, of course, lots of stuff to look at on the BE and CERN websites ...



LHCb

ATLAS

CERN Meyrin

CERN Prévessin

SPS 7 km

PS 4.25 km

ALICE

CMS

Have fun out there!

LHC 27 km

SUISSE
FRANCE