

CERN

European Organization for Nuclear Research
Organisation Européenne pour la Recherche Nucléaire

Accelerate your career with work experience at the frontiers of science and technology

Mick Storr

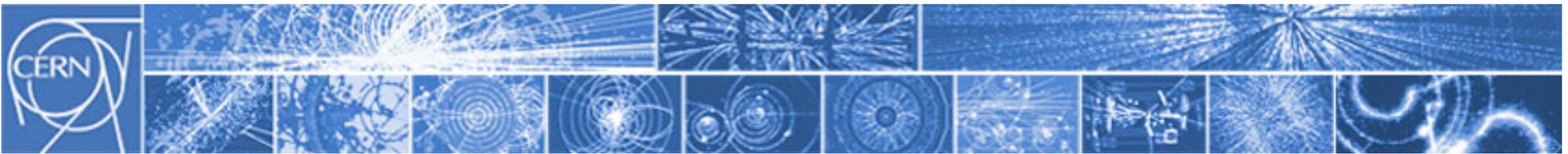
CERN

Geneva, Switzerland

University of Birmingham Work Experience Fair

3/2/2010

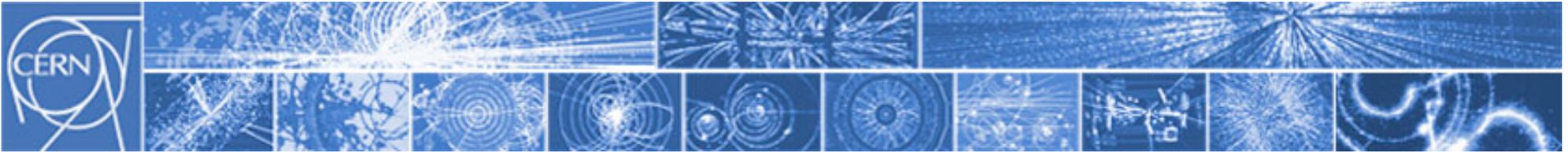




30th November 2009 LHC sets new world record

Early this morning CERN's Large Hadron Collider become the world's highest energy particle accelerator, having accelerated its twin beams of protons to an energy of **1.18 TeV**. This exceeds the previous world record of 0.98 TeV, which had been held by the US Fermi National Accelerator

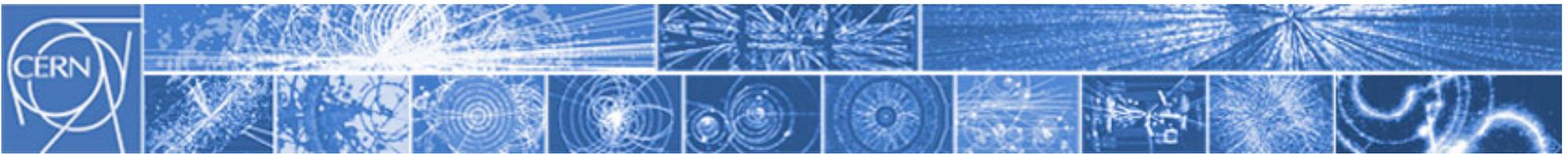




Goals



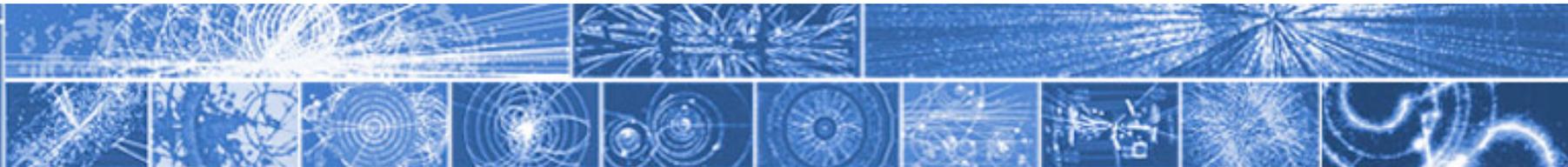
- Introduce CERN
- Describe work experience opportunities
- Q/A
- LHC - what next ?



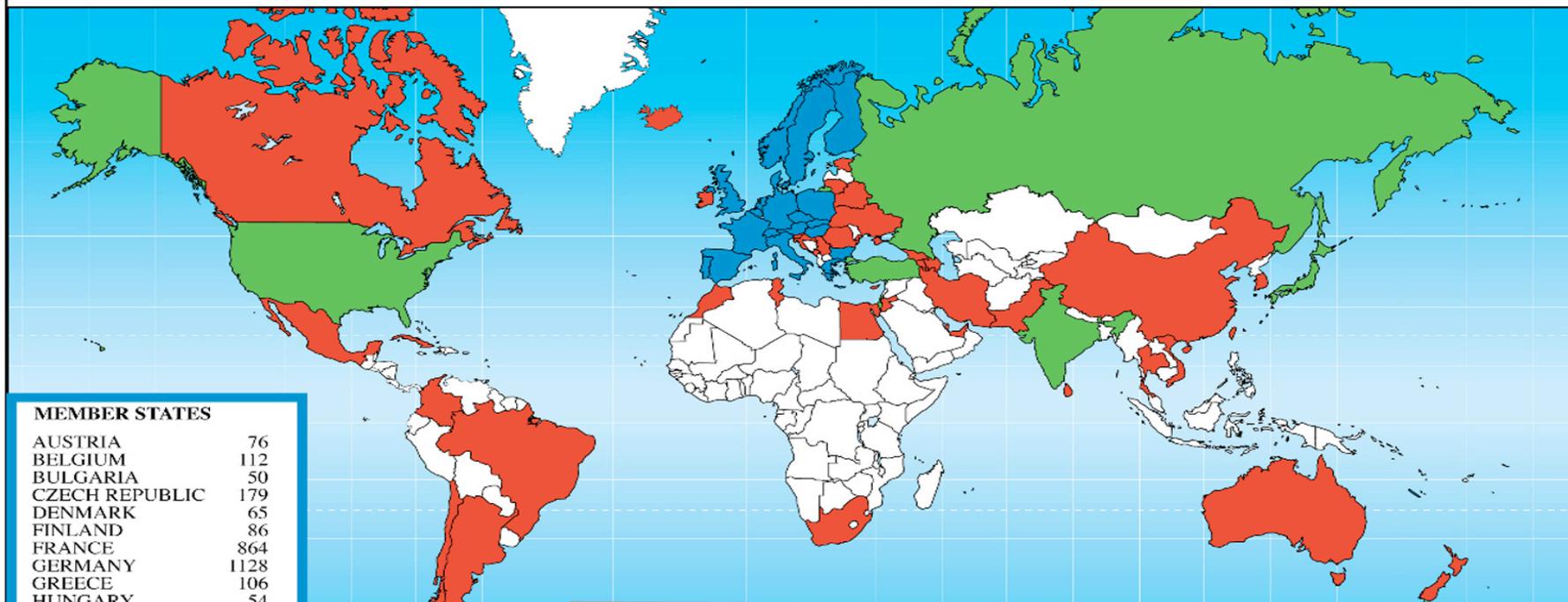
CERN

- **Budget 2009:**
1,100 million CHF
(£650 million)
- Each member state
pays in proportion
to GDP
- UK pays 15%
(£97 million) per year
- £1.60 : one cup of
coffee per person
per year





Distribution of All CERN Users by Nation of Institute on 27 October 2009



MEMBER STATES

AUSTRIA	76
BELGIUM	112
BULGARIA	50
CZECH REPUBLIC	179
DENMARK	65
FINLAND	86
FRANCE	864
GERMANY	1128
GREECE	106
HUNGARY	54
ITALY	1455
NETHERLANDS	166
NORWAY	76
POLAND	190
PORTUGAL	123
SLOVAKIA	56
SPAIN	303
SWEDEN	72
SWITZERLAND	363
UNITED KINGDOM	728

6252

OBSERVER STATES

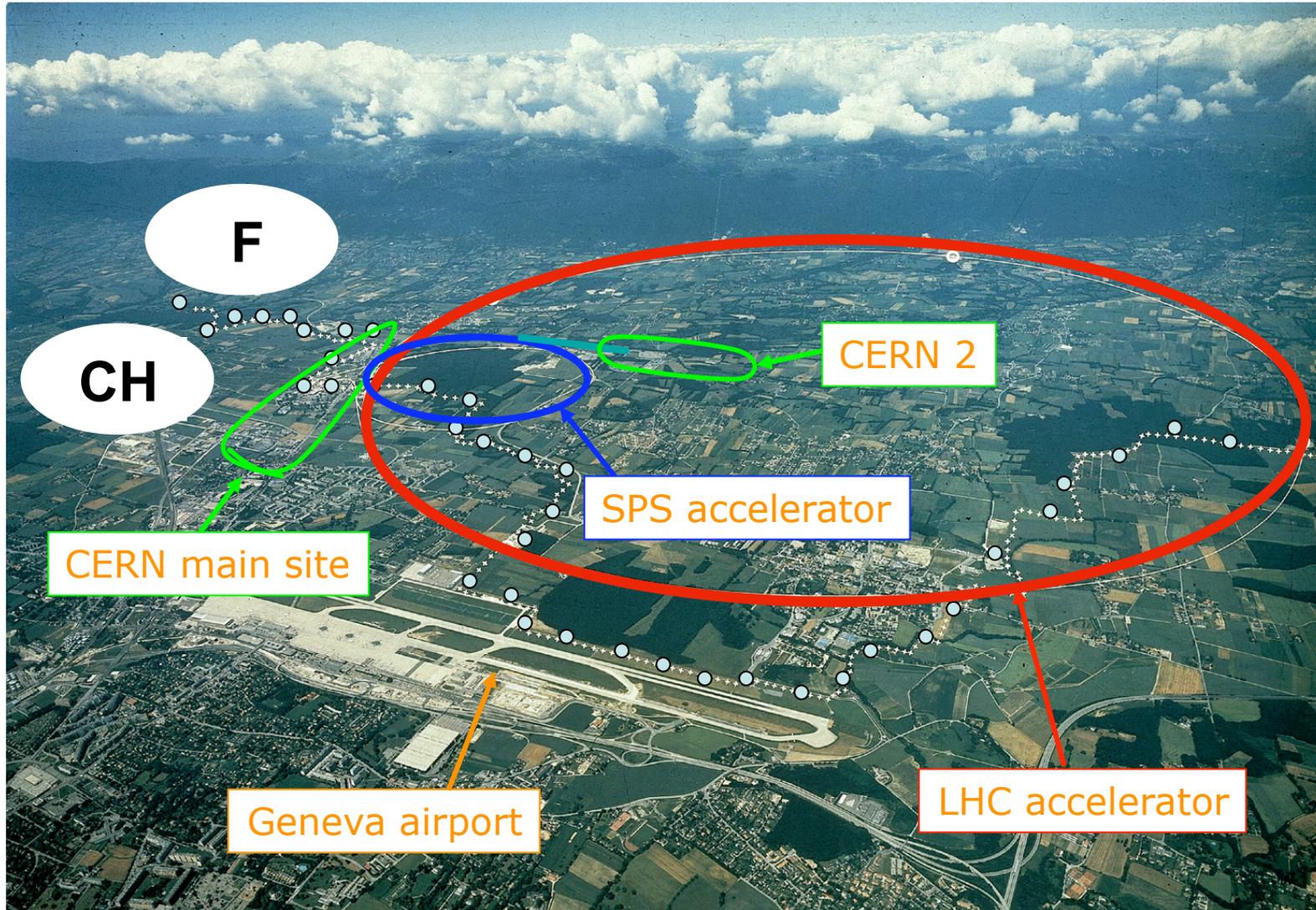
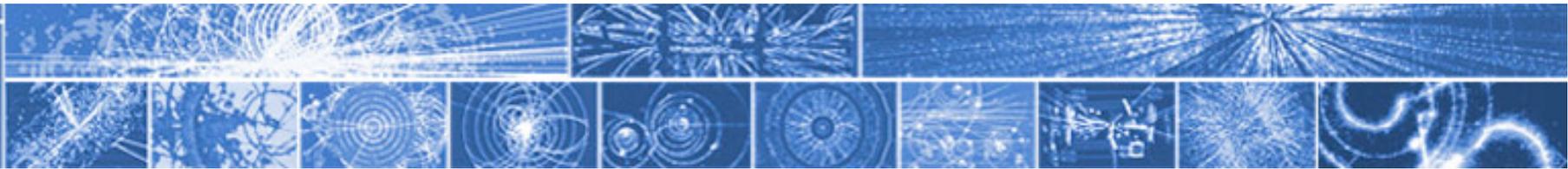
INDIA	97
ISRAEL	55
JAPAN	203
RUSSIA	915
TURKEY	64
USA	1629

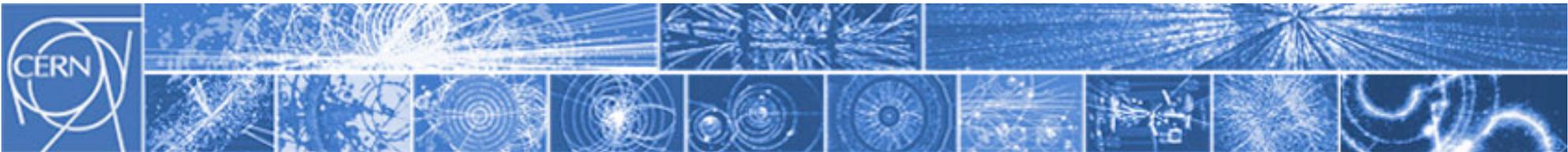
2963

OTHERS

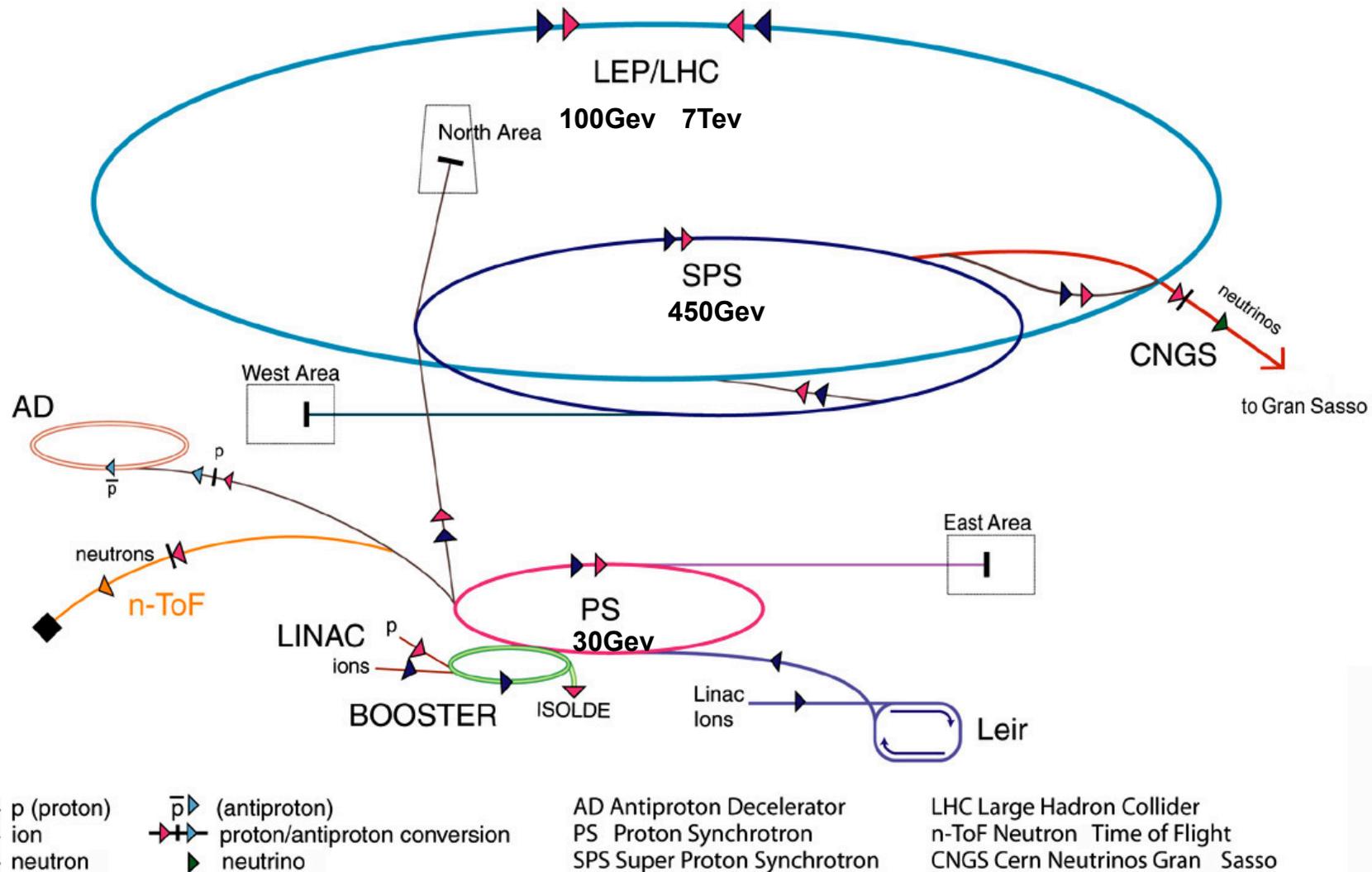
ARGENTINA	8	CROATIA	19	MALTA	1	THAILAND	1
ARMENIA	15	CUBA	4	MEXICO	30	TUNISIA	1
AUSTRALIA	15	CYPRUS	8	MONTENEGRO	1	UKRAINE	17
AZERBAIJAN	1	EGYPT	2	MOROCCO	5	U.A.E.	1
BELARUS	19	ESTONIA	11	NEW ZEALAND	8	VIETNAM	1
BRAZIL	71	GEORGIA	10	PAKISTAN	18		
CANADA	143	ICELAND	1	QATAR	1		
CHILE	3	IRAN	12	ROMANIA	53		
CHINA	85	IRELAND	13	SERBIA	20		
CHINA (TAIPEI)	57	JORDAN	1	SLOVENIA	17		
COLOMBIA	12	KOREA	61	SOUTH AFRICA	9		
		LITHUANIA	6	SRI LANKA	1		

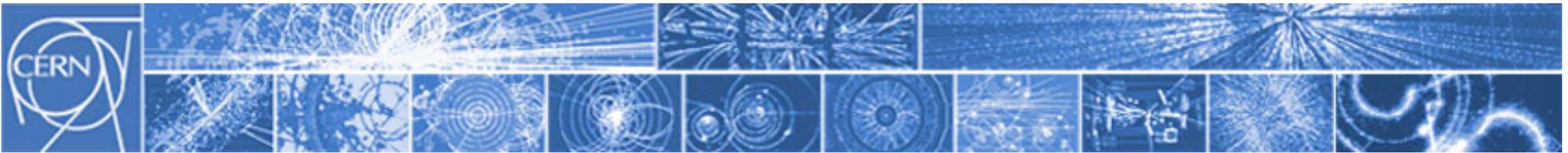
759





Accelerator chain at CERN, a complex business

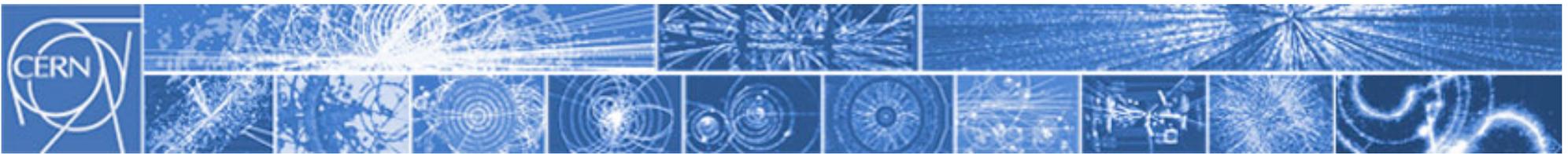




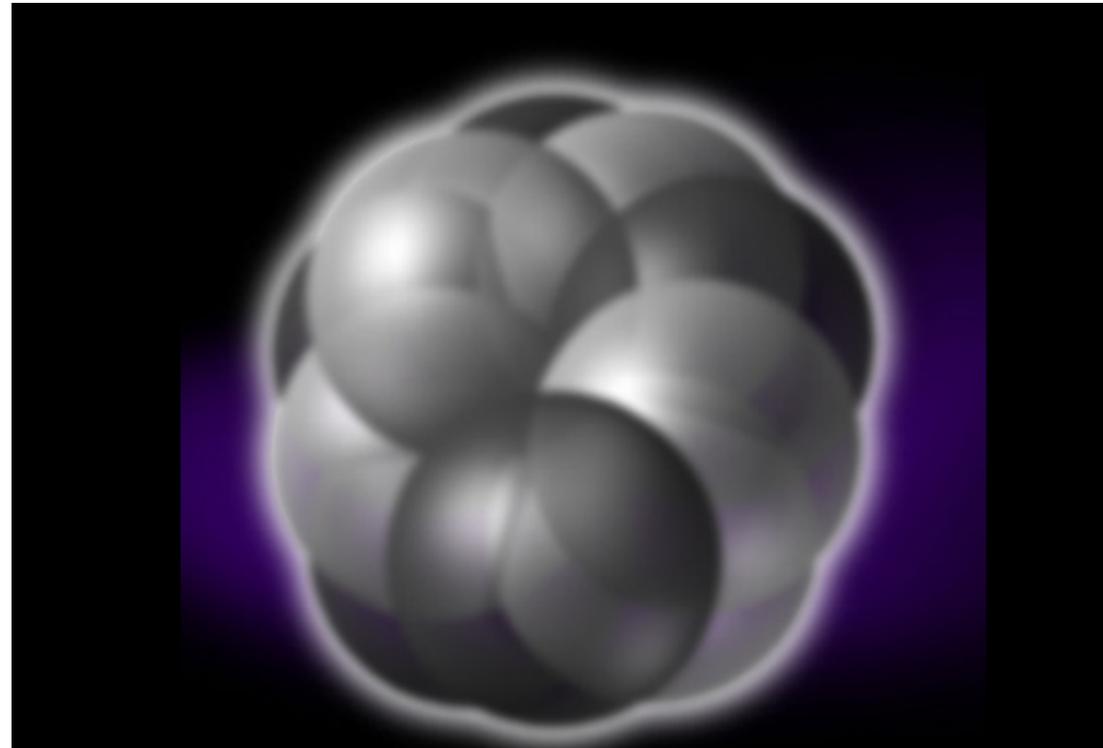
Particle physics and the standard model

Conduct fundamental research in Particle Physics:

- elementary constituents of matter
- fundamental forces controlling them
- origin and structure of the Universe



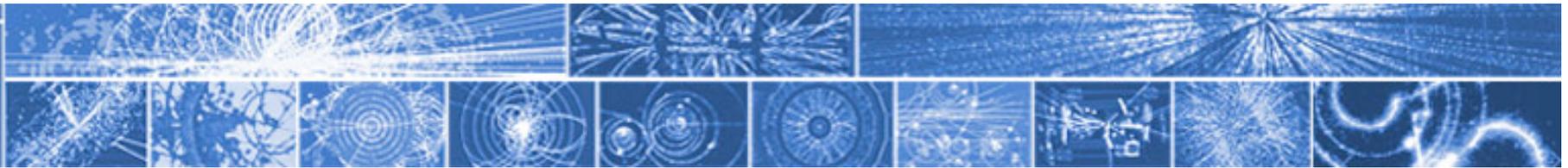
- Why do we collide particles at all?
- Let's have a closer look!
- Every day life:
 - ~1 km to ~1 mm
- Material Sciences, Electronics,
 - ~0.1 mm to 10 nm
- Microbiology, Chemistry
 - 10nm to ~0.1 nm
- Nuclear Physics
 - ~10 fm



← 0.000 000 000 000 01 m →

Most famous formula in physics

$$E = mc^2$$



Quarks



up



down



charm



strange



top



bottom

Leptons



electron



e-neutrino



muon



μ -neutrino



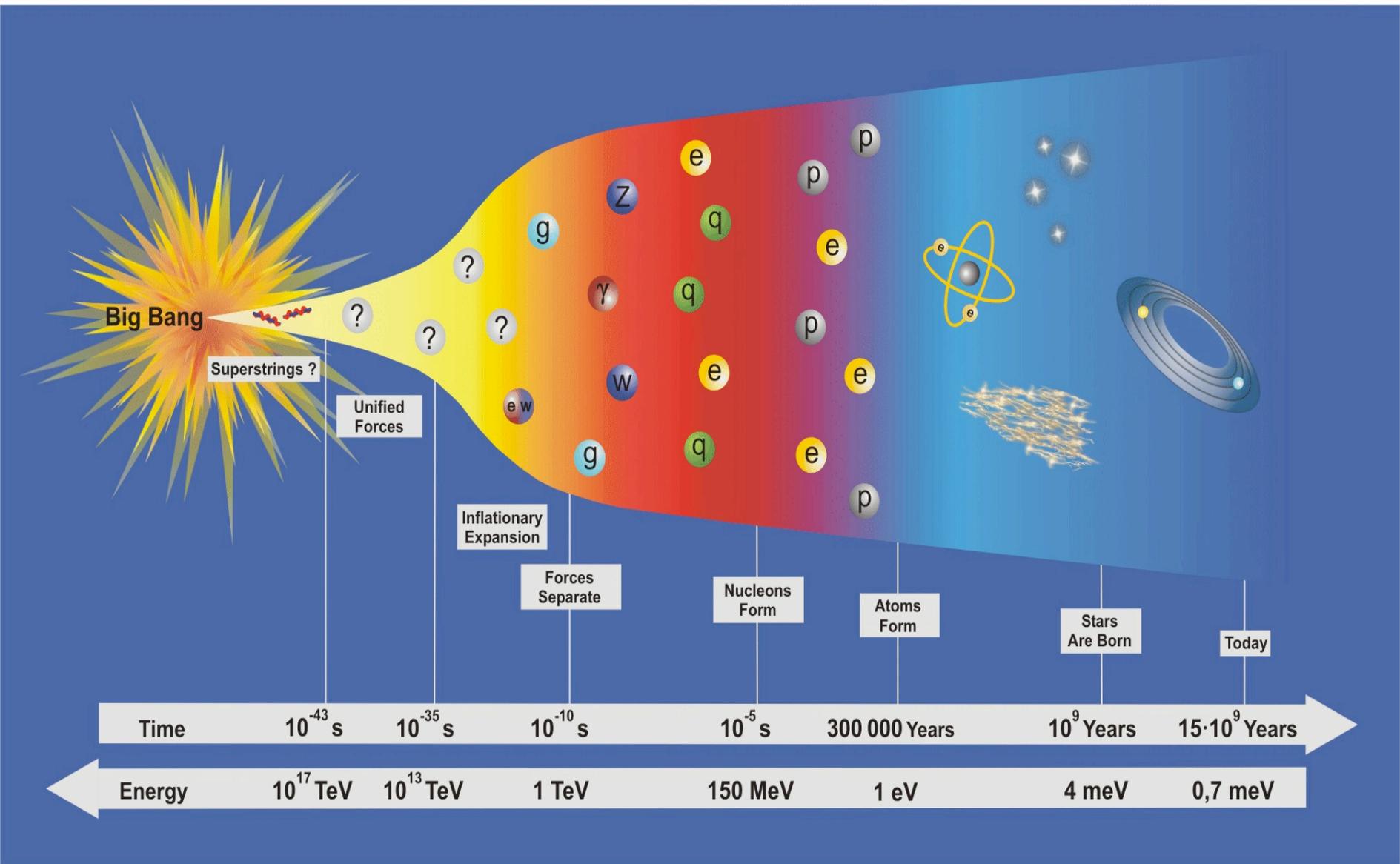
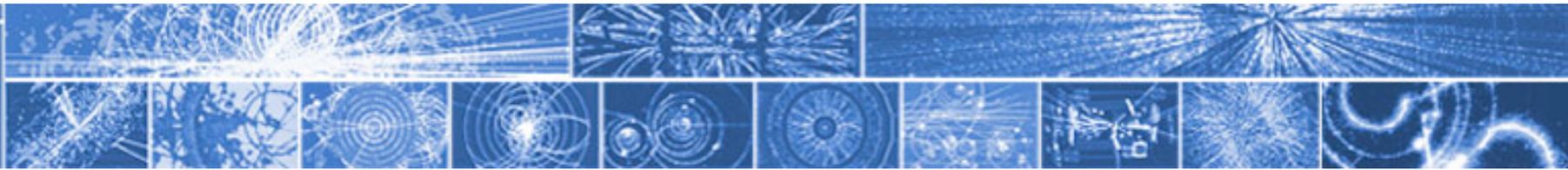
tau

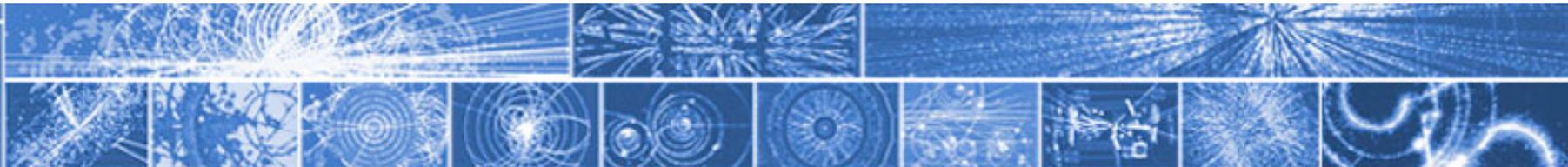


τ -neutrino

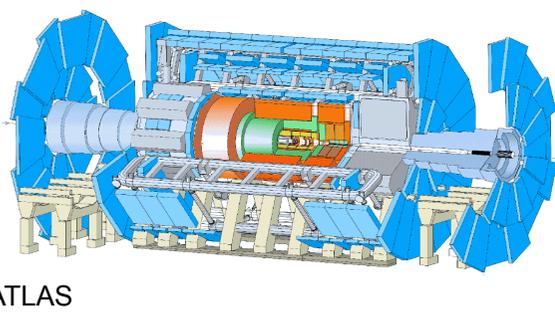
Example

- In every day life, only the **up-quark**, the **down-quark** and the **electron** play a role.
- A **proton** is just a combination of one up-quark and two down-quarks
- A **neutron** is just a combination of two up-quarks and one down-quark

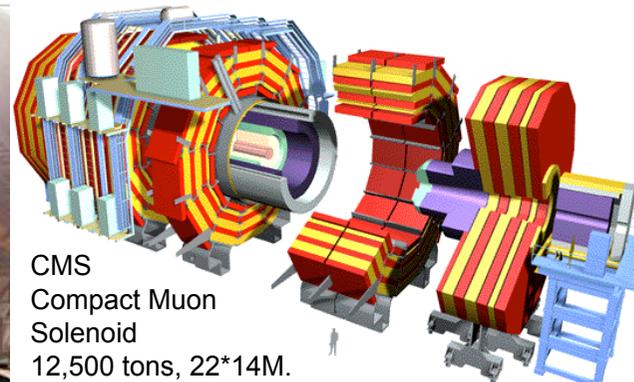
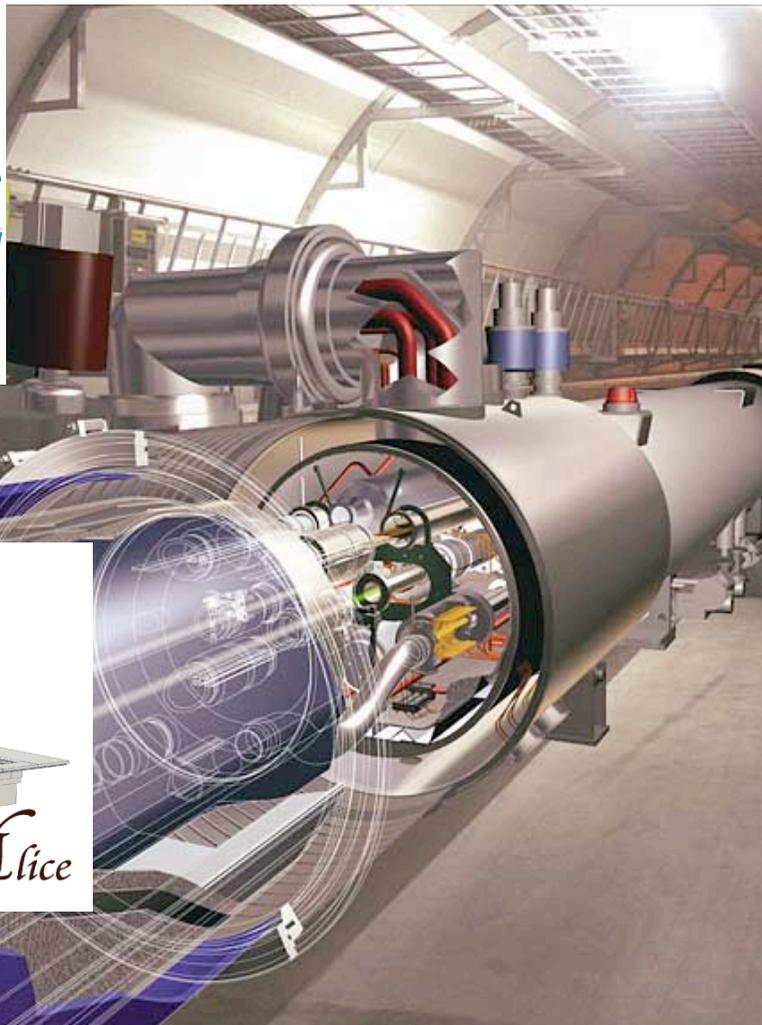




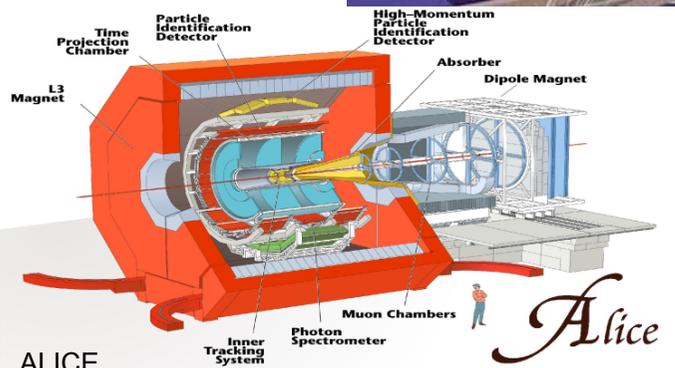
The LHC has started operation. It will certainly change our view of the Universe



ATLAS
A Toroidal LHC Apparatus
8000 tons
44*22M

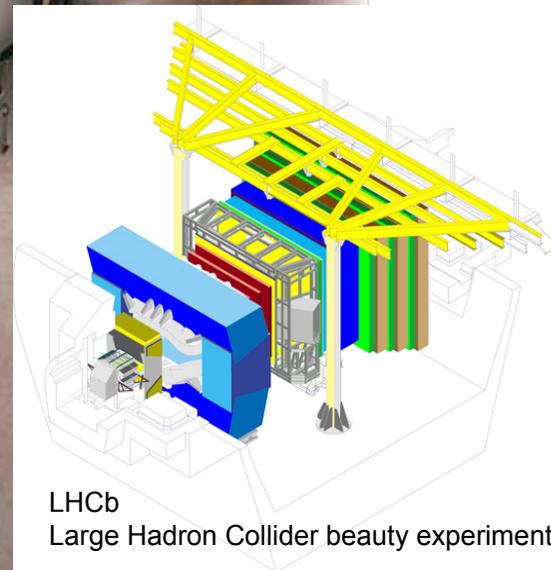


CMS
Compact Muon
Solenoid
12,500 tons, 22*14M.



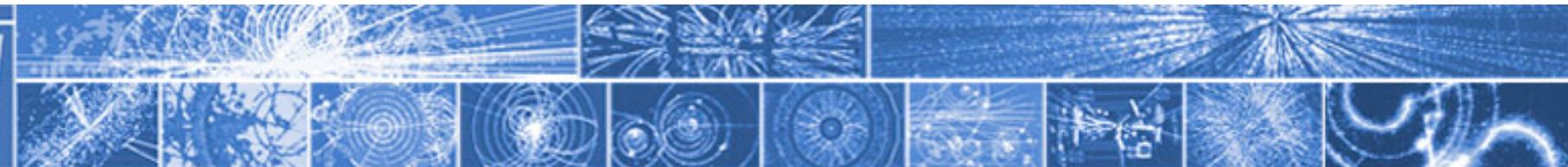
ALICE
A Large Ion
Collider Experiment.

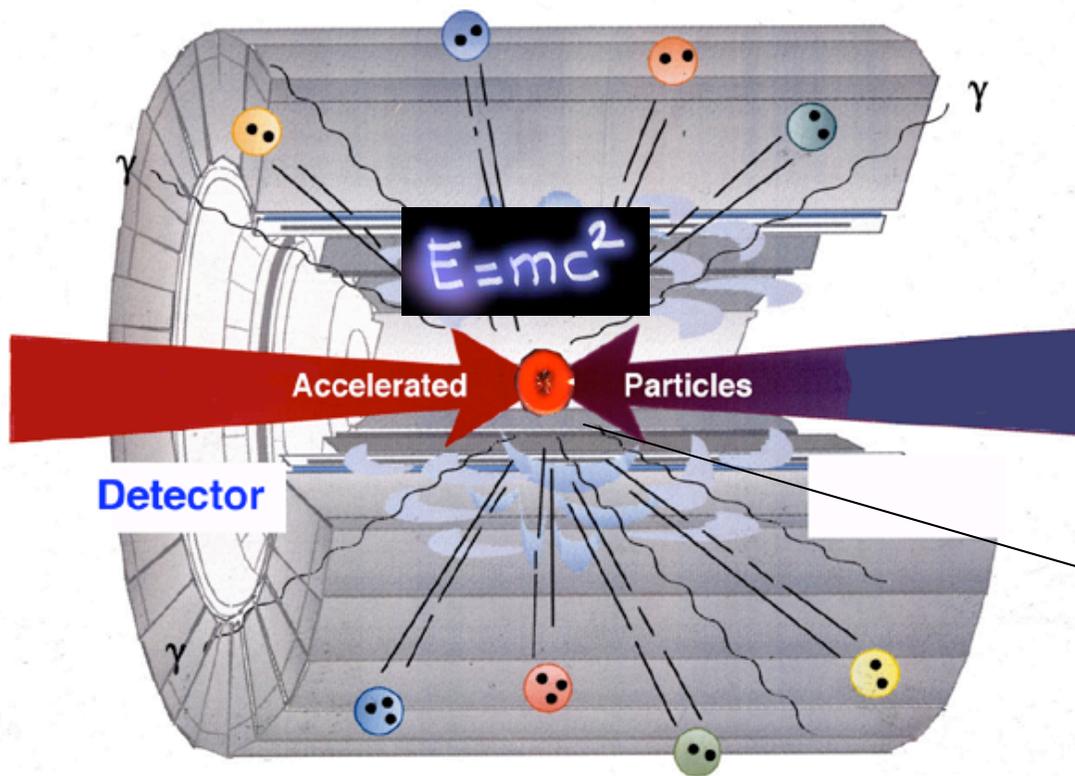
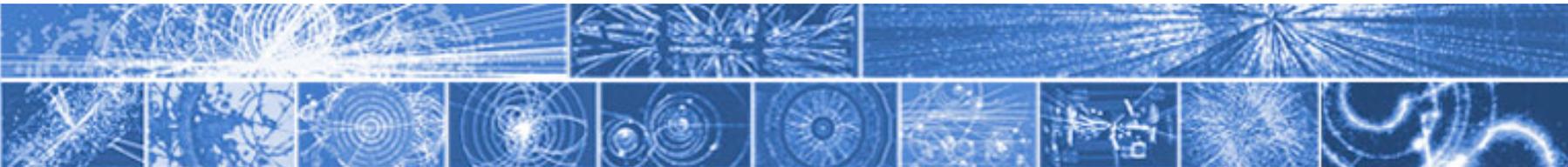
ALICE



LHCb
Large Hadron Collider beauty experiment



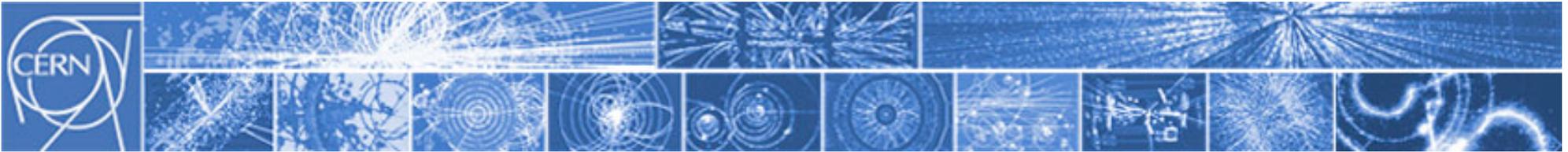




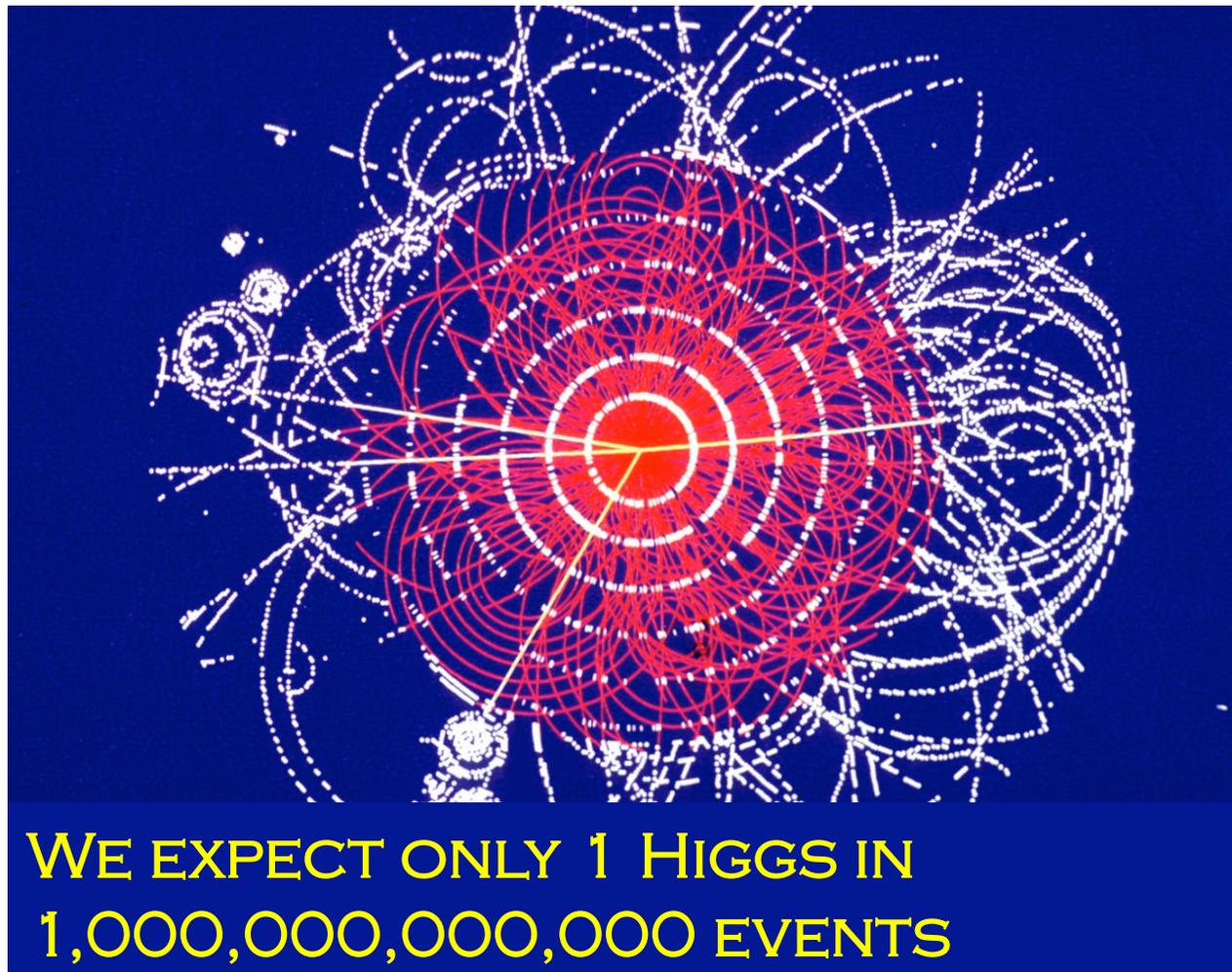
1) Concentrate energy on particles (**accelerator**)

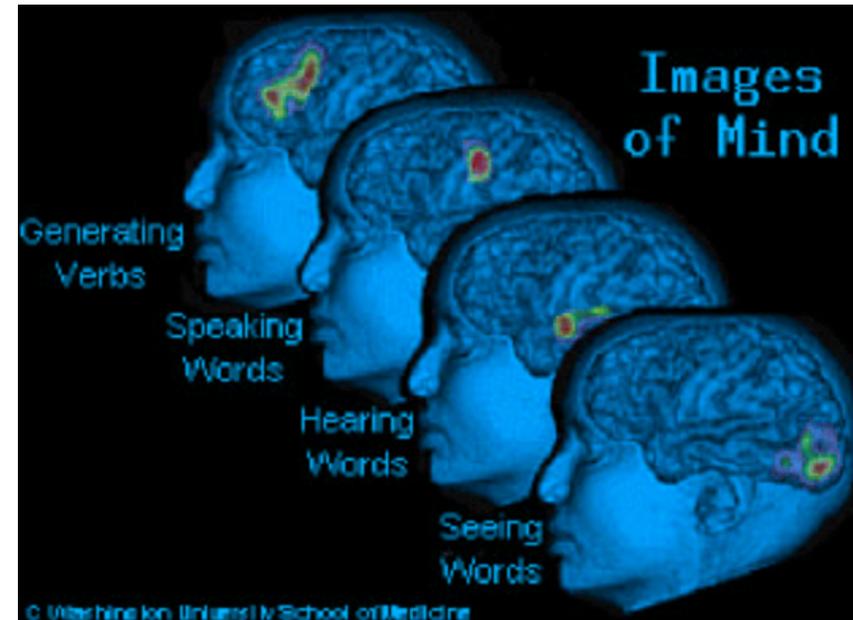
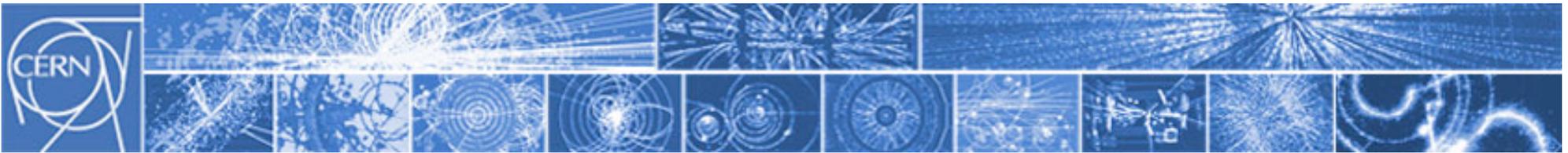
2) **Collide** particles (recreate conditions after Big Bang)

3) Identify created particles in **Detector** (search for new clues)



The two proton beams at the LHC will collide head-on 800 million times per second

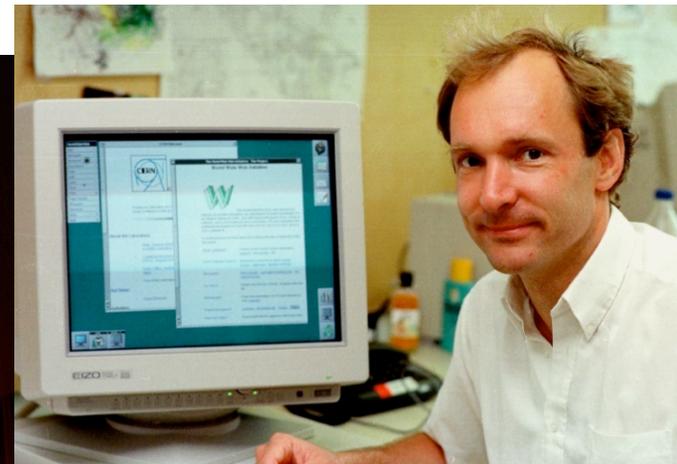




Cryogenics
LHC one of the coldest places in the Universe



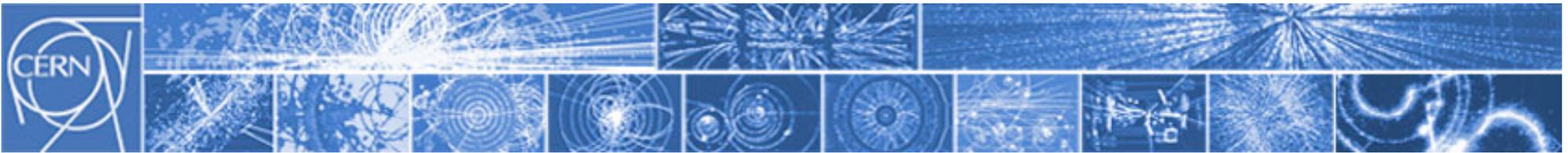
Spin-offs of particle physics research



Tim Berners-Lee
World Wide Web
1989

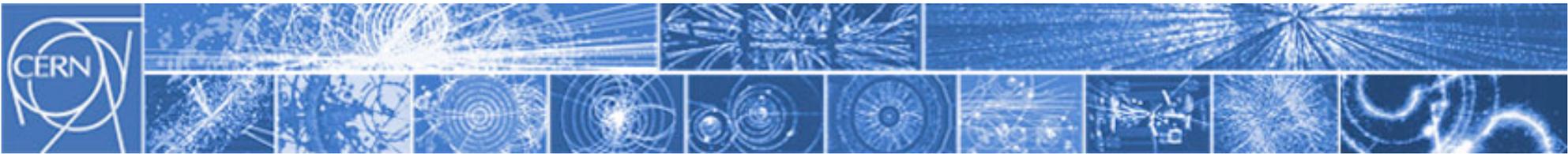
www.cern.ch

Computing
GRID



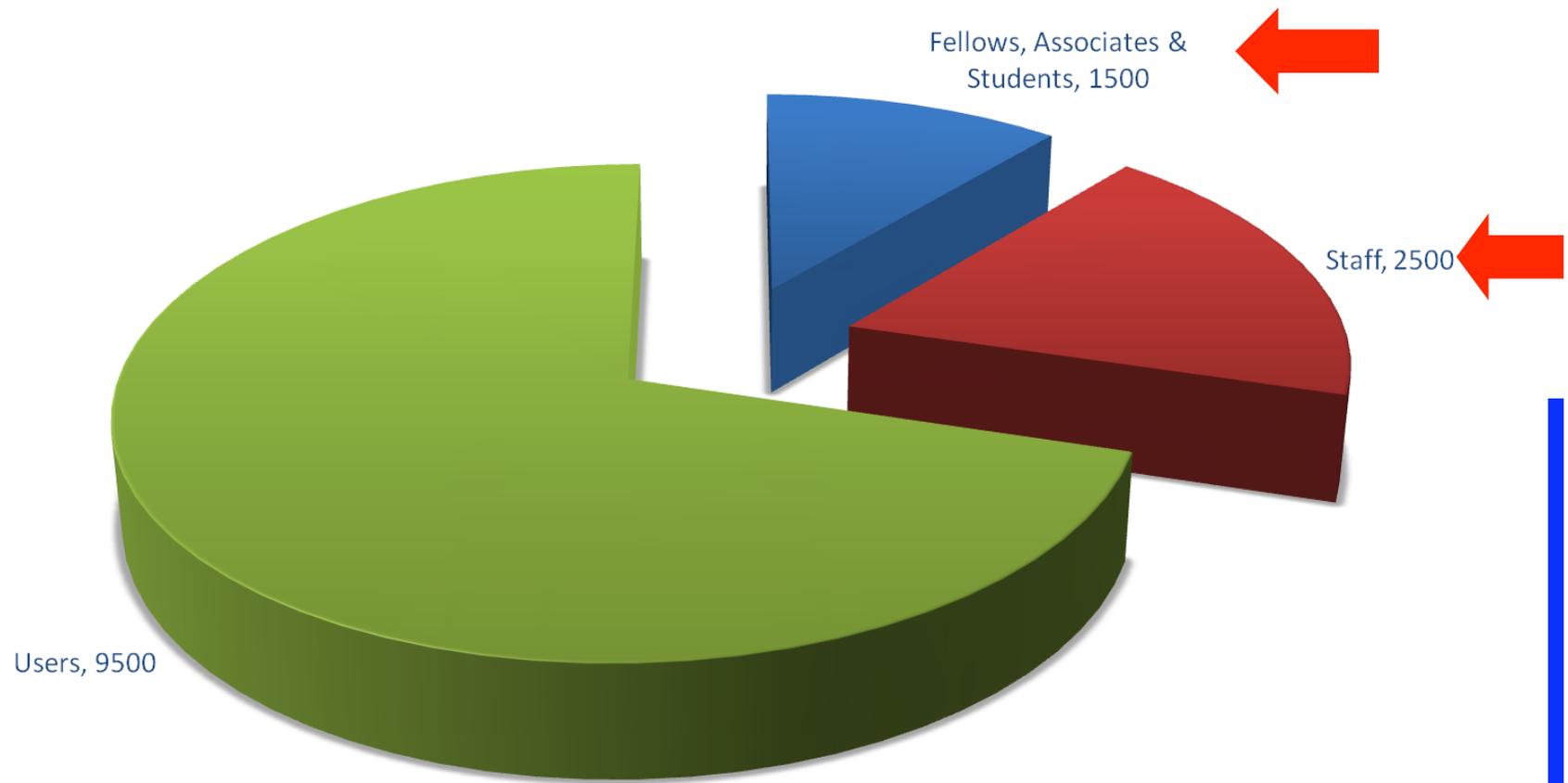
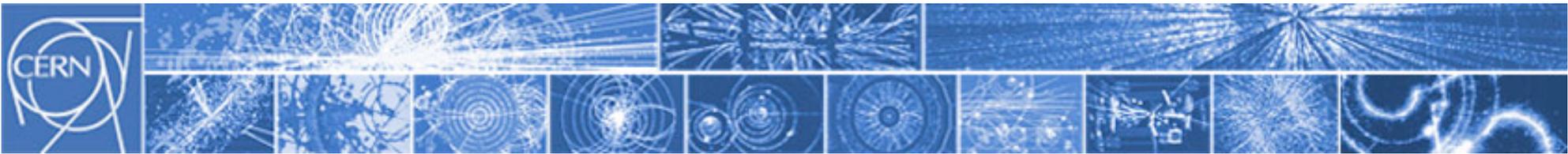
YOU CAN JOIN THE ADVENTURE

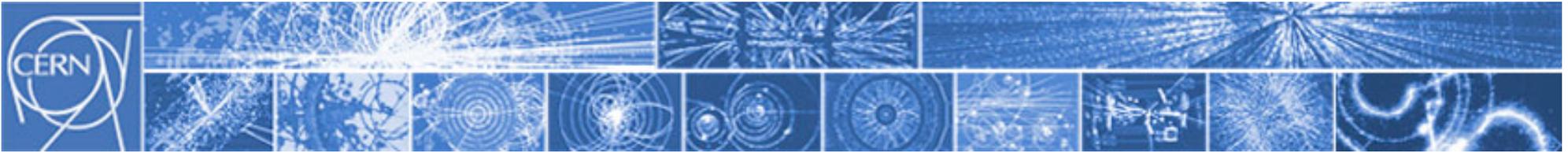




HOW







Graduate Science & Engineering Training Programme

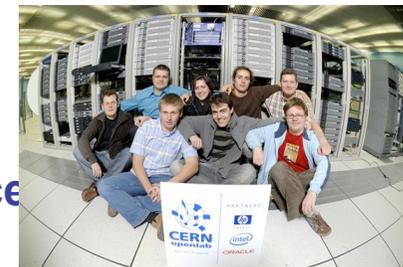
University graduates wanting to work for between 1 and 3 years in an international environment at the forefront of research

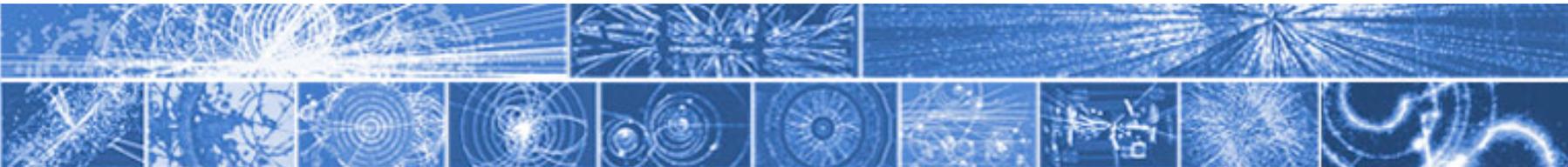
- **Fields :** physics, engineering, computing, scientific communication
- **Length :** usually 2 years (up to 3 years)
- **Eligibility :** BSc, MSc or PhD
no more than 10 years relevant post-MSc experience
- **Features :** a project with a supervisor
an employment contract with CERN
an attractive salary, social benefits, allowance

“ ... a great place to be using cutting edge technologies that tend to arrive later in the other industries...”

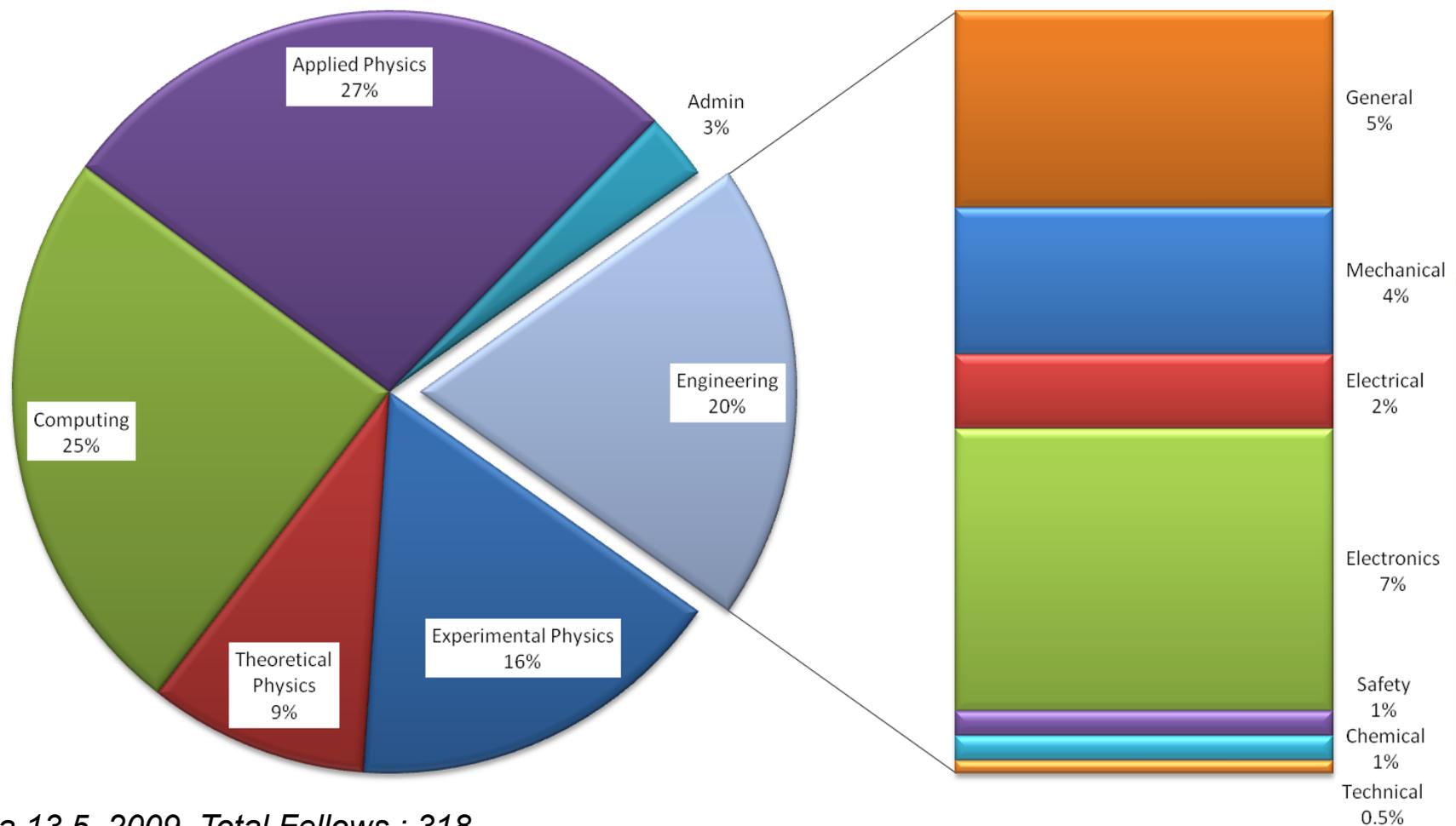
“ ... a great environment to get started in the professional world...”

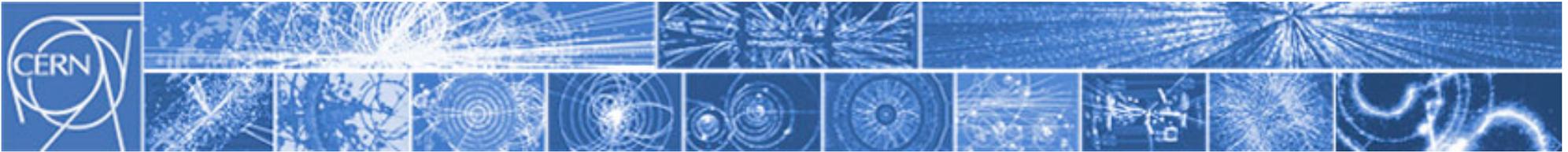
“ ...an ideal place to follow the most recent ideas in physics and start new collaborations...”





Fellows by Discipline

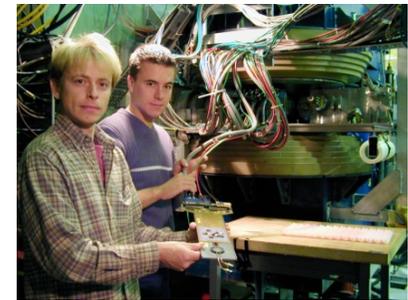




Students

Undergraduate and Doctoral students do all or part of their training or thesis at CERN

- **Fields :** applied physics, engineering, computing
- **Length :** 4 to 13 months for undergraduate student
1 to 3 years for doctoral students
8 to 13 weeks for summer students
- **Eligibility :** 18 months of technical undergraduate studies
Enrolled on a doctoral programme in a Member State university
- **Features :** a real technical project with a CERN supervisor
a living allowance



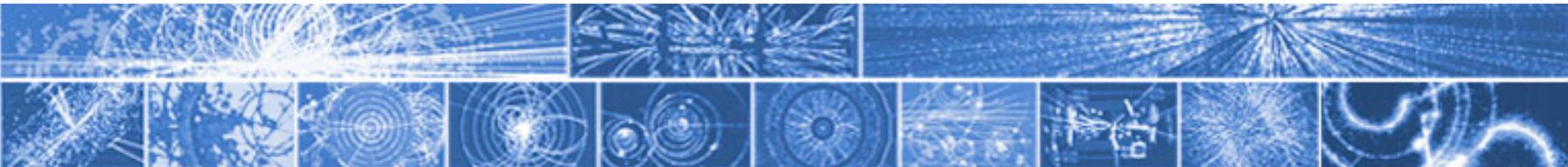
“It’s a great place to start a career, it’s a great place to learn new skills, make new friends...”

“The main advantage of working here is the International environment.”

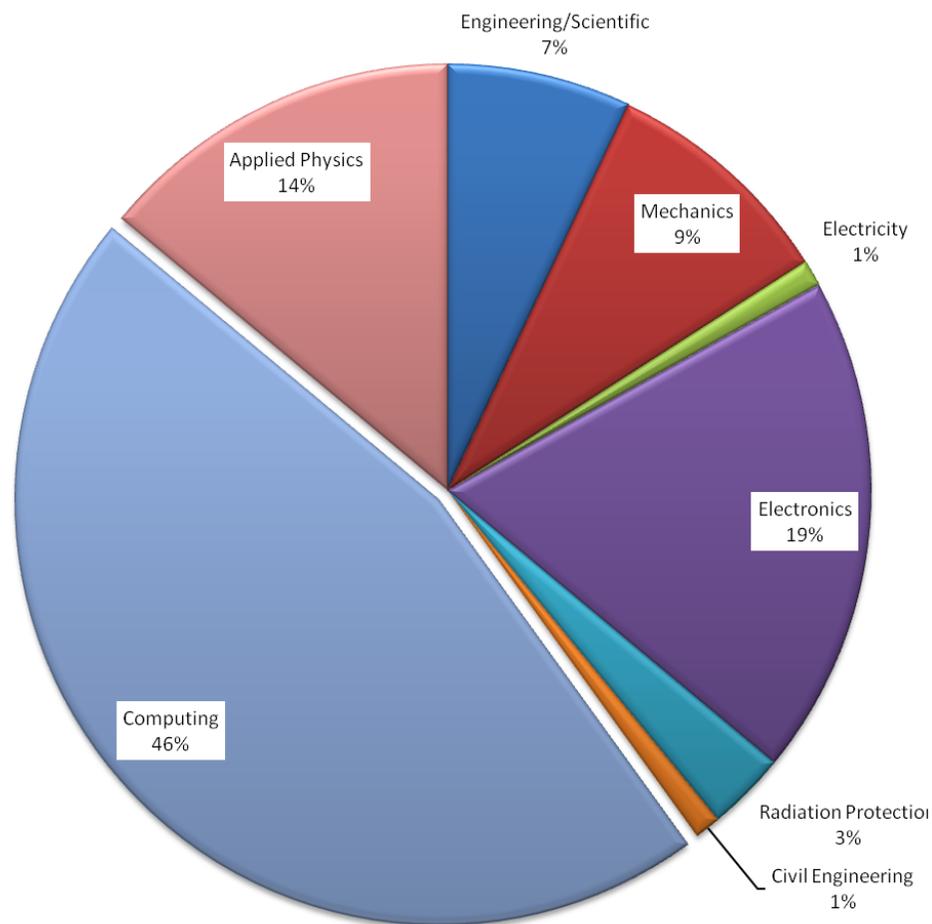
“This internship gave me the opportunity to meet important people, especially in the research fields”.

“I would tell student not think it twice, just to apply, they won’t regret it”

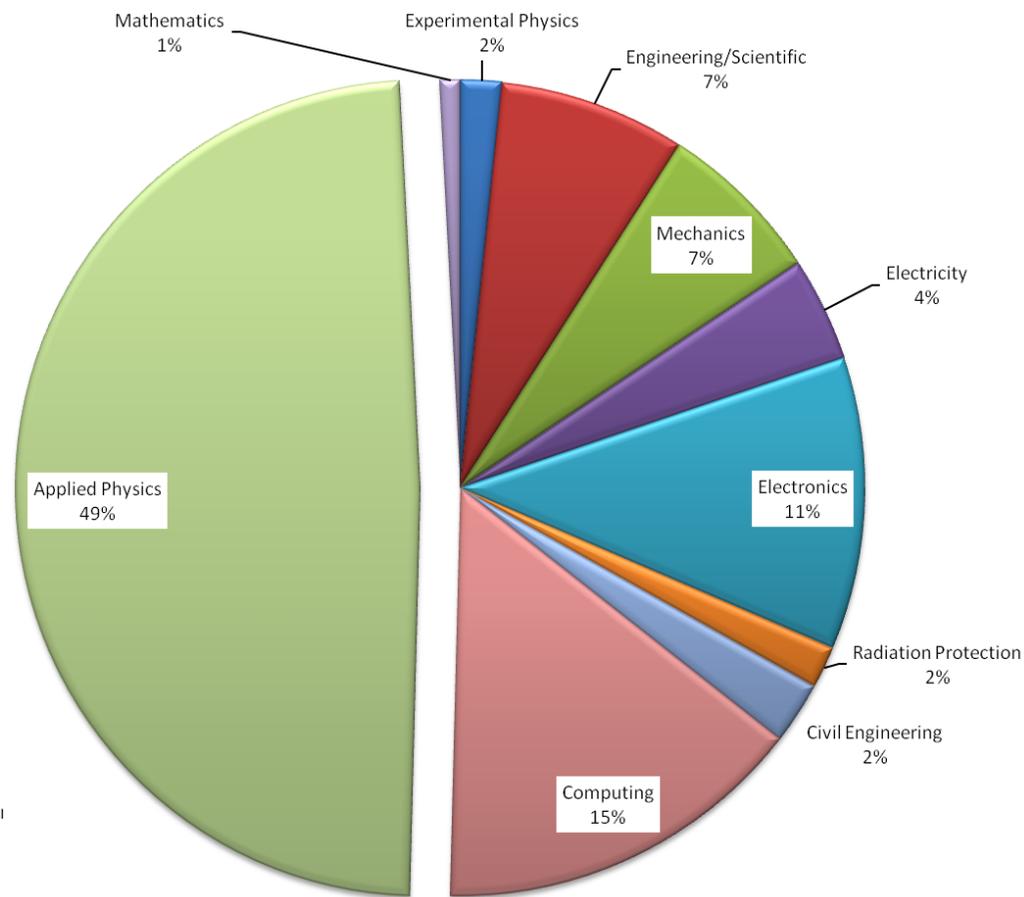




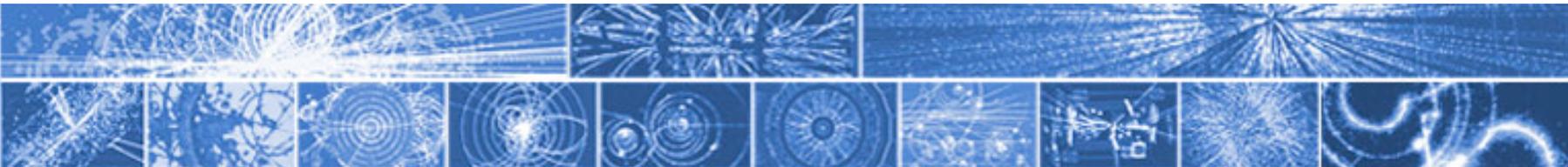
Students by Discipline



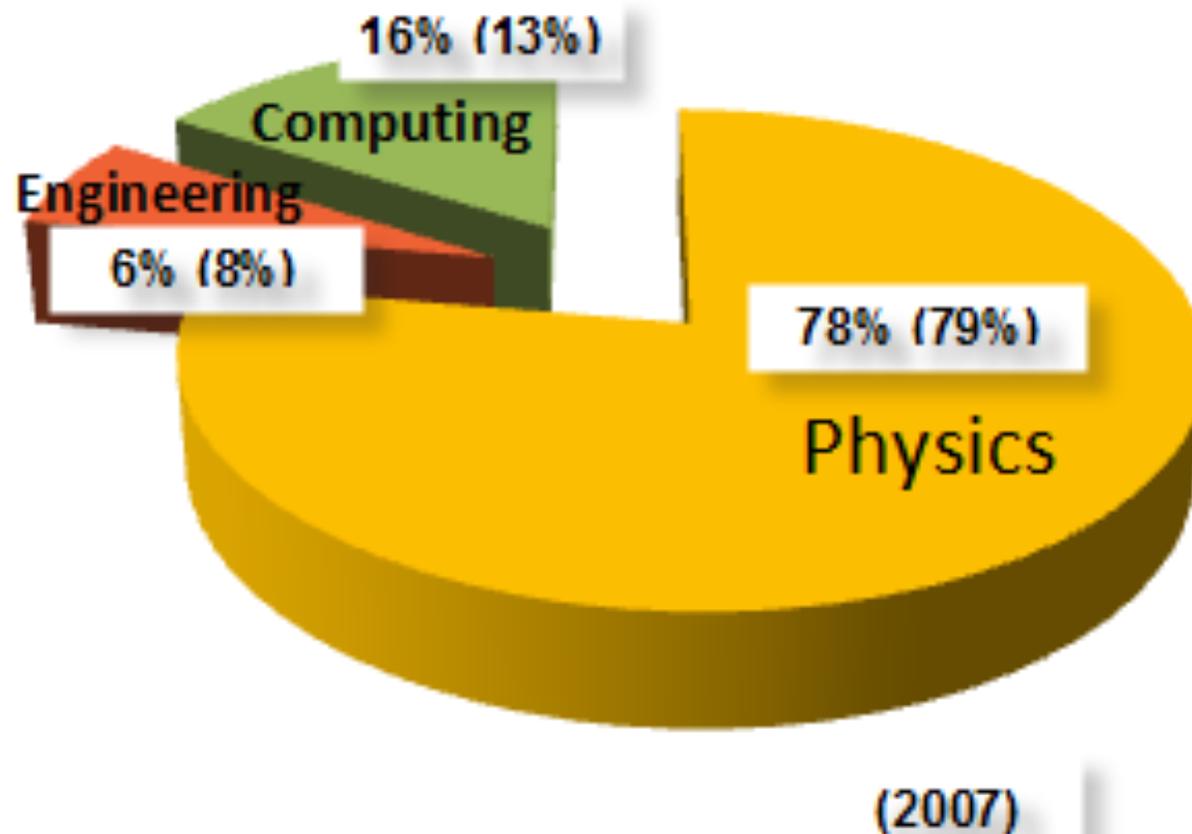
Technical Students

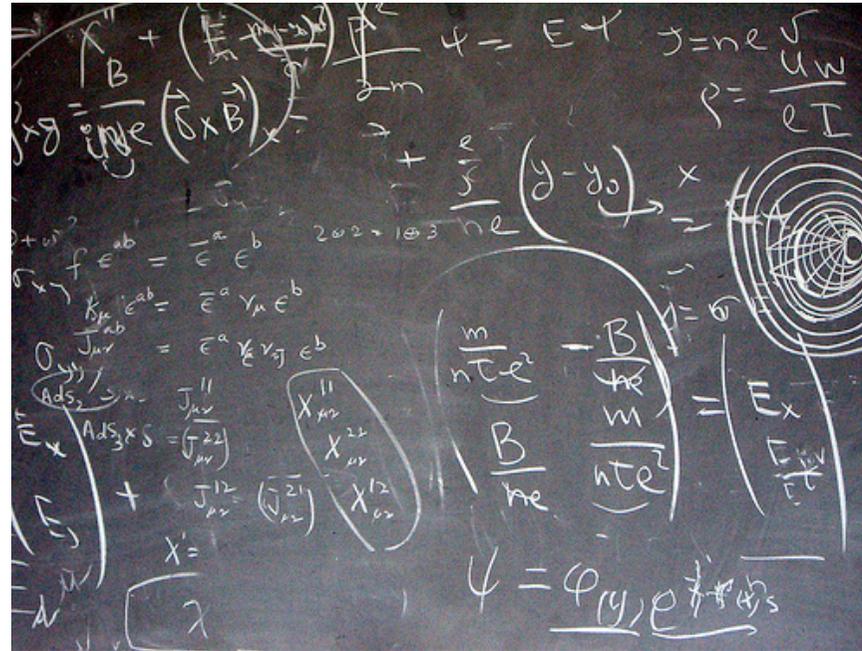
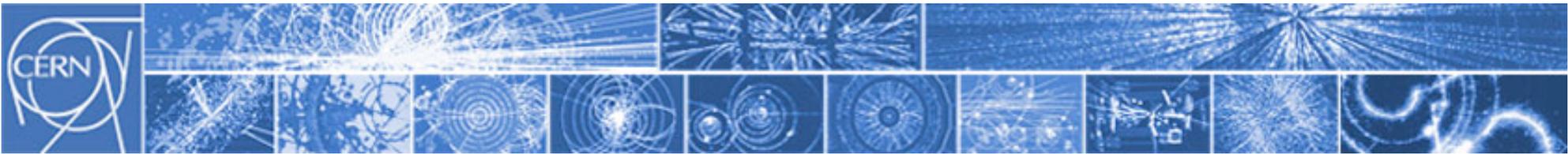


Doctoral Students

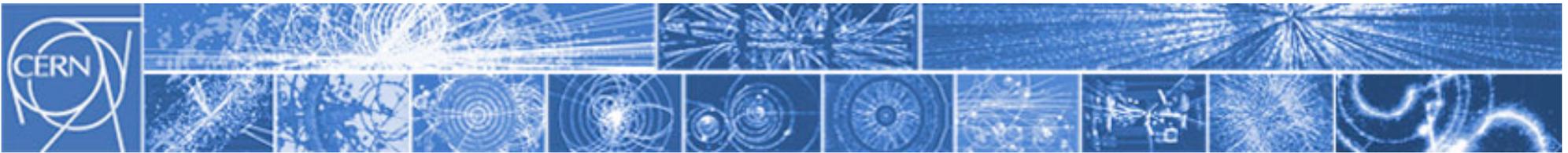


Summer Students 2008





THE COMPLICATED BIT...

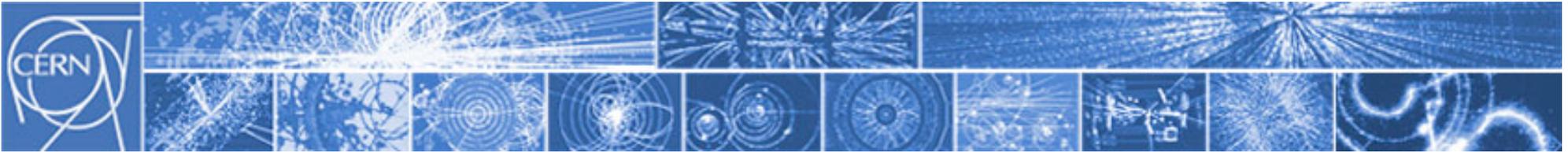


HOW TO APPLY ?

More Information

- Leaflets
- At the Fair (Great Hall)
- www.cern.ch
- recruitment.service@cern.ch





A great team

Confident &
Optimistic!



Helping Each other!



To climb new heights...



