

# Welcome

## VOESTALPINE STEEL DIVISION

Austria

to



*Accelerating Science and Innovation*



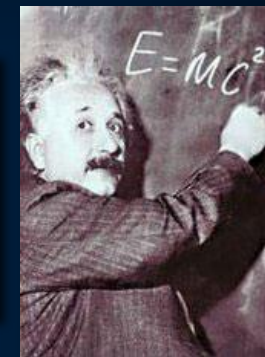
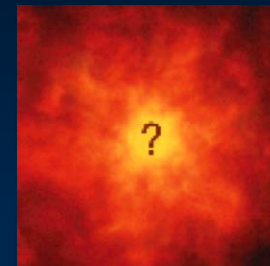




# The Mission of CERN

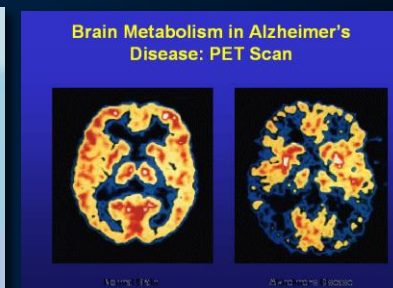
- ❑ **Push back** the frontiers of knowledge

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

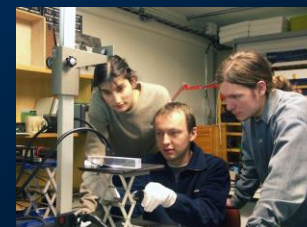


- ❑ **Develop** new technologies for accelerators and detectors

Information technology - the Web and the GRID  
Medicine - diagnosis and therapy



- ❑ **Train** scientists and engineers of tomorrow



- ❑ **Unite** people from different countries and cultures



# CERN: founded in 1954: 12 European States

“Science for Peace”

## Today: 21 Member States

~ 2300 staff

~ 1300 other paid personnel

~ 11500 scientific users

Budget (2015) ~1000 MCHF

**Member States:** Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Israel, Italy, Netherlands, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland and United Kingdom

**States in accession to Membership:** Romania, Serbia

**Applications for Membership or Associate Membership:**

Brazil, Croatia, Cyprus, Pakistan, Russia, Slovenia, Turkey, Ukraine

**Observers to Council:** India, Japan, Russia, Turkey, United States of America; European Union, JINR and UNESCO

# CERN is global

Users per 31.12.2014:

Member States:

6535

Observer States:

3110

Non-member states:

1109

Candidate for Accession:

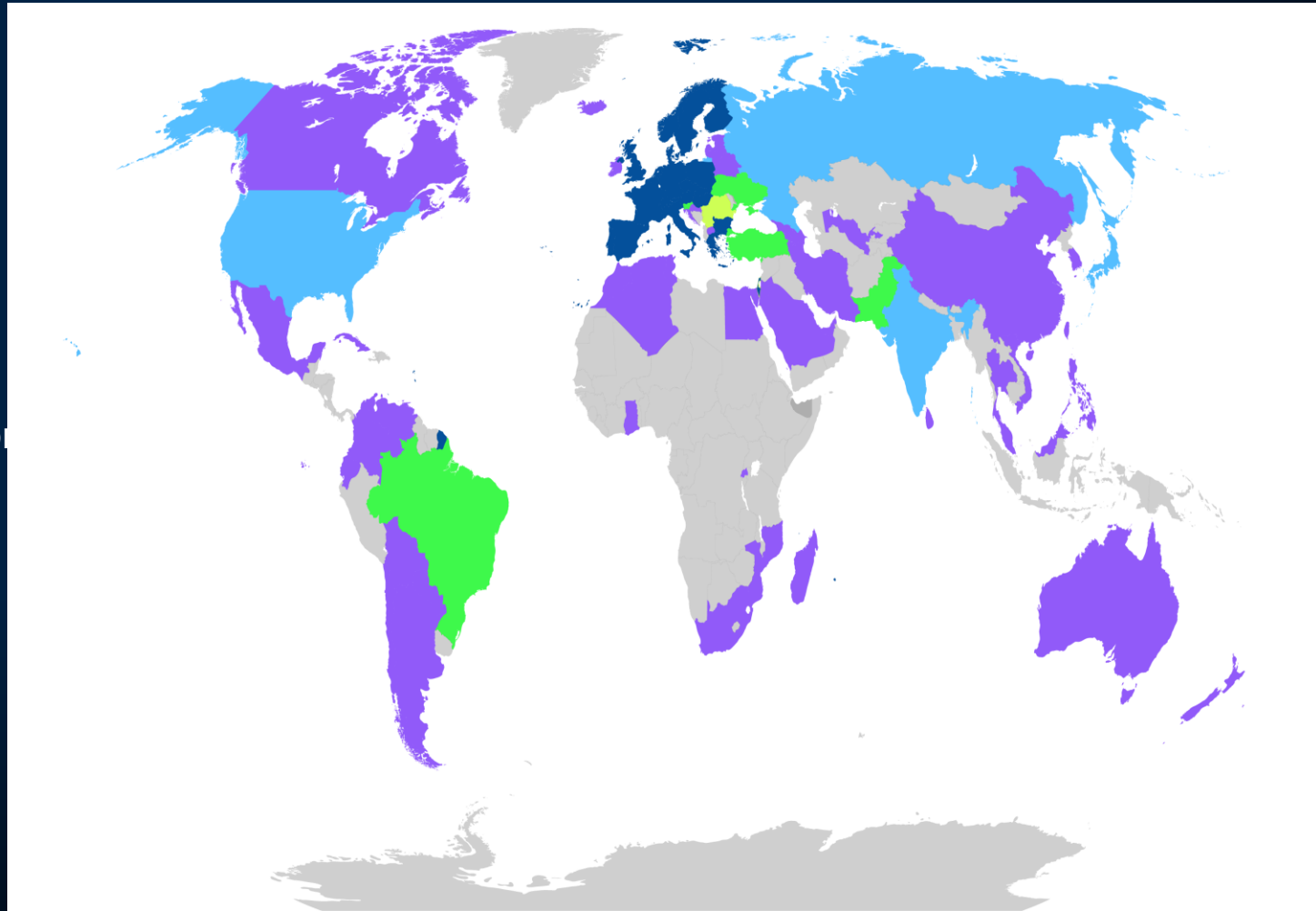
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Associate Member:

0032

Total:

10885

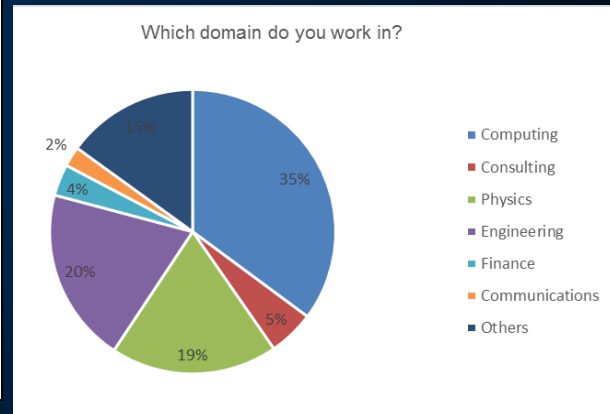
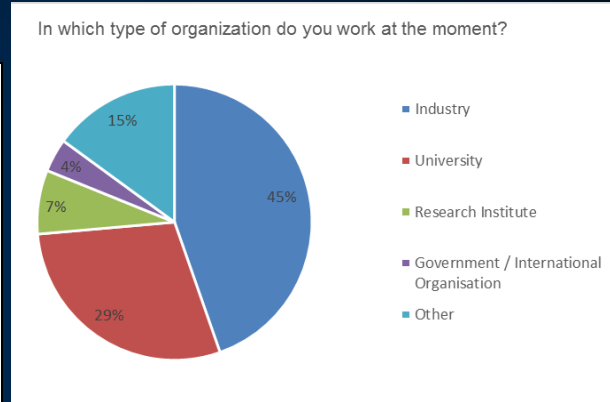
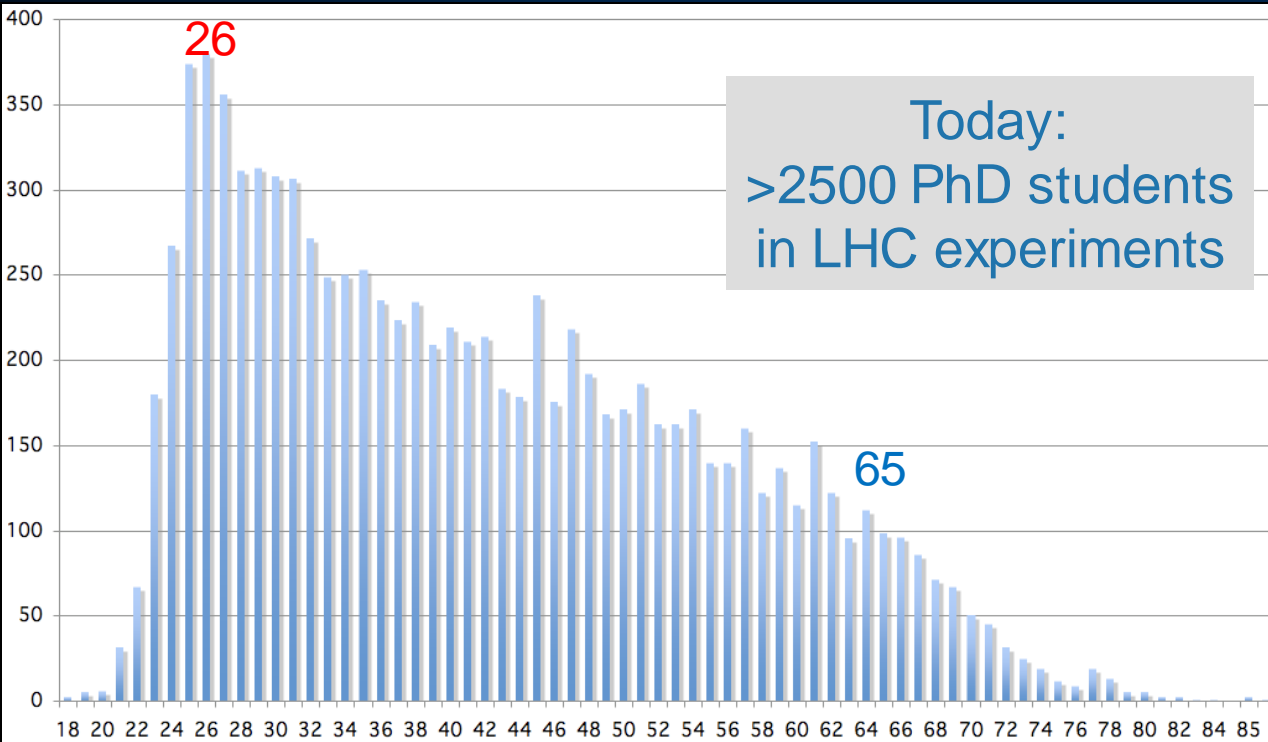






# Age Distribution of Scientists

- and where they go afterwards

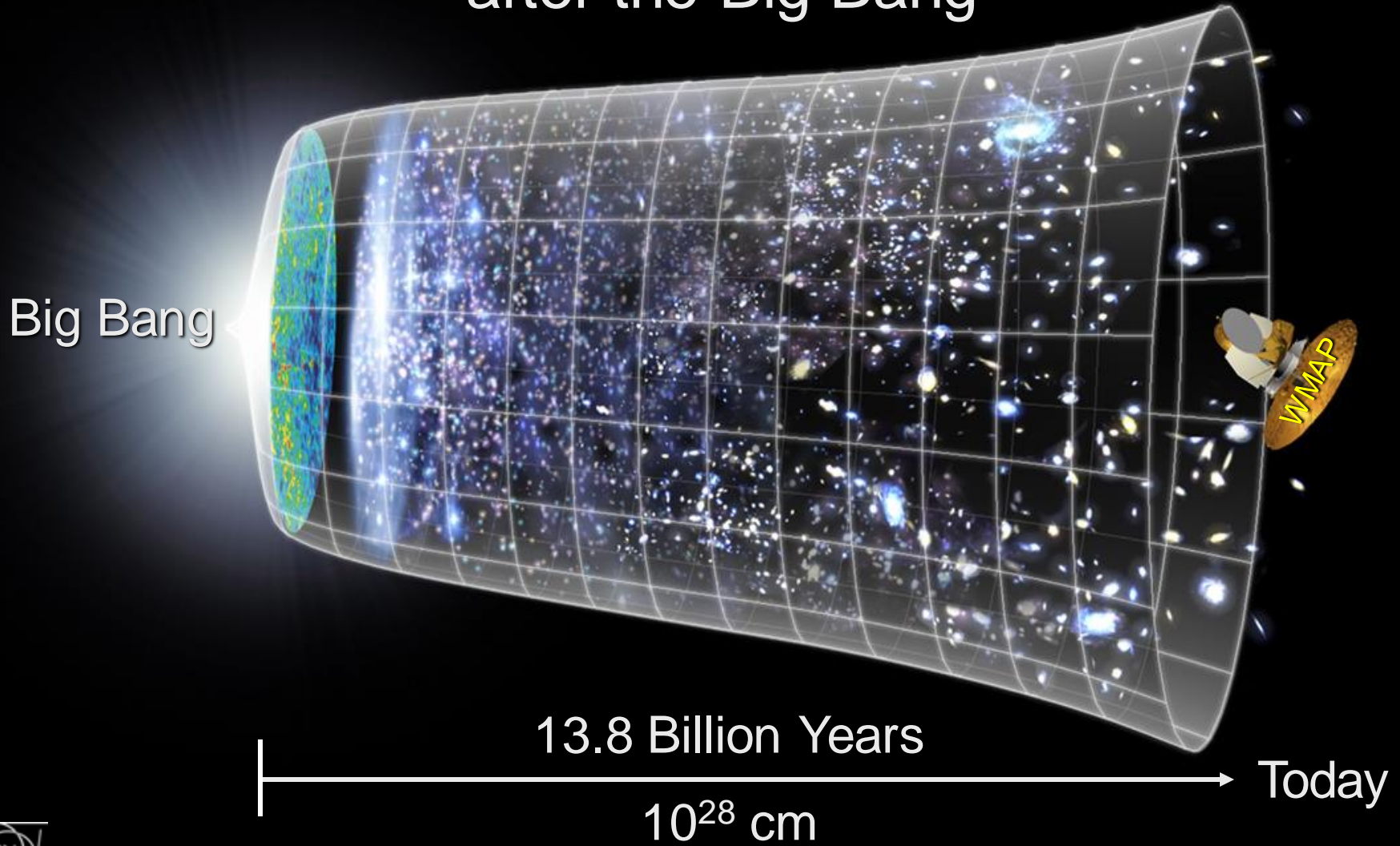


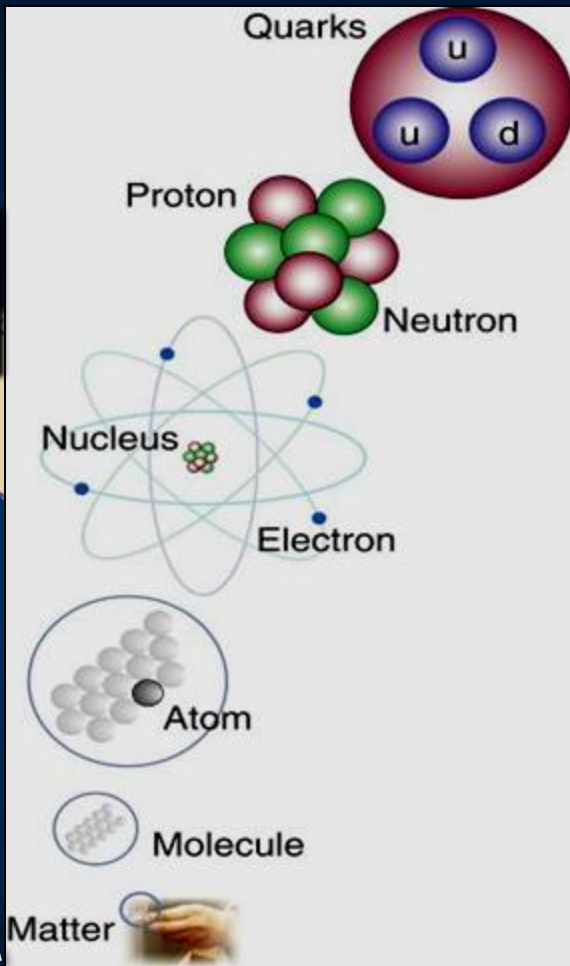
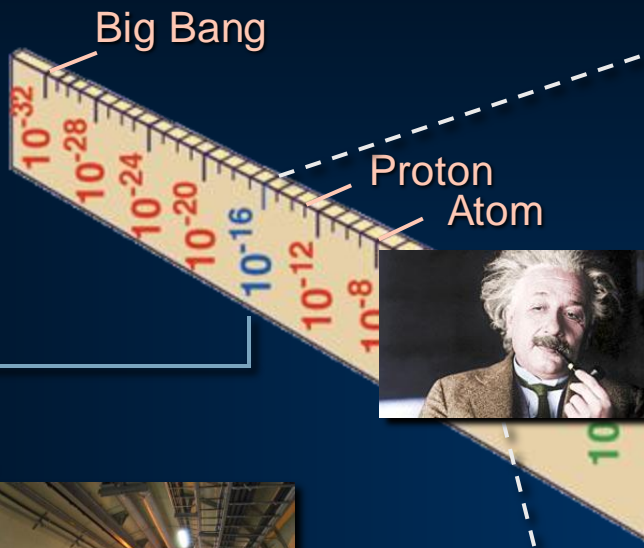
They do not all stay: where do they go?



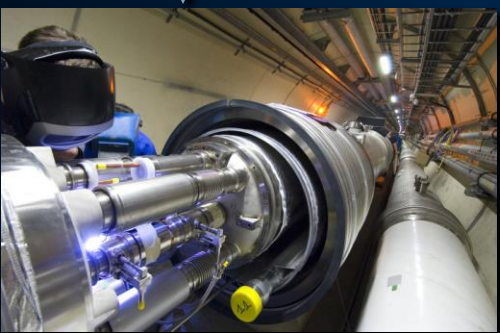
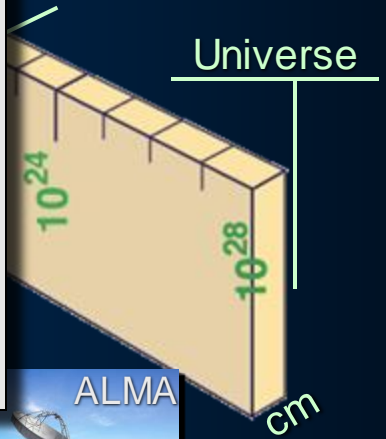
# Next Scientific Challenge:

to understand the very first moments of our Universe  
after the Big Bang





Radius of Galaxies



LHC

Super-Microscope



Study physics laws of first moments after Big Bang increasing Symbiosis between Particle Physics, Astrophysics and Cosmology





# Discovery 2012, Nobel Prize in Physics 2013



The Nobel Prize in Physics 2013 was awarded jointly to François Englert and Peter W. Higgs *"for the theoretical discovery of a mechanism that contributes to our understanding of the origin of mass of subatomic particles, and which recently was confirmed through the discovery of the predicted fundamental particle, by the ATLAS and CMS experiments at CERN's Large Hadron Collider"*.





# 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)

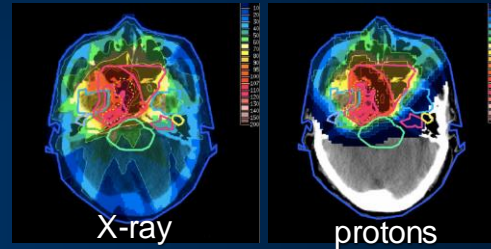
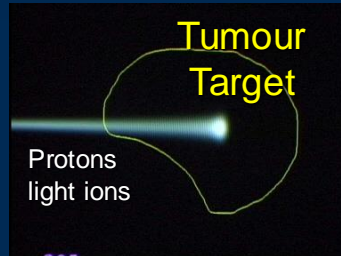
# Medical Application as an Example of Particle Physics Spin-off

Combining Physics, ICT, Biology and Medicine to fight cancer



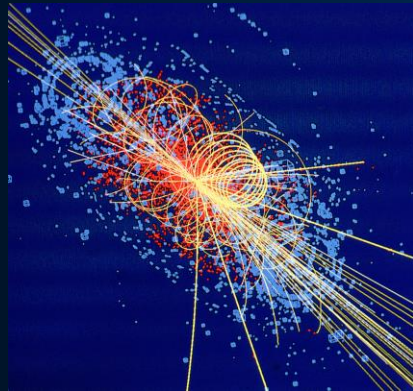
## Hadron Therapy

Accelerating particle beams  
~30'000 accelerators worldwide  
~17'000 used for medicine



Leadership in Ion Beam Therapy now in Europe and Japan

>100'000 patients treated worldwide (45 facilities)  
>50'000 patients treated in Europe (14 facilities)

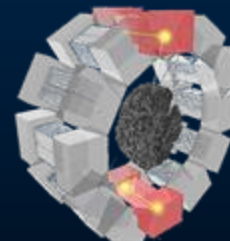


## Imaging

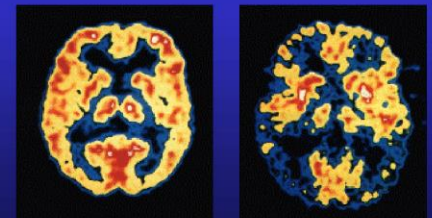
Clinical trial in Portugal, France and Italy for new breast imaging system (ClearPEM)



## PET Scanner



Brain Metabolism in Alzheimer's Disease: PET Scan



Detecting particles



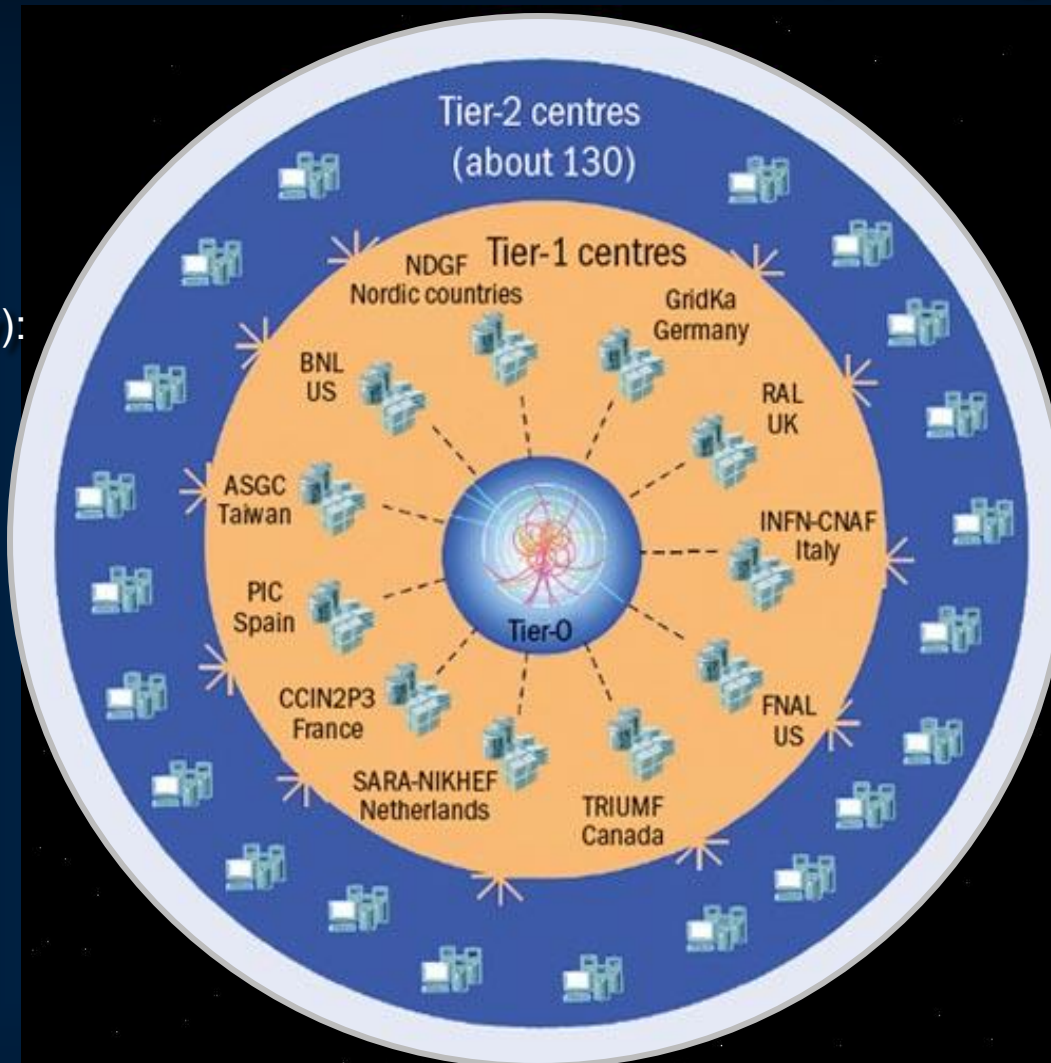


# The Worldwide LHC Computing Grid

Tier-0  
(CERN and Hungary):  
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



## Latin American School of High-Energy Physics

Natal, Brazil, 2011  
Arequipa, Peru, 2013  
Ibarra, Ecuador, 2015

## Young Researchers

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



## Physics Students

Summer Students  
Programme



## CERN Teacher Schools

International and National  
Programmes





Thank You!



*Accelerating Science and Innovation*