

# ***CERN – Science without Borders:***

*An example of a scientific, technical and training  
co-operation on a global scale*



Bern  
19 May 2017

Felicitas Pauss  
ETH Zurich





# The foundations for CERN's success

Scientific and political leaders from 12 European States with visionary minds founded CERN in 1954 with a dual mission:  
Fundamental research and collaboration for the betterment of humanity



1954: Start of construction in Meyrin (close to Geneva)

*“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”*

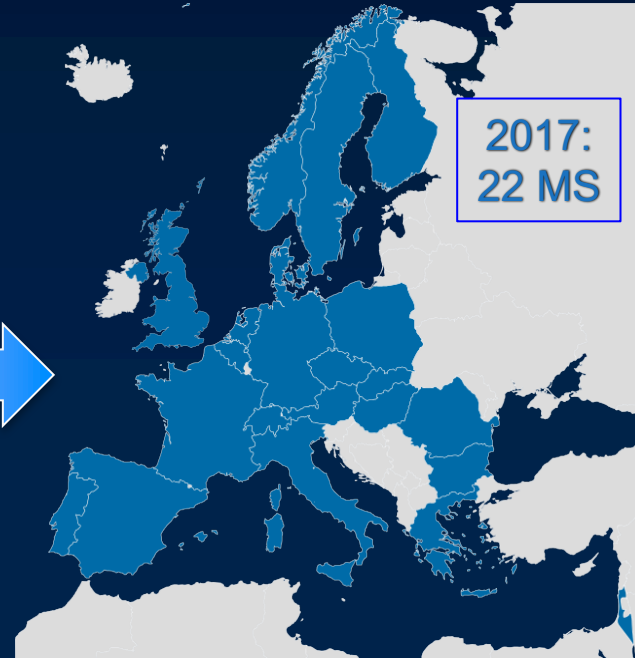
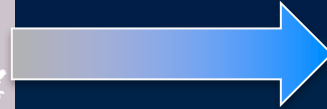
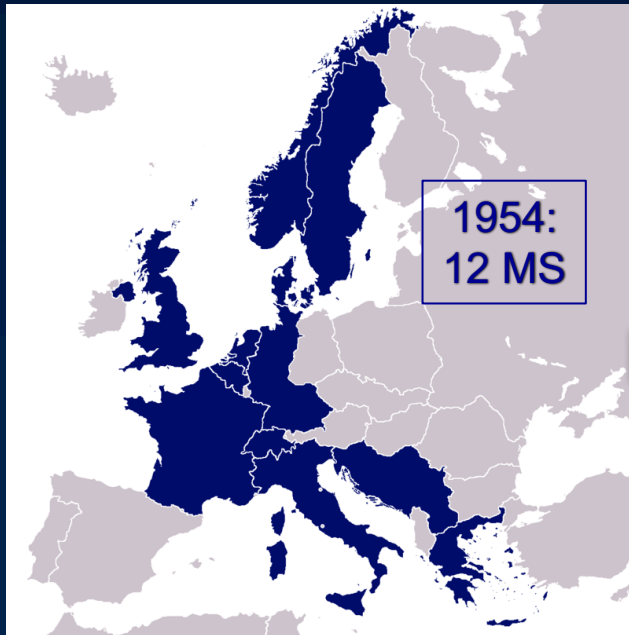


L. De Broglie  
1892–1987  
NP in 1929 for his  
discovery of the  
wave nature of  
electrons





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



### Sir Ben Lockspeiser

(first president of CERN Council):

*“Scientific research lives and flourishes in an atmosphere of freedom – freedom to doubt, freedom to enquire and freedom to discover. These are the conditions under which this new laboratory has been established.”*

#### Member states (22):

21 European + Israel

#### Associate in pre-stage to MS:

Cyprus, Serbia

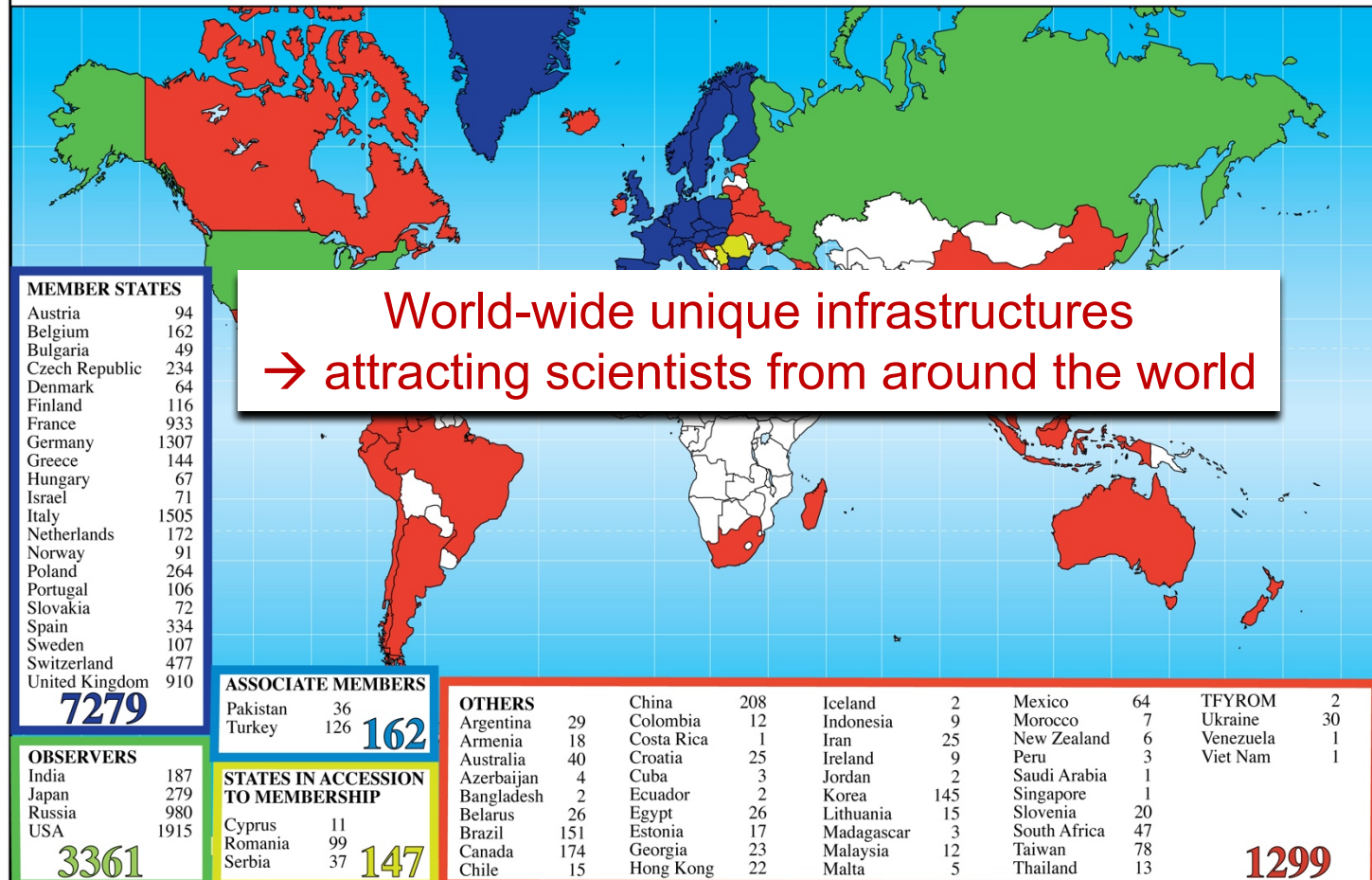
#### Associate Members:

India, Pakistan, Turkey, Ukraine

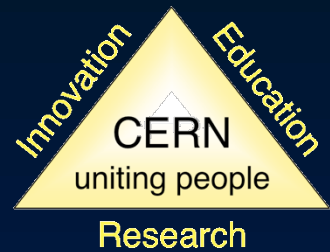
CERN: ~ 2300 staff; ~ 1000 fellows, etc  
Budget ~1'000 MCHF

# CERN Users: A global scientific community

## Distribution of All CERN Users by Location of Institute on 12 January 2016



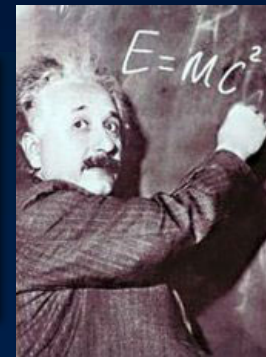
>12'000 Users from Institutes located in 73 countries; ~60% from MS and A-MS  
Users: 102 nationalities



# The Mission of CERN

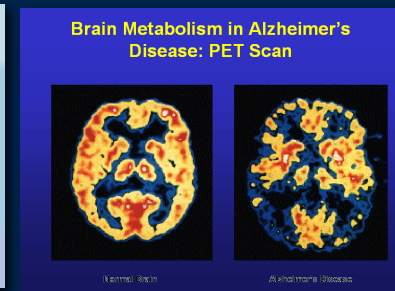
## ❑ Push back the frontiers of knowledge

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

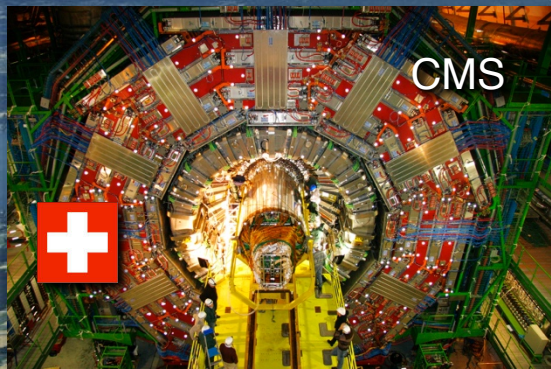


## ❑ Unite people from different countries and culture





# A New Era in Fundamental Science



CMS



LHCb



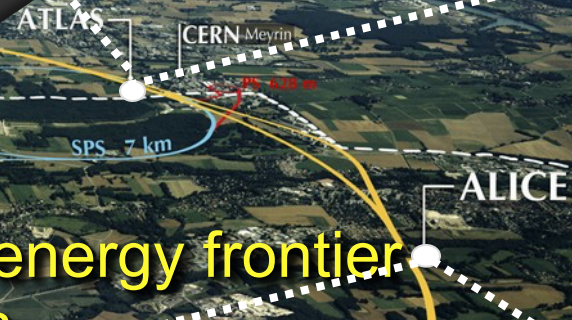
ATLAS



Since March 2010

operation of a new energy frontier  
on a global scale

LHC ring:  
27 km circumference

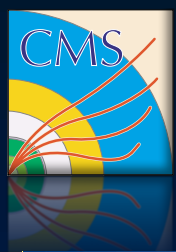


ALICE

ATLAS	A Toroidal LHC Apparatus
CMS	Compact Muon Solenoid
LHCb	Large Hadron Collider beauty
ALICE	A Large Ion Collider Experiment



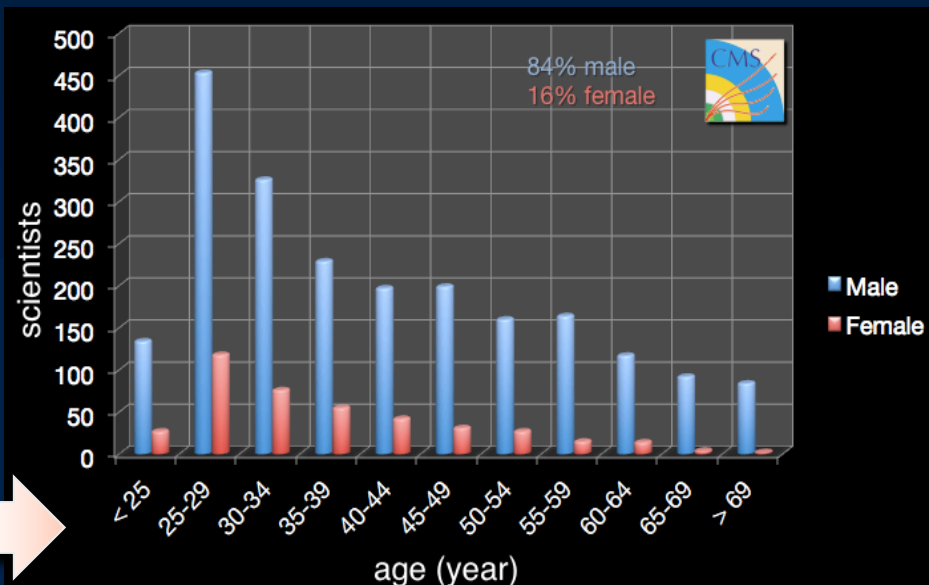
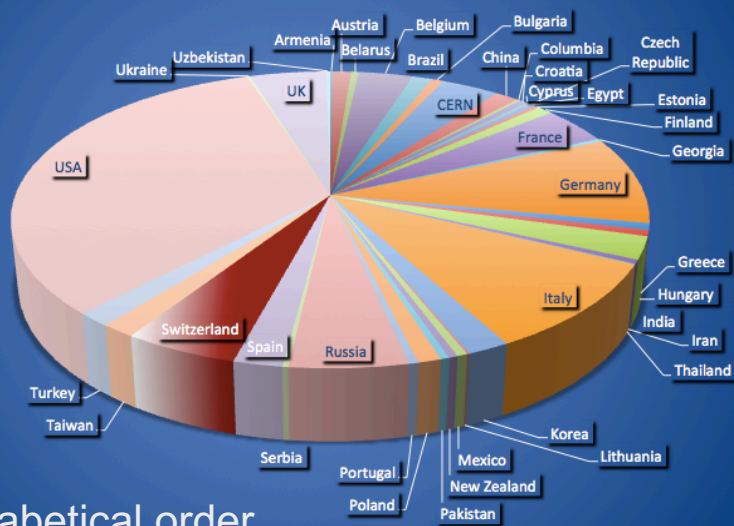




# CMS: a truly global scientific project

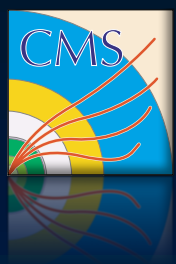
~3000 scientists, ~200 institutes, ~40 countries

CMS authors for Higgs discovery paper

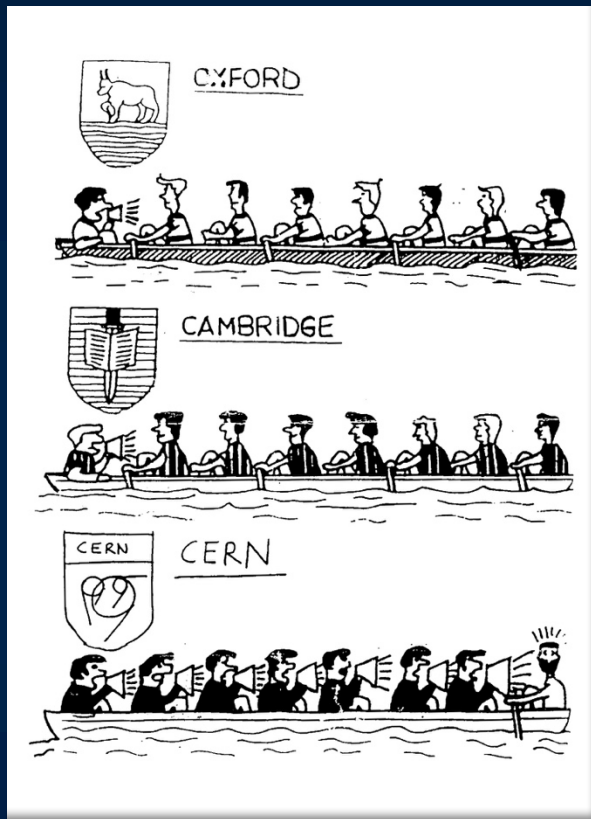


## Impact of large international collaborations:

- ❑ a place where people learn how to work together
- ❑ cooperation and competition are the path to success
- ❑ open access and sharing results allows everyone to participate and contribute to new developments



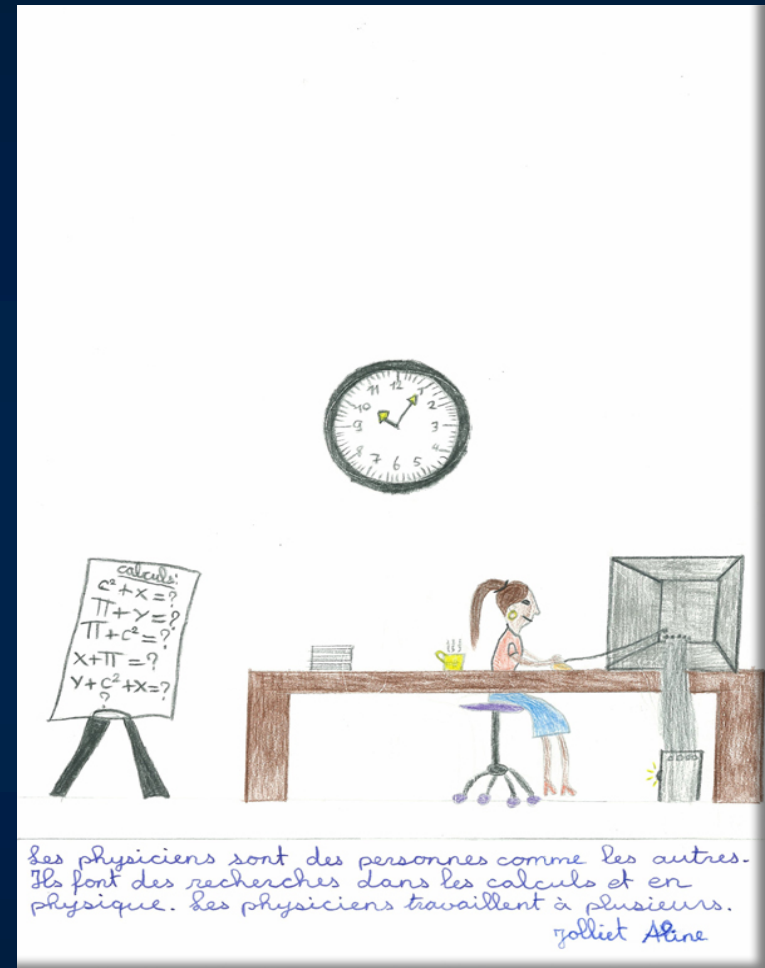
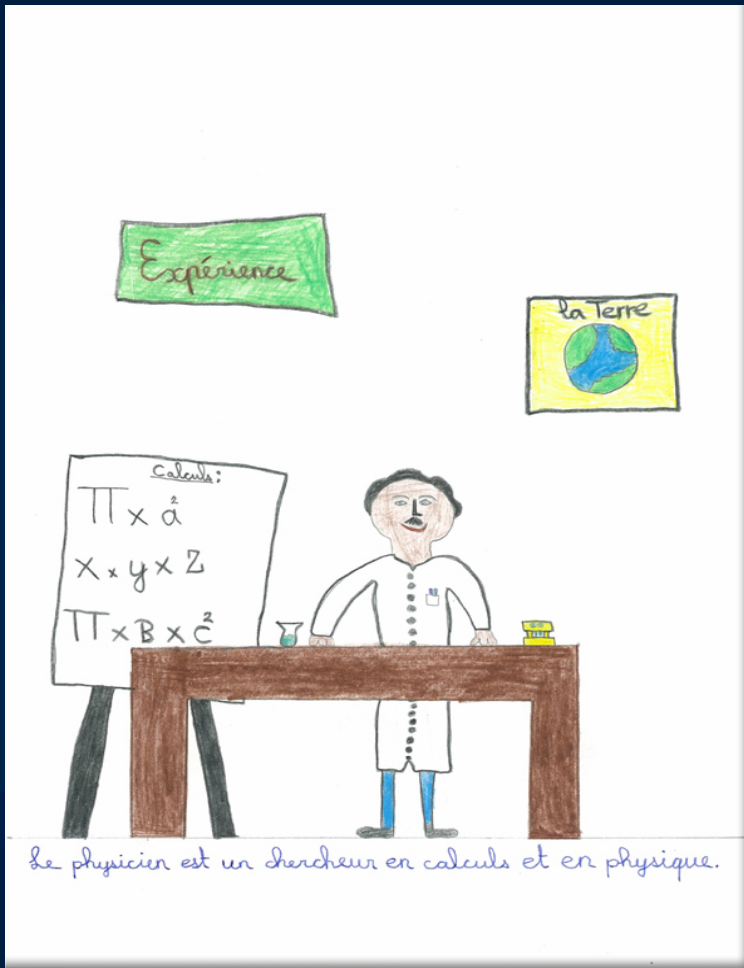
... you learn how to collaborate and to manage .....



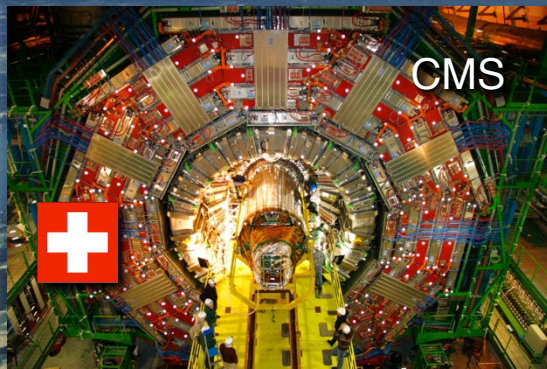
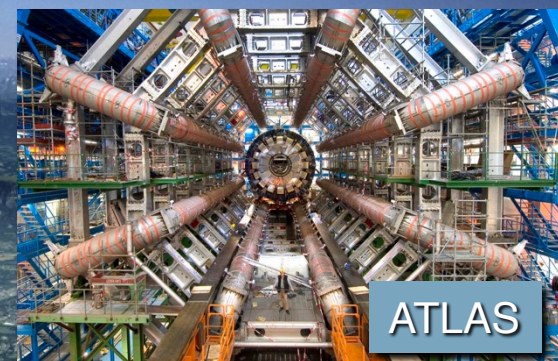
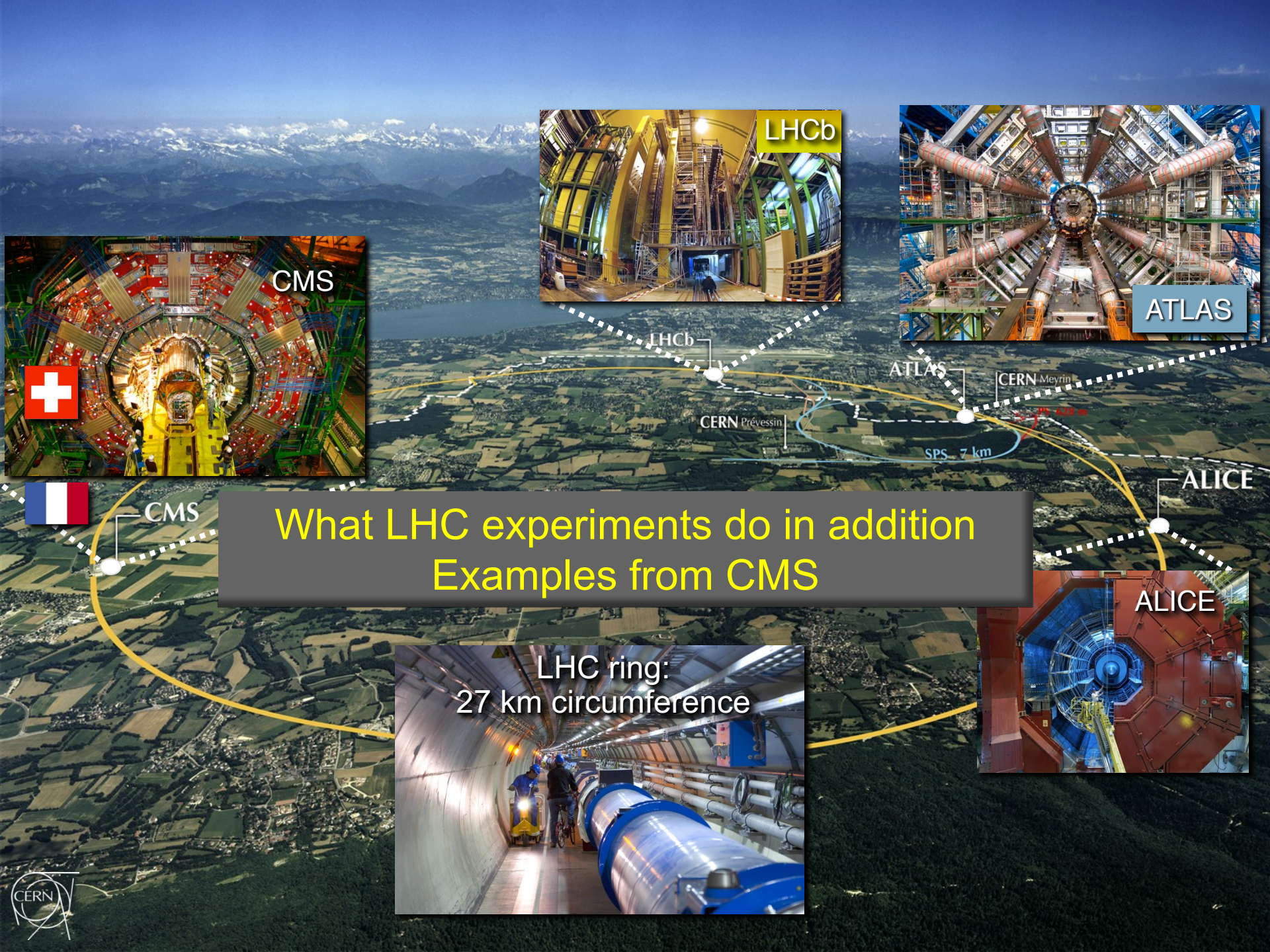


# Dessine-moi un physicien

[www.cern.ch/dessine-moi-un-physicien/](http://www.cern.ch/dessine-moi-un-physicien/)



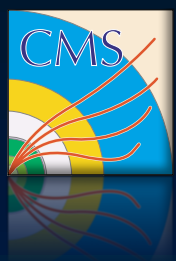




# What LHC experiments do in addition Examples from CMS



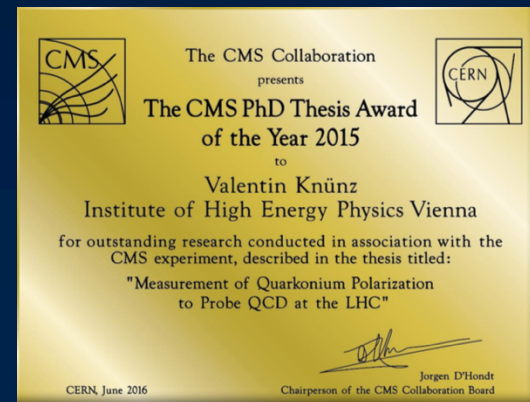




# *Examples of CMS Awards*

## *CMS Thesis Award (initiated in 2000, also Industry Award)*

- presents thesis results in the opening plenary session of a CMS week
- receives an Award plaque
- has the opportunity to attend an international conference to present the thesis results, with expenses paid by CMS
- thesis is eligible to be nominated for publication in the Springer Theses series



## *CMS Young Researcher Prize*

- recognize outstanding achievements of young members
- awarded annually to at least three members who have made a very significant and sustained contribution to CMS over many years in any area of the experiment (hardware, software, technical, analysis etc.).







# CERN – Science without Borders:

*An example of a scientific, technical and training co-operation on a global scale*



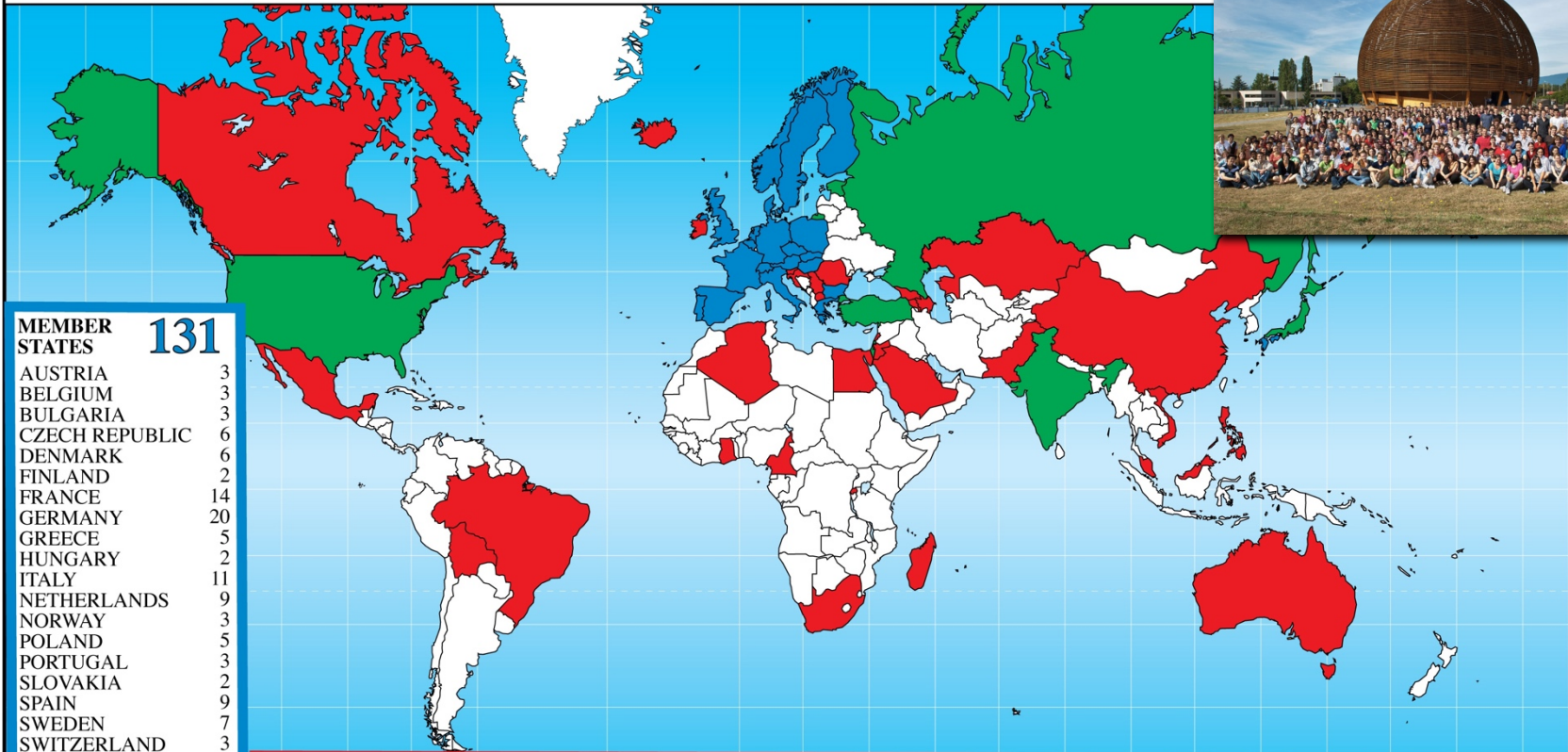


# Additional Information



# CERN Summer Students 2010

## Distribution of Summer Students 2010



### MEMBER STATES 131

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

### OBSERVER STATES 53

INDIA	8
ISRAEL	4
JAPAN	5
RUSSIA	9
TURKEY	10
USA	17

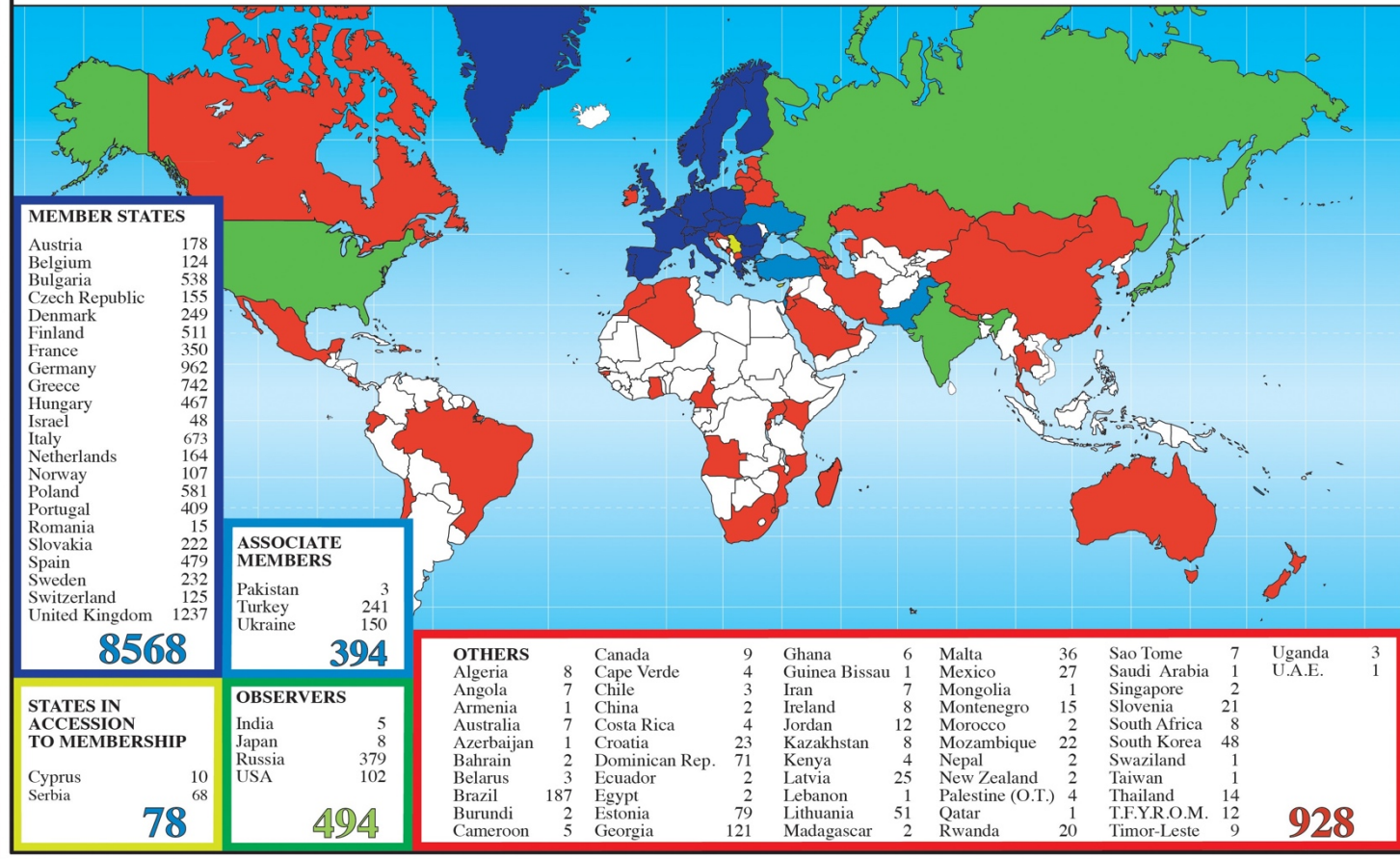
### NON-MEMBER STATES

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

# High-school Teacher programme

## Teacher Programme Participants 1998 - 2016 (Total: 10462)



High-School Teacher Programme:  
87 different nationalities