

# Workshop: World Cooperation in Physics Bridging the Gaps



Foz do Iguaçu, Brazil  
5 June 2011

Felicitas Pauss / CERN and ETH Zurich

**CERN was founded in 1954 (12 European States)**  
with a dual mission:  
**research and collaboration for the betterment of humanity**



### **Louis De Broglie:**

*“A laboratory where it would be possible to carry out **scientific work** above and beyond the framework of the various nations taking part*

*.....  
an engine for peaceful collaboration across borders”*

### **Today:**

20 European Member States

1 Candidate for Accession

8 Observers:

USA, Japan, Indian, Russia, Israel, Turkey,  
EU and UNESCO

→ **World's largest Particle Physics Laboratory**

20 Member States +  
Candidate State contribute to  
CERN budget

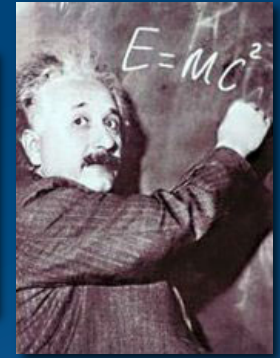
% contribution based on NNI



# The Mission of CERN

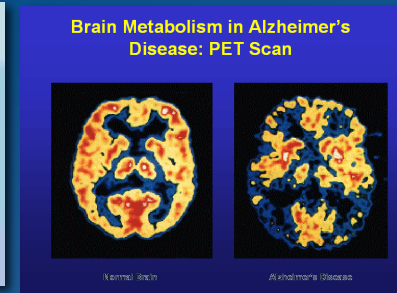
- ❑ **Push forward** the frontiers of knowledge

E.g. the secrets of the Big Bang, what is the matter like within the first moments of the universe, what is the nature of dark matter and dark energy?

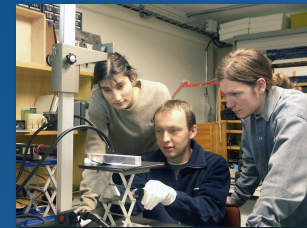


- ❑ **Develop** new technologies, accelerators and detectors

Information technology  
Medicine - diagnosis and therapy



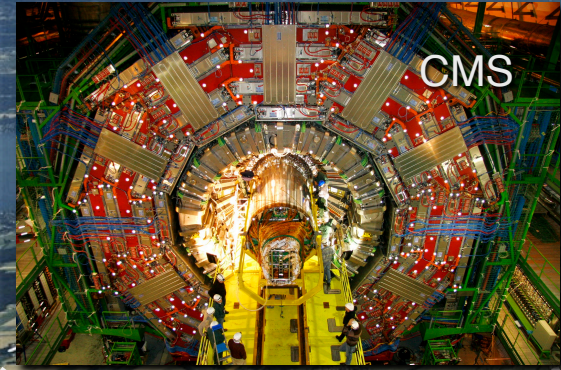
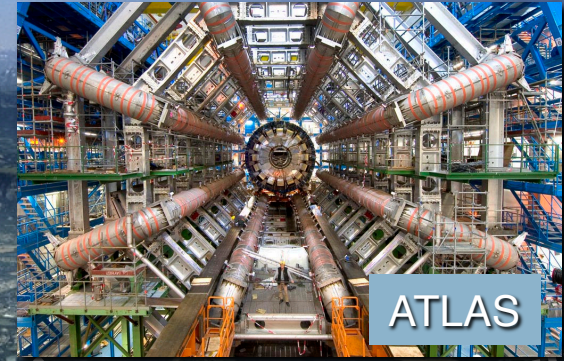
- ❑ **Train** scientists and engineers of tomorrow



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

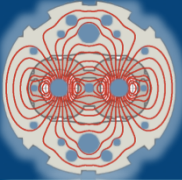


# LHC → a New Era in Fundamental Science



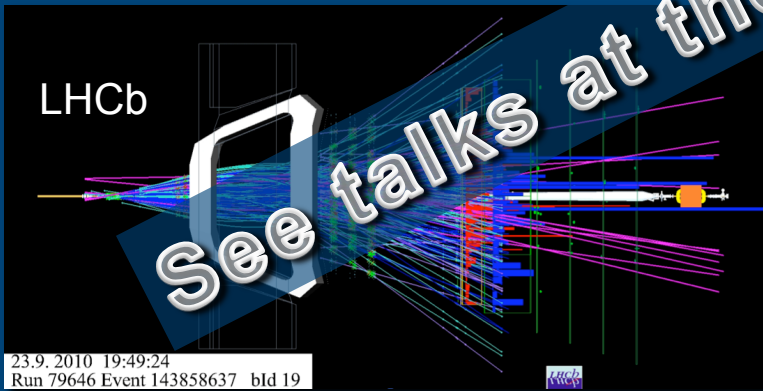
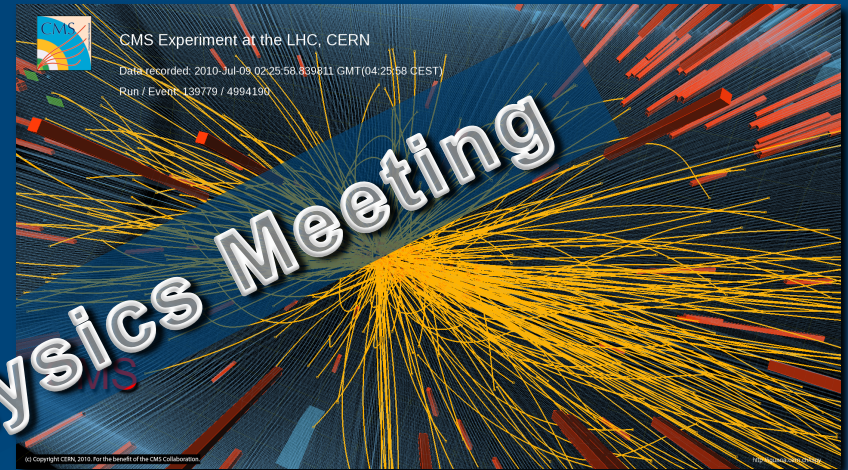
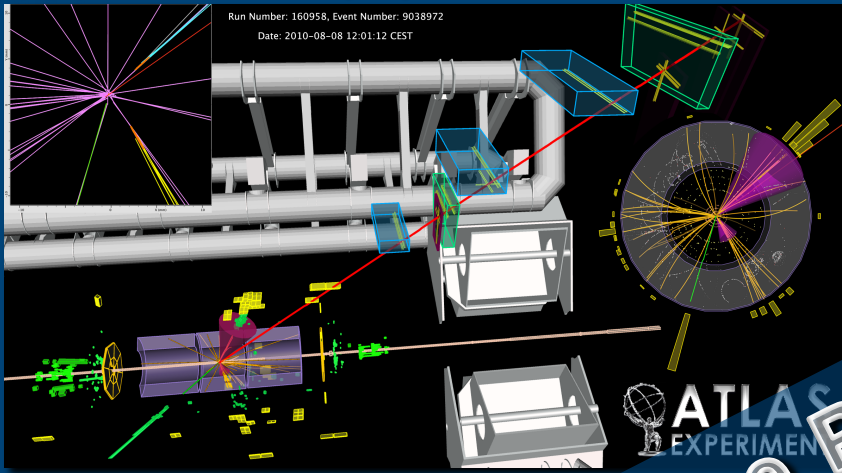
Exploration of a new energy frontier  
in p-p and Pb-Pb collisions



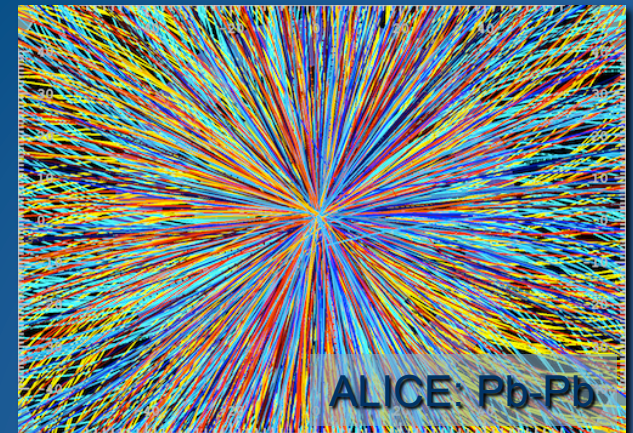


# LHC and Experiments – CERN’s Flagship project

## First p-p collisions at $\sqrt{s} = 7$ TeV on 30 March 2010



First Pb-Pb collisions at  $\sqrt{s} = 2.76$  TeV/N on 7 Nov 2010

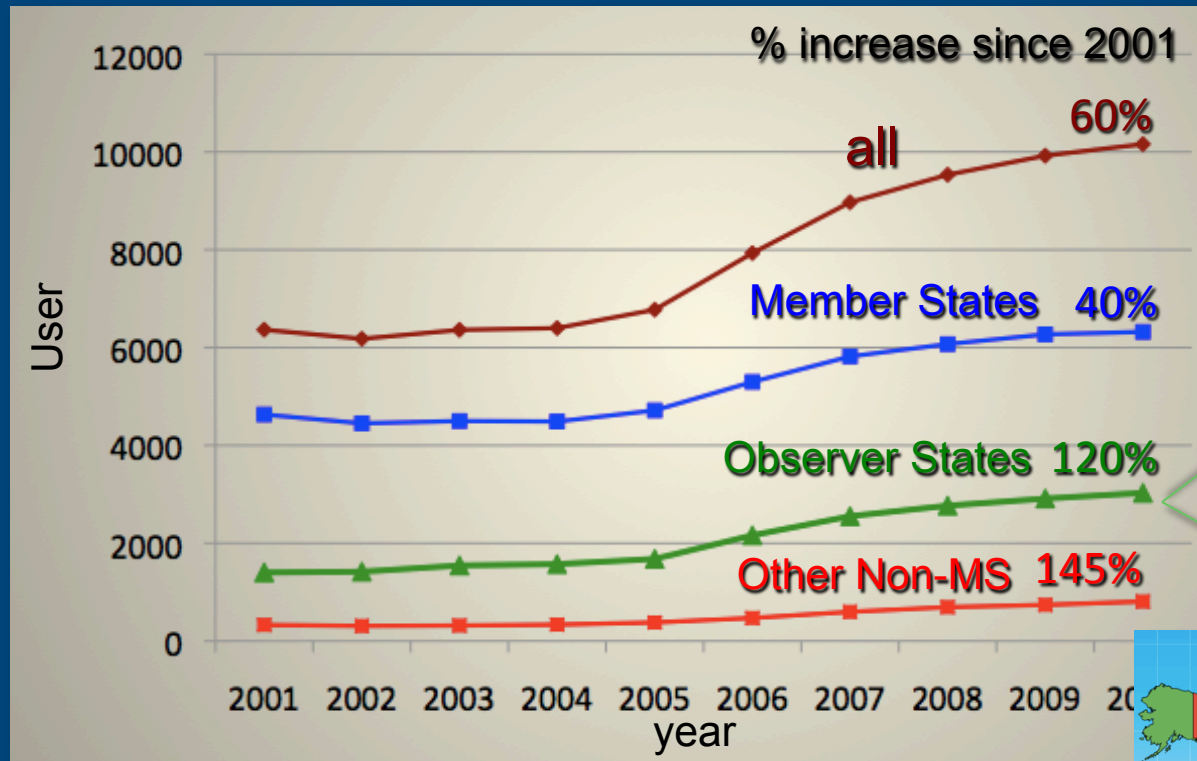


- Excellent performances of LHC, experiments and GRID computing
- 1<sup>st</sup> collisions in 2011 on 13 March → Brilliant performance so far

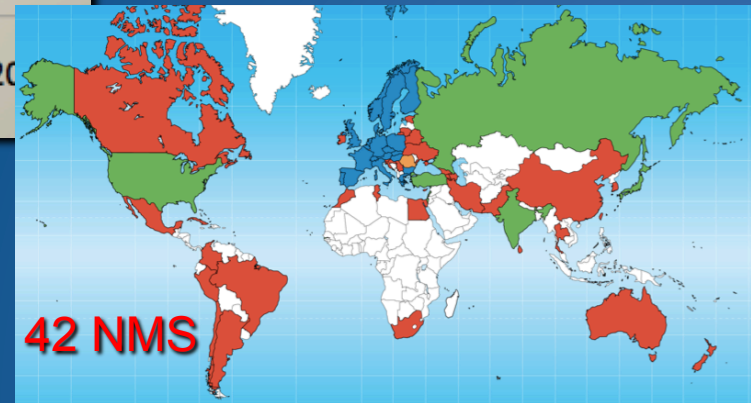


# Impact of LHC on Evolution of CERN Users

Evolution of the number of CERN users by geographical location of the home institute: 2001-2010



6 Observer States:  
India, Israel, Japan,  
Russia, Turkey, USA

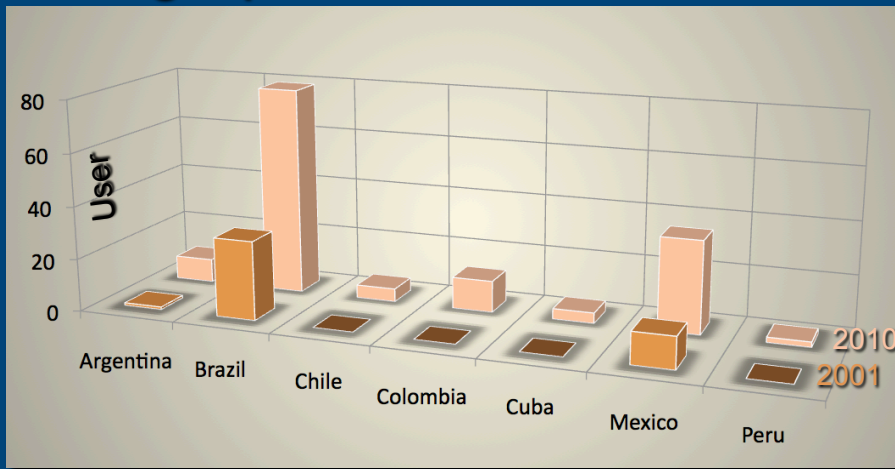


Impact of LHC!



# Evolution of CERN Users from Latin America

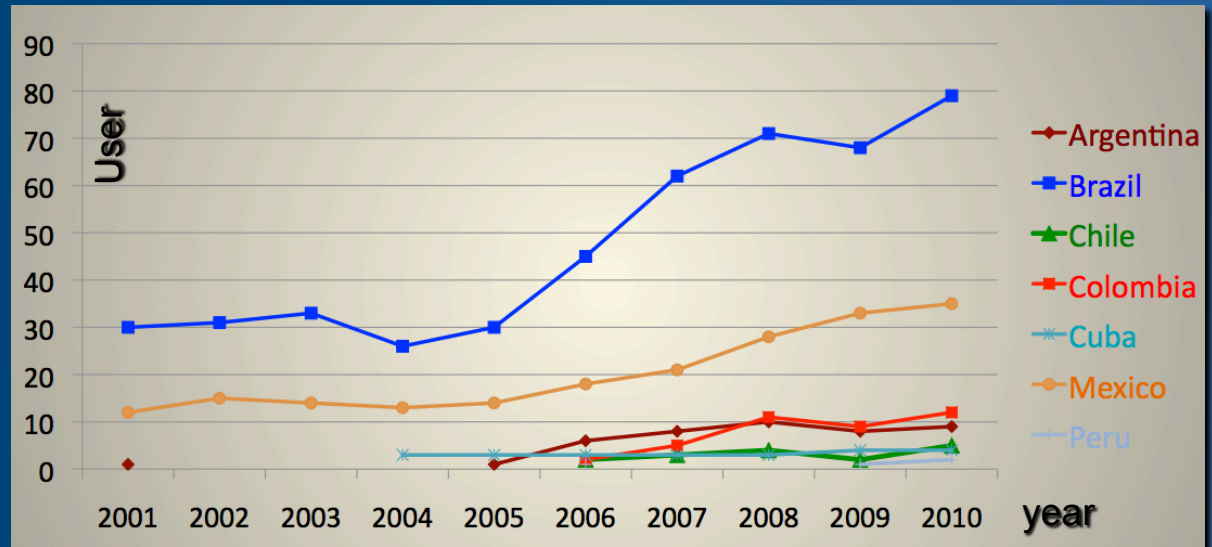
## Geographical location of the home institute: 2001-2010



Total number of users

2001: 43

2010: 146

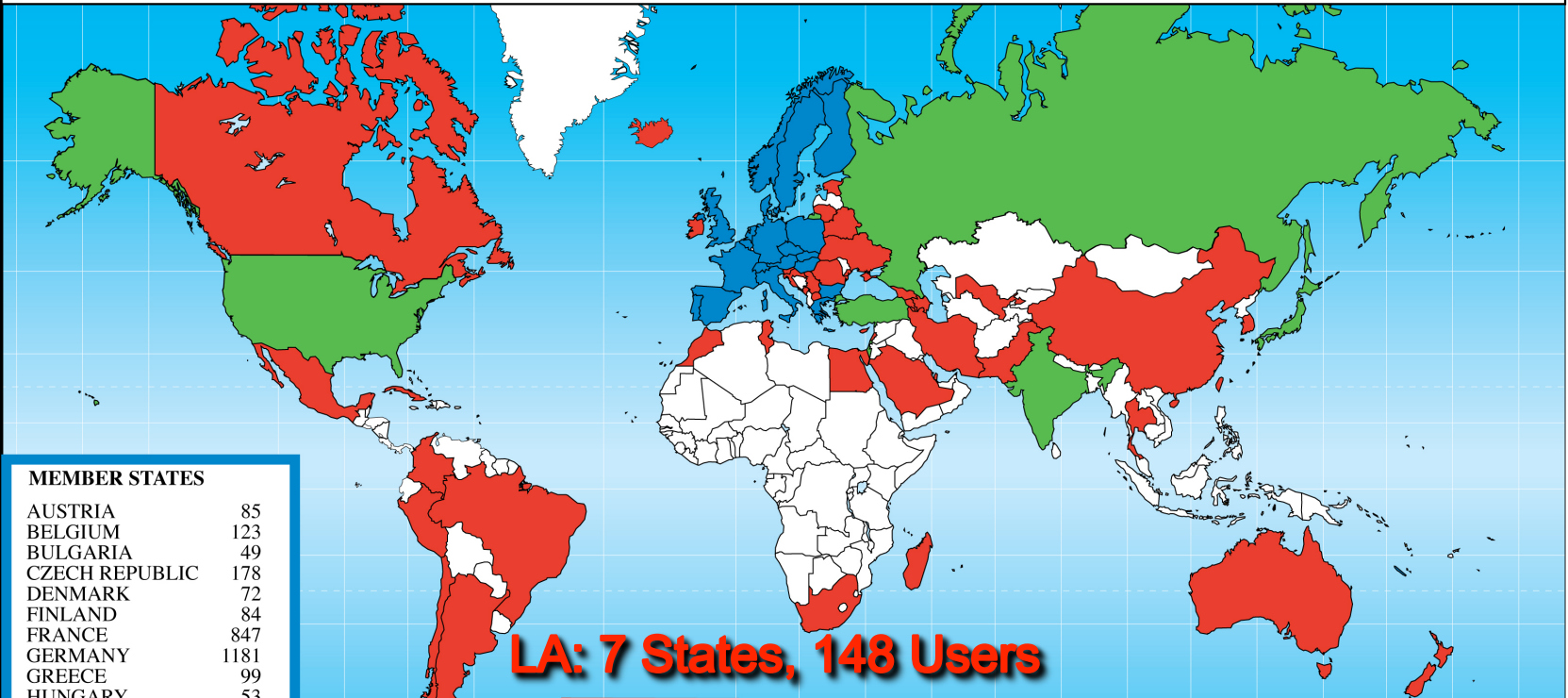




# Science is getting more and more global



## Distribution of All CERN Users by Nation of Institute on 8 March 2011



### MEMBER STATES

AUSTRIA	85
BELGIUM	123
BULGARIA	49
CZECH REPUBLIC	178
DENMARK	72
FINLAND	84
FRANCE	847
GERMANY	1181
GREECE	99
HUNGARY	53
ITALY	1377
NETHERLANDS	169
NORWAY	87
POLAND	198
PORTUGAL	126
SLOVAKIA	63
SPAIN	317
SWEDEN	74
SWITZERLAND	360
UNITED KINGDOM	701

**6243**

### OBSERVER STATES

INDIA	90
ISRAEL	60
JAPAN	213
RUSSIA	818
TURKEY	70
USA	1664

**2915**

**LA: 7 States, 148 Users**

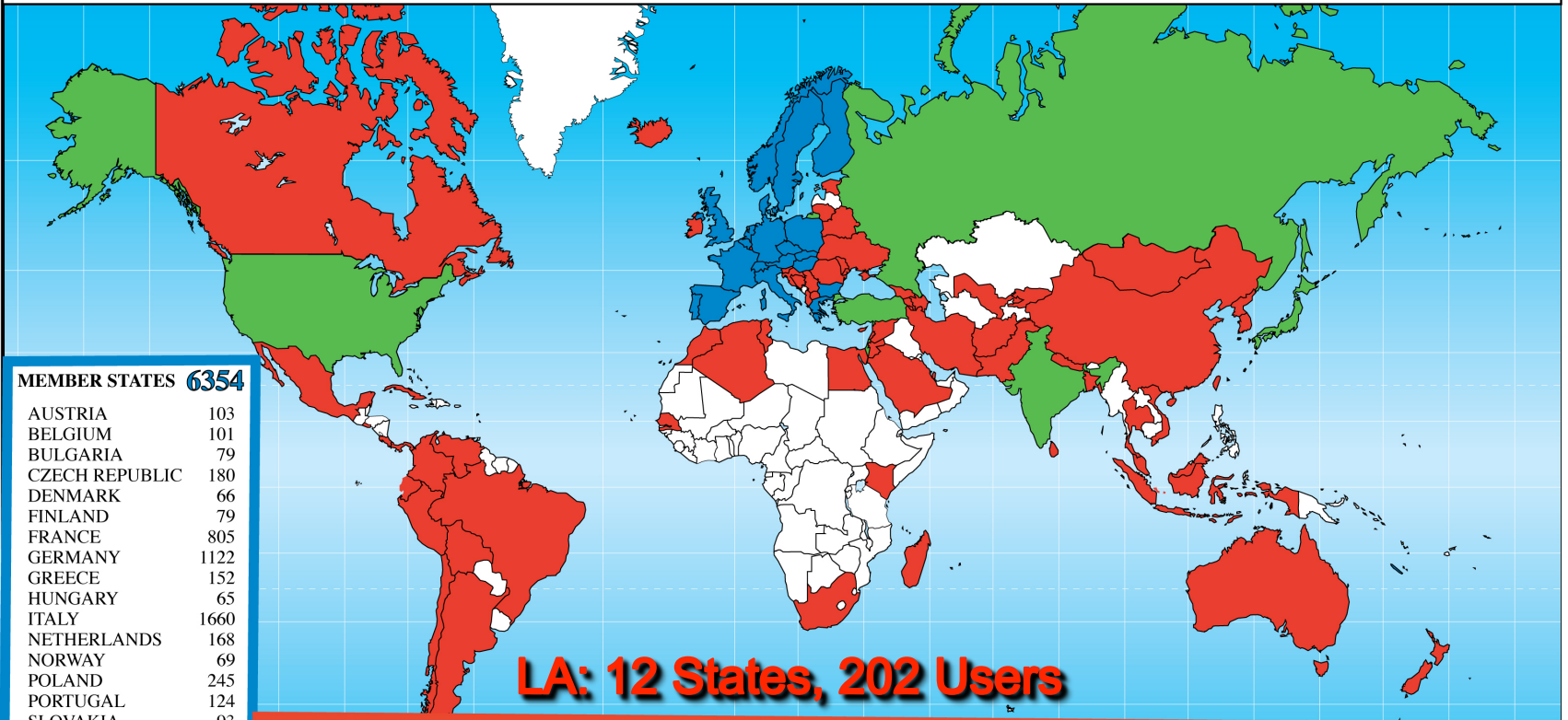
### OTHERS

ARGENTINA	11	CROATIA	15	LITHUANIA	17	SERBIA	21
ARMENIA	12	CUBA	4	MADAGASCAR	1	SLOVENIA	29
AUSTRALIA	18	CYPRUS	6	MALTA	1	SOUTH AFRICA	12
AZERBAIJAN	1	EGYPT	5	MEXICO	34	THAILAND	1
BELARUS	20	ESTONIA	12	MONTENEGRO	1	F.Y.R.O.M.	2
BRAZIL	83	GEORGIA	8	MOROCCO	6	TUNISIA	1
CANADA	153	ICELAND	3	NEW ZEALAND	8	UKRAINE	17
CHILE	4	IRAN	18	PAKISTAN	14	UZBEKISTAN	1
CHINA	83	IRELAND	13	PERU	2		
CHINA (TAIPEI)	53	KOREA	78	QATAR	1		
COLOMBIA	10	LEBANON	1	ROMANIA	61		
				SAUDI ARABIA	2		

**843**



## Distribution of All CERN Users by Nationality on 8 March 2011



### MEMBER STATES 6354

AUSTRIA	103
BELGIUM	101
BULGARIA	79
CZECH REPUBLIC	180
DENMARK	66
FINLAND	79
FRANCE	805
GERMANY	1122
GREECE	152
HUNGARY	65
ITALY	1660
NETHERLANDS	168
NORWAY	69
POLAND	245
PORTUGAL	124
SLOVAKIA	93
SPAIN	337
SWEDEN	74
SWITZERLAND	214
UNITED KINGDOM	618

### OBSERVER STATES 2422

INDIA	167
ISRAEL	61
JAPAN	241
RUSSIA	948
TURKEY	95
USA	910

**LA: 12 States, 202 Users**

### OTHERS 1287

AFGHANISTAN	1	BRAZIL	85	ESTONIA	9	LEBANON	10	PAKISTAN	34	SYRIA	2
ALBANIA	3	CANADA	138	GEORGIA	32	LITHUANIA	20	PALESTINE (O.T.)	1	THAILAND	3
ALGERIA	11	CHILE	4	GIBRALTAR	1	LUXEMBOURG	4	PANAMA	1	F.Y.R.O.M.	1
ARGENTINA	13	CHINA	214	HONG KONG	1	MADAGASCAR	4	PERU	3	TUNISIA	6
ARMENIA	22	CHINA (TAIPEI)	41	ICELAND	3	MALAYSIA	5	QATAR	1	UKRAINE	40
AUSTRALIA	18	COLOMBIA	26	INDONESIA	2	MALTA	2	ROMANIA	95	UZBEKISTAN	2
AZERBAIJAN	5	COSTA RICA	2	IRAN	24	MAURITIUS	1	SAN MARINO	1	VENEZUELA	9
BANGLADESH	3	CROATIA	22	IRELAND	23	MEXICO	50	SAUDI ARABIA	3	VIET NAM	7
BELARUS	37	CUBA	5	JORDAN	1	MOLDOVA	1	SENEGAL	1		
BOLIVIA	2	CYPRUS	11	KENYA	1	MONGOLIA	1	SERBIA	35		
BOSNIA AND HERZEGOVINA	1	ECUADOR	2	KOREA, D.P.R.	3	MOROCCO	15	SLOVENIA	30		
		EGYPT	8	KOREA REP.	99	NEPAL	2	SOUTH AFRICA	9		
		EL SALVADOR	1	KYRGYZSTAN	1	NEW ZEALAND	8	SRI LANKA	5		

CERN  
programmes

Capacity  
building

Capacity  
development

Example of  
Latin America



Bridging  
the Gaps



# Capacity Building → Capacity Development

Investment in **human capital**, enabling individuals to realize their potential

Includes **development of systems & structures** within the home countries of individuals for them to efficiently work there

**CERN's education programme – one of CERN's mission –** includes many aspects of **“capacity building”**:  
research experience for undergraduate students, PhD opportunities, schools, training programmes, etc

**AND**

**“capacity development”**:  
assistance in building up research groups in home countries, sharing best practices in management of national/international programmes, etc



# CERN's Education Programme

## Scientists at CERN

Academic Training Programme



## Young Researchers

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

In 2013 in Peru



Latin American School  
Natal, Brazil, 2011



CERN School of Physics  
Cheile Gradistei,  
Romania, Sep 2011

## Physics Students

Summer Students  
Programme



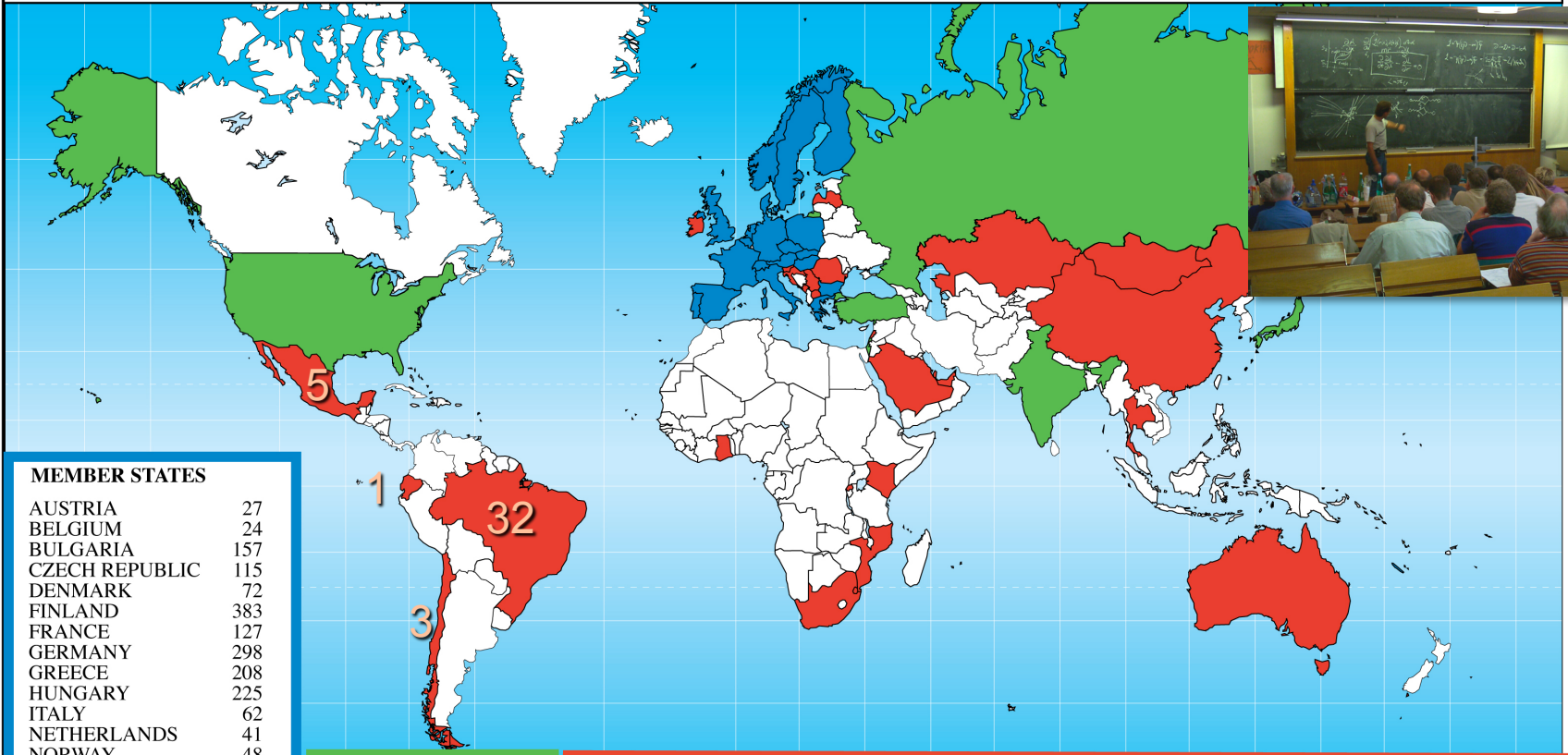
## CERN Teacher Schools

International and National  
Programmes



# CERN Teacher Programme Participants: 1998 – December 2010

## CERN Teacher Programme Participants 1998 - 2010



### MEMBER STATES

AUSTRIA	27
BELGIUM	24
BULGARIA	157
CZECH REPUBLIC	115
DENMARK	72
FINLAND	383
FRANCE	127
GERMANY	298
GREECE	208
HUNGARY	225
ITALY	62
NETHERLANDS	41
NORWAY	48
POLAND	485
PORTUGAL	212
SLOVAKIA	189
SPAIN	168
SWEDEN	79
SWITZERLAND	34
UNITED KINGDOM	668

**3622**

### OBSERVER STATES

INDIA	2
ISRAEL	1
JAPAN	2
RUSSIA	84
TURKEY	2
USA	51

**142**

### OTHERS

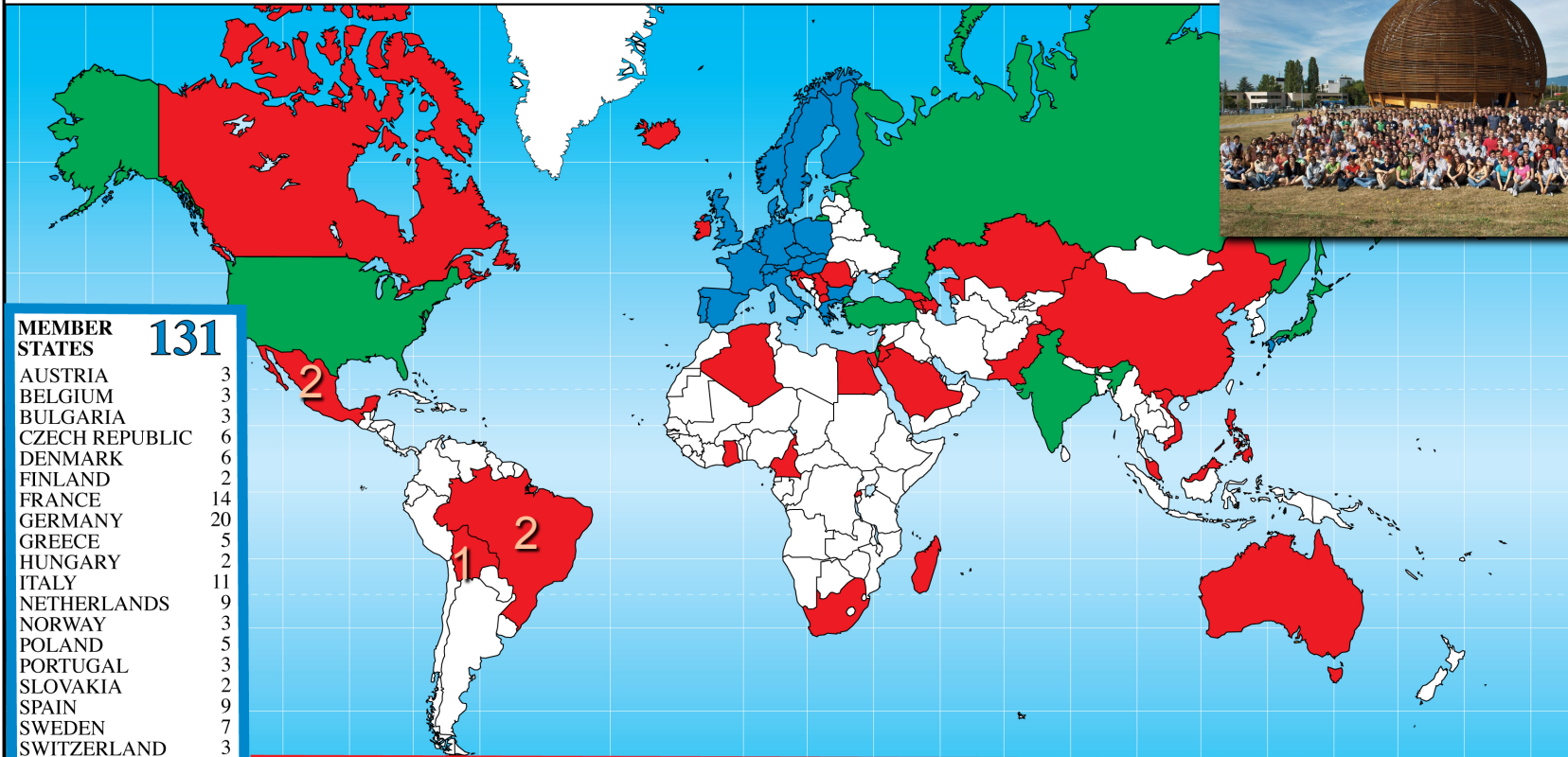
AUSTRALIA	1	GHANA	2	MONTENEGRO	13	SLOVENIA	21
AZERBAIJAN	1	IRELAND	3	MOZAMBIQUE	9	SOUTH AFRICA	6
<u>BRAZIL</u>	32	KAZAKHSTAN	3	QATAR	1	SWAZILAND	1
CAPE VERDE	1	KENYA	1	ROMANIA	7	THAILAND	2
CHILE	3	LATVIA	1	RWANDA	7	F.Y.R.O.M.	11
CHINA	1	LEBANON	1	SAO TOME	1	U.A.E.	1
CROATIA	1	MALTA	36	SAUDI ARABIA	1		
<u>ECUADOR</u>	1	MEXICO	5	SERBIA	10		
		MONGOLIA	1	SINGAPORE	2		

**187**



# CERN Summer Students 2010

## Distribution of Summer Students 2010



<b>MEMBER STATES</b>	<b>131</b>
AUSTRIA	3
BELGIUM	3
BULGARIA	3
CZECH REPUBLIC	6
DENMARK	6
FINLAND	2
FRANCE	14
GERMANY	20
GREECE	5
HUNGARY	2
ITALY	11
NETHERLANDS	9
NORWAY	3
POLAND	5
PORTUGAL	3
SLOVAKIA	2
SPAIN	9
SWEDEN	7
SWITZERLAND	3
UNITED KINGDOM	15

<b>OBSERVER STATES</b>	<b>53</b>
INDIA	8
ISRAEL	4
JAPAN	5
RUSSIA	9
TURKEY	10
USA	17

### NON-MEMBER STATES

ALGERIA	2	CAMEROON	1	IRELAND	1	PHILIPPINES	1
ARMENIA	2	CANADA	5	JORDAN	1	ROMANIA	1
AUSTRALIA	2	CHINA	2	KAZAKHSTAN	1	RWANDA	1
AZERBAIJAN	1	CROATIA	4	LEBANON	1	SAUDI ARABIA	2
BOLIVIA	1	EGYPT	1	MADAGASCAR	2	SERBIA	1
BOSNIA & HERZEGOVINA	2	ESTONIA	2	MALAYSIA	1	SINGAPORE	1
BRAZIL	2	GHANA	1	MALTA	3	SLOVENIA	1
		GIBRALTAR	1	MEXICO	2	SOUTH AFRICA	1
		ICELAND	1	PAKISTAN	6	SOUTH KOREA	1
						THAILAND	2
						F.Y.R.O.M.	2
						VIETNAM	4

**66**



# CERN – Latin American School of High-Energy Physics

6<sup>th</sup> CERN–Latin American School of High-Energy Physics (CLASHEP) was held in Natal, Brazil from 23 March to 5 April 2011



- 2011 attendance: 83 students from 15 countries on 3 continents – a record breaking attendance!

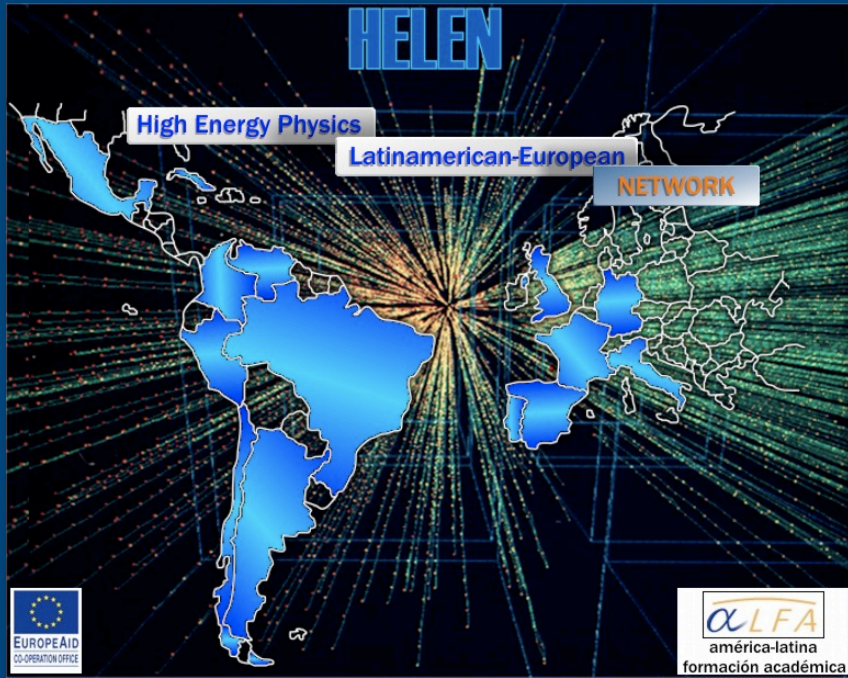


- Established in 2001 as a way of engaging young LA scientists in the field of particle physics → played an important role in encouraging LA institutes to collaborate with CERN  
1<sup>st</sup> in Brazil, than Mexico, Argentina, Chile, Colombia, Brazil, in 2013 in Peru
- Brazil has made significant contributions to supporting neighbouring nations by helping students from across LA



# The HELEN Network (2005 – 2009)

LA: Argentina, Brazil, Chile, Columbia, Cuba, Mexico, Peru, Venezuela



- ❑ Essential to strengthen existing collaborations between **Latin America and Europe**
- ❑ Helped to promote new scientific collaborations
- ❑ CERN center of activities: >70% of Grant Holders
- ❑ **HELEN used the mobility of the personnel**
- ❑ CERN provided environment for scientific and technical training

Follow-up project **EPLANET (FP7 programme)**:

started in February 2011 (4 years)

Participating Countries: Argentina, Brazil, Chile and Mexico  
(subset of HELEN Network)





# Latin America – CERN Collaboration



- Governmental Co-operation Agreements (ICA)
- Other scientific contacts
- IT contacts
- HELEN network

## Involvement in LHC programme (first ICA):

Argentina (ICA '92)	ATLAS
Brazil (ICA '90)	ATLAS, CMS, LHCb, ALICE
Chile (ICA '91)	ATLAS
Colombia (ICA '93)	ATLAS, CMS
Cuba	ALICE
Mexico (ICA '98)	ALICE, CMS
Peru (ICA '93)	ALICE (via Mexican team)

## Under discussions – interests in:

Bolivia (ICA '07)	ALICE
Ecuador (ICA '99)	CMS
Venezuela	ATLAS



# CERN – a Global Laboratory

- ❑ Fundamental science as carried out at CERN provides **the foundations for future knowledge and innovation**
- ❑ CERN became a **world-class centre of excellence, attracting the best scientists and connecting Europe** to the rest of the world → CERN became a **GLOBAL LABORATORY**



CERN Council recognizes the increasing globalization of the field, and the important role played by CERN and thus decided at its June 2010 Session to

- ❑ open **Membership to any State**, independent on its geographical location
- ❑ introduce a revised **Associate Membership** status



# Associate Membership

- ❑ CERN's **four key missions** (research in fundamental physics, training, advancing technology and international collaboration) provide a coherent package for capacity development.
- ❑ While any country collaborating with CERN derives some benefit from these activities of CERN, **full benefits are reserved for states that are either Associate or Full Members of CERN.**
- ❑ CERN is at the forefront of developments in technologies that have many applications in other fields → research groups collaborating with CERN participate in international networks that share and transfer knowledge in these areas, but **formal participation in CERN's Knowledge and Technology Transfer programmes is reserved for (Associate) Member States.**



Thank You!  
Obrigado!

SUISSE  
FRANCE

CMS

LHCb

ATLAS

CERN Meyrin

CERN Prévessin

SPS 7 km

ALICE

LHC 27 km