CERN

Accelerating Science and Innovation

LHCb
ATLAS
CERN Meyrin
CERN Prévessin
SPS 7 km
SUISSE
FRANCE
ALICE
CMS
LHC 27 km

CERN

FTK - Pisa 130311 B. Magnin

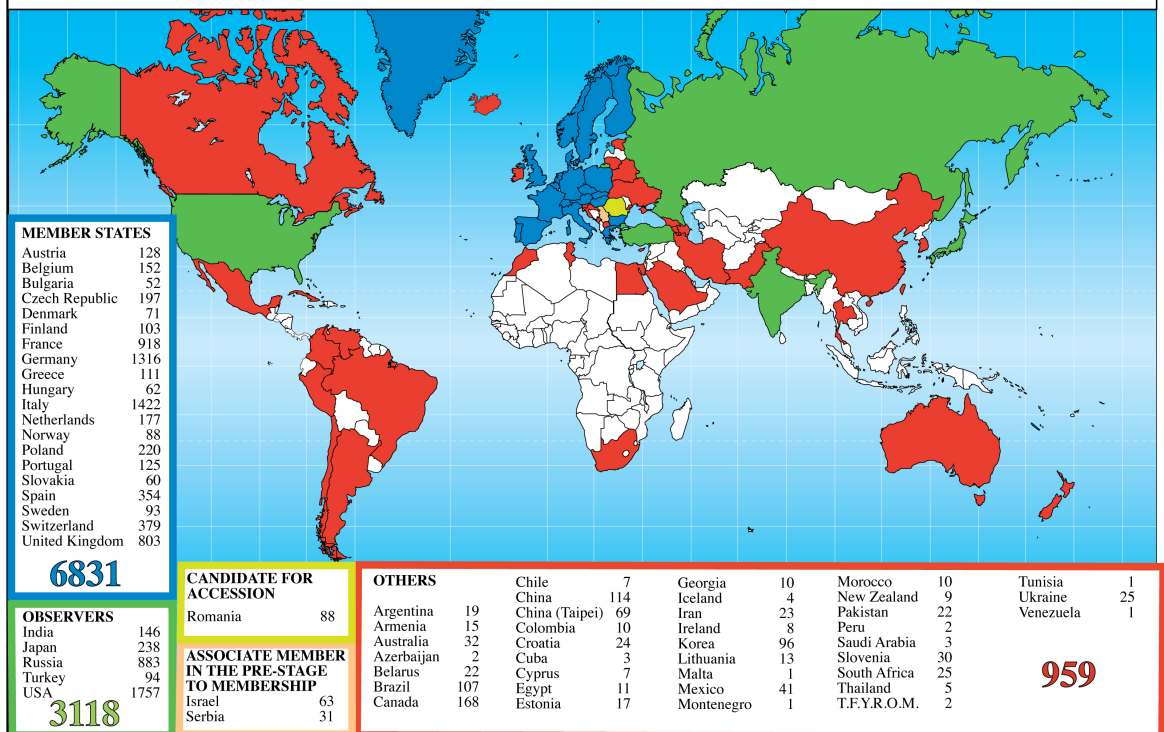# CERN was founded 1954: 12 European States
"Science for Peace"

Today: 20 Member States

~ 2300 staff
~ 1000 other paid personnel
> 11000 users
Budget (2013) ~1000 MCHF

Distribution of All CERN Users by Location of Institute on 14 January 2013

MEMBER STATES

Austria	128
Belgium	152
Bulgaria	52
Czech Republic	197
Denmark	71
Finland	103
France	918
Germany	1316
Greece	111
Hungary	62
Italy	1422
Netherlands	177
Norway	88
Poland	220
Portugal	125
Slovakia	60
Spain	354
Sweden	93
Switzerland	379
United Kingdom	803

6831

OBSERVERS

India	146
Japan	238
Russia	883
Turkey	94
USA	1757

3118

CANDIDATE FOR ACCESSION

Romania	88

ASSOCIATE MEMBER IN THE PRE-STAGE TO MEMBERSHIP

Israel	63
Serbia	31

OTHERS

Argentina	19	Chile	7	Georgia	10	Morocco	10	Tunisia	1
Armenia	15	China	114	Iceland	4	New Zealand	9	Ukraine	25
Australia	32	China (Taipei)	69	Iran	23	Pakistan	22	Venezuela	1
Azerbaijan	2	Colombia	10	Ireland	8	Peru	2	
Belarus	22	Croatia	24	Korea	96	Saudi Arabia	3	
Brazil	107	Cuba	3	Lithuania	13	Slovenia	30	
Canada	168	Cyprus	7	Malta	1	South Africa	25	
		Egypt	11	Mexico	41	Thailand	5	
		Estonia	17	Montenegro	1	T.F.Y.R.O.M.	2	

959

The Mission of CERN

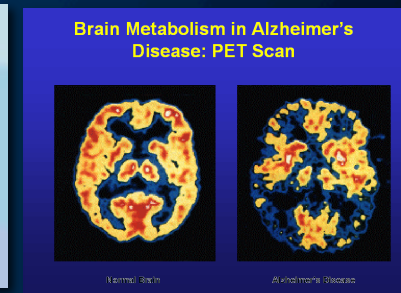

□ **Push forward** the frontiers of knowledge

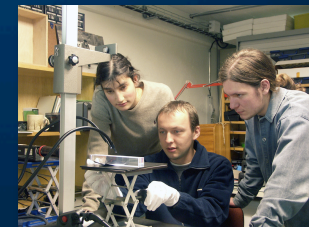 E.g. the secrets of the Big Bang ...what was the matter like within the first moments of the Universe's existence?

Brain Metabolism in Alzheimer's Disease: PET Scan
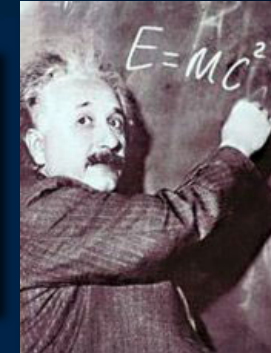
□ **Develop** new technologies for accelerators and detectors

  Information technology - the Web and the GRID

  Medicine - diagnosis and therapy

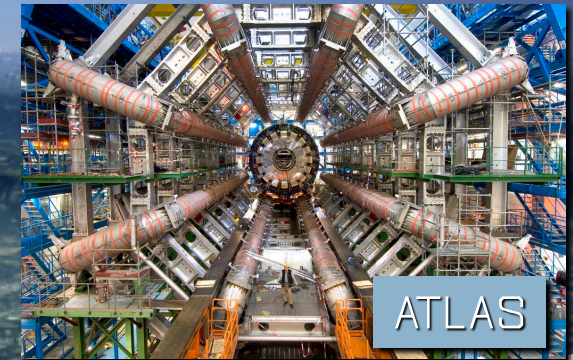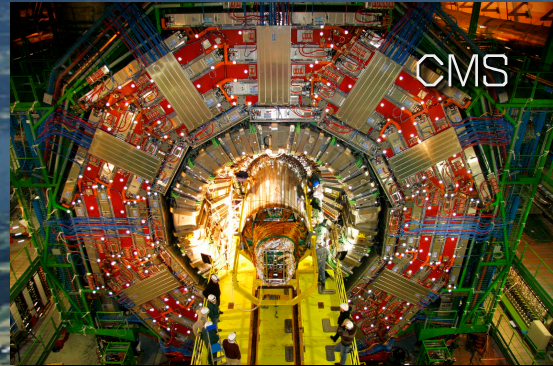

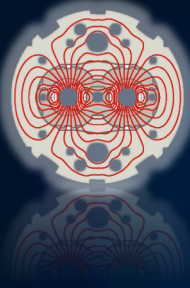□ **Train** scientists and engineers of tomorrow

□ **Unite** people from different countries and cultures

Enter a New Era in Fundamental Science

LHCb

CMS

ATLAS

ALICE

Exploration of a new energy frontier
in p-p and Pb-Pb collisions

LHC ring:
27 km circumference

The study of LHC data will allow us to answer some of the big questions …

Will we understand the **primordial state of matter** after the Big Bang before protons and neutrons formed?
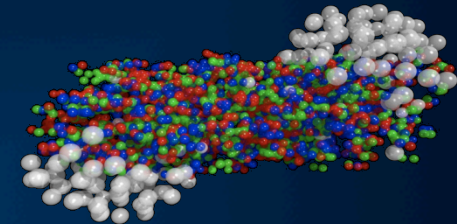
Have we found the **Higgs particle** that is responsible for **giving mass** to all particles?
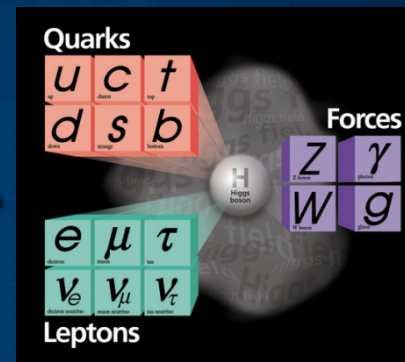
Will we find the reason why **antimatter and matter did not completely destroy each other**?

Will we find the **particle(s)** that make up the **mysterious 'dark matter'** in our Universe?

4 July 2012: "CERN experiments observe particle consistent with long-sought Higgs boson"
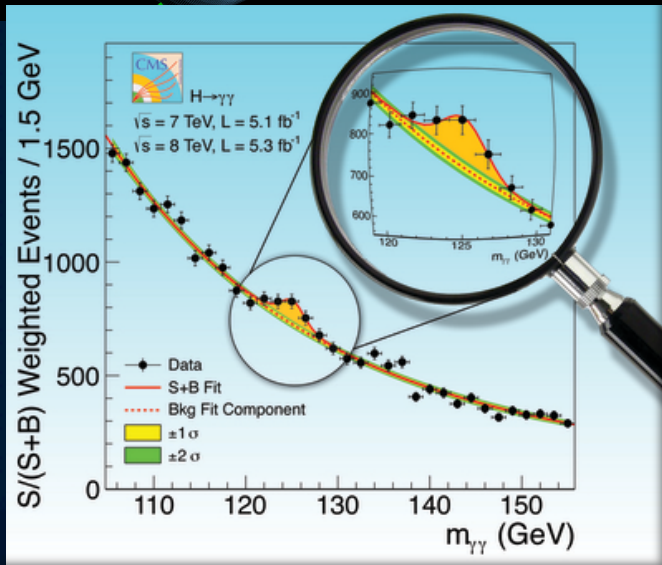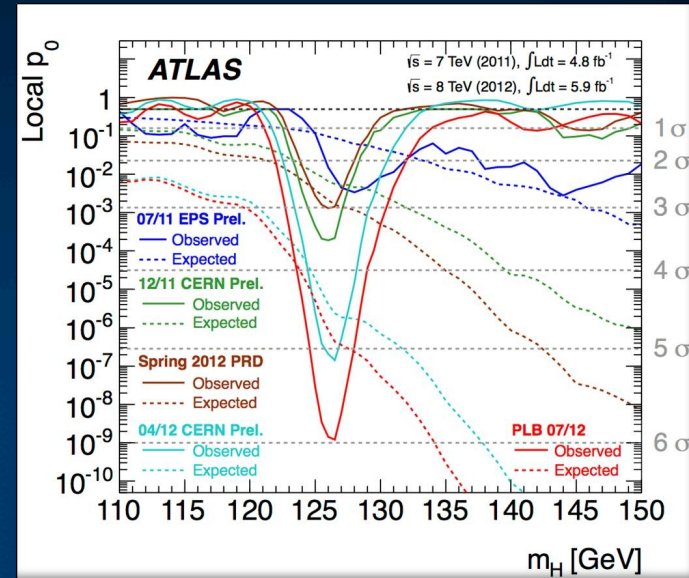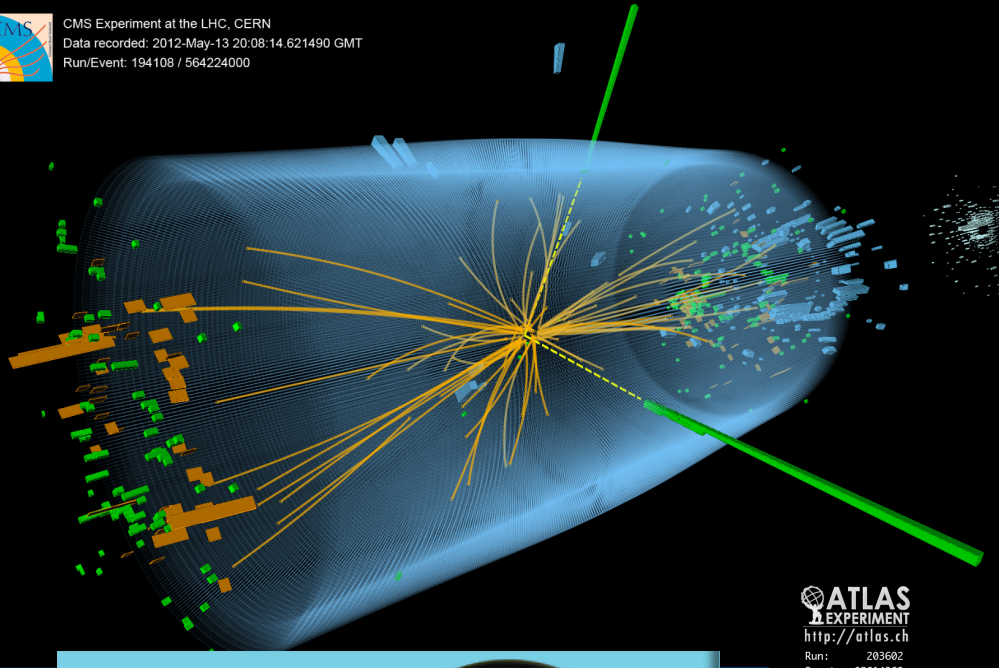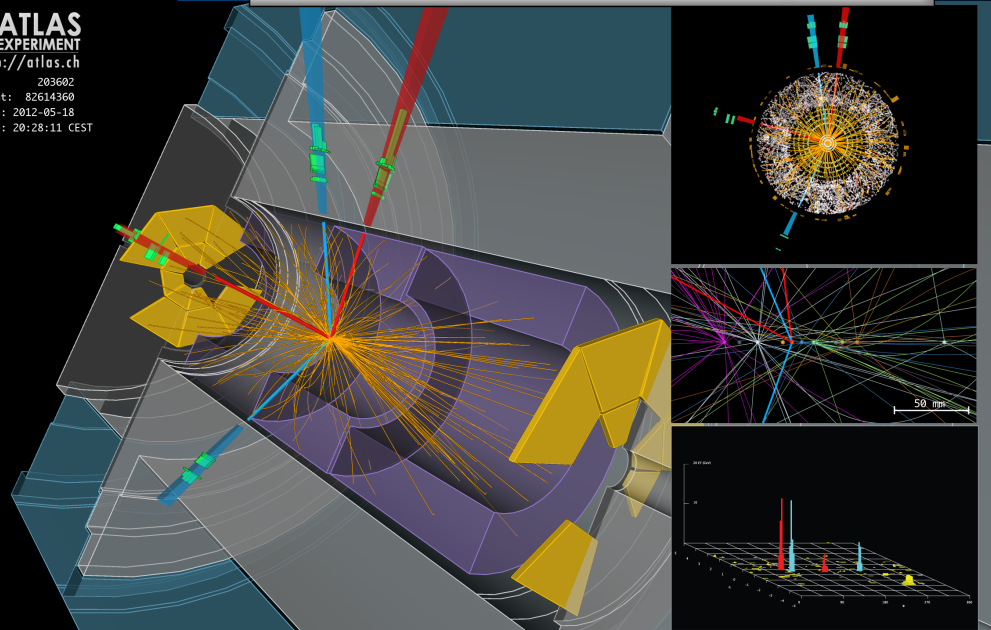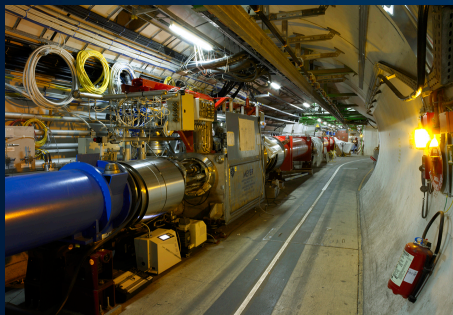
CERN: Particle Physics and Innovation

- ❑ **Interfacing** between fundamental science and key technological developments

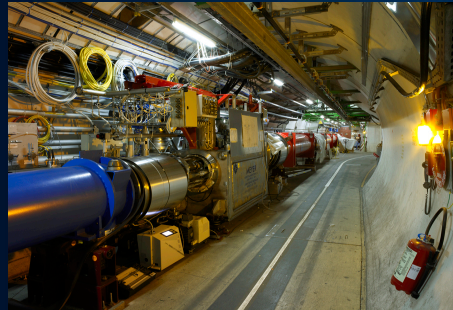- ❑ **CERN Technologies and Innovation**

Accelerating particle beams

Detecting particles

Large-scale computing (Grid)

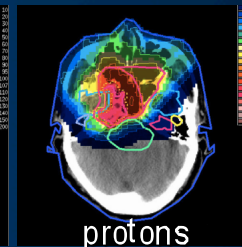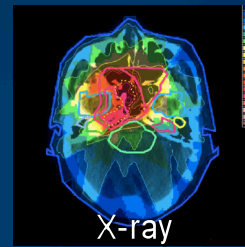# Medical Application as an Example of Particle Physics Spin-off

Combining Physics, ICT, Biology and Medicine to fight cancer

↔ **Hadron Therapy**

Tumour Target

Protons light ions

X-ray

protons

Leadership in Ion Beam Therapy now in Europe and Japan

Accelerating particle beams

~30'000 accelerators worldwide
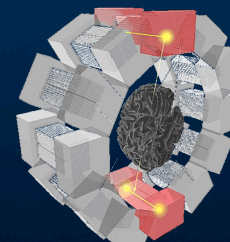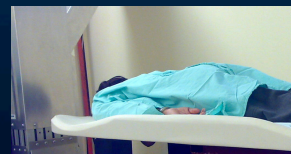~17'000 used for medicine

>70'000 patients treated worldwide (30 facilities)
>21'000 patients treated in Europe (9 facilities)

↔ **Imaging**

PET Scanner

Brain Metabolism in Alzheimer's Disease: PET Scan

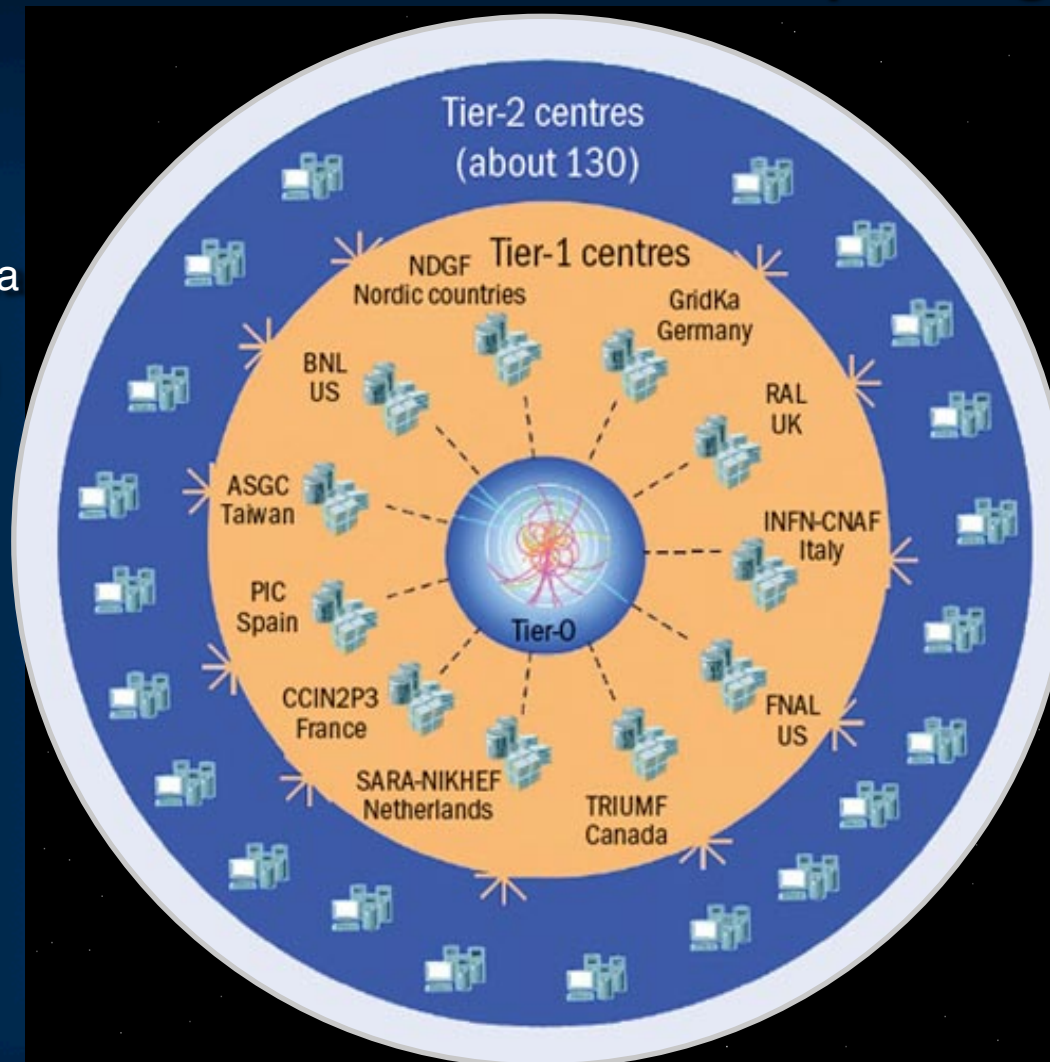Clinical trial in Portugal for new breast imaging system (ClearPEM)
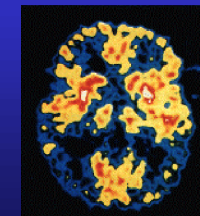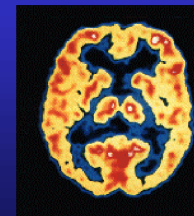
Detecting particles

The Worldwide LHC Computing Grid

Tier-0 (CERN): data recording, reconstruction and distribution

Tier-1: permanent storage, re-processing, analysis

Tier-2: Simulation, end-user analysis

nearly 160 sites, 35 countries

~250'000 cores

173 PB of storage

> 2 million jobs/day

10 Gb links

WLCG:
An International collaboration to distribute and analyse LHC data

Integrates computer centres worldwide that provide computing and storage resource into a single infrastructure accessible by all LHC physicists

CERN Education Activities

Scientists at CERN
Academic Training Programme

NEW:
Asia-Europe-Pacific School
of High-Energy Physics
Fukuoka, Oct 2012
India, 2014

Latin American School
Natal, Brazil, 2011
Arequipa, Peru, 2013

Young Researchers
CERN School of High Energy Physics
CERN School of Computing
CERN Accelerator School

The 2013
European School
of High-Energy
Physics
5 – 18 June 2013

CERN School of
Physics
Hungary, June 2013

Physics Students
Summer Students
Programme

CERN Teacher Schools
International and National
Programmes

Thank You !