

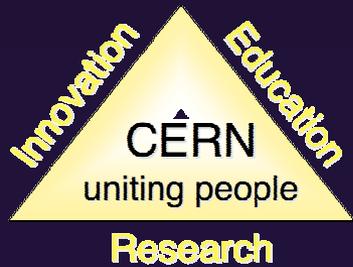
**Welcome - Добро
пожаловать**

**First CERN-JINR Dubna Teachers
Programme – October 2009**

to



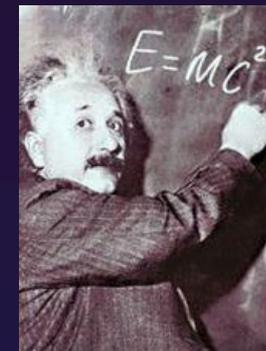
Accelerating Science and Innovation



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 seconds of the Universe's life?

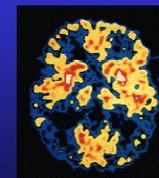
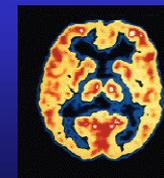


- **Develop** new technologies

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



Brain Metabolism in Alzheimer's Disease: PET Scan



Normal Brain

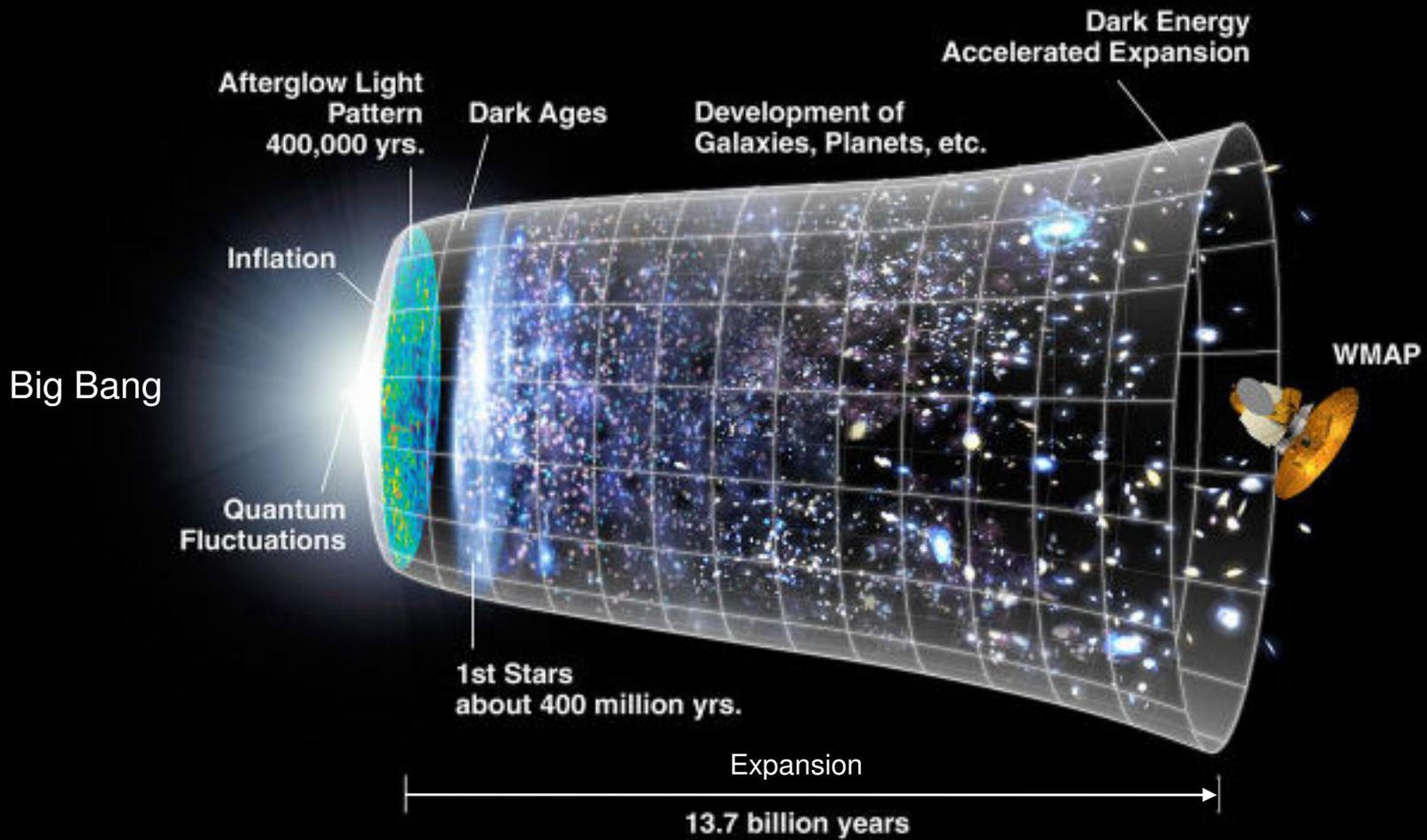
Alzheimer's Disease

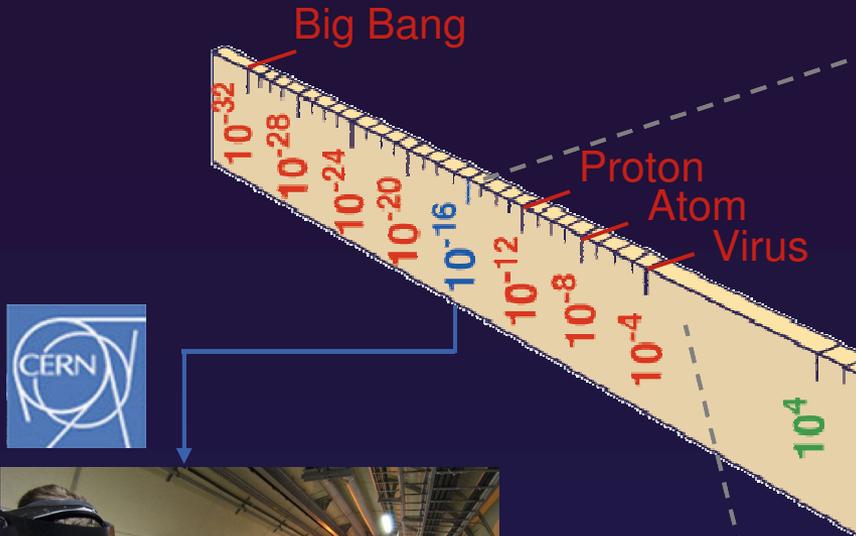
- **Train** scientists and engineers of tomorrow



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





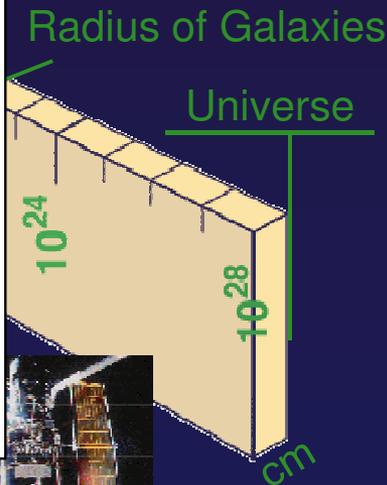
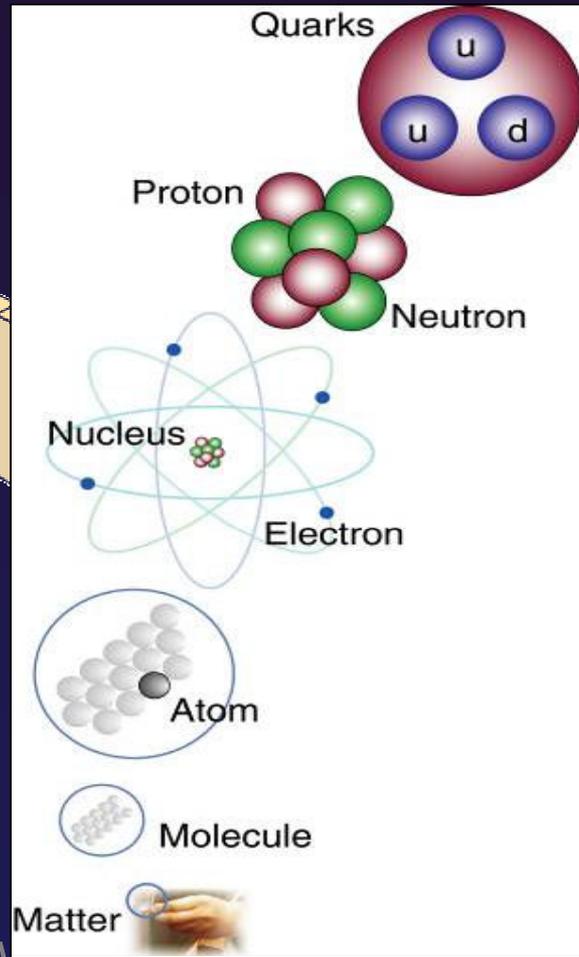


LHC

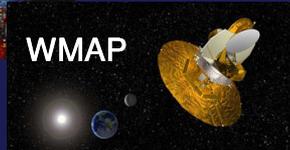
Super-Microscope



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



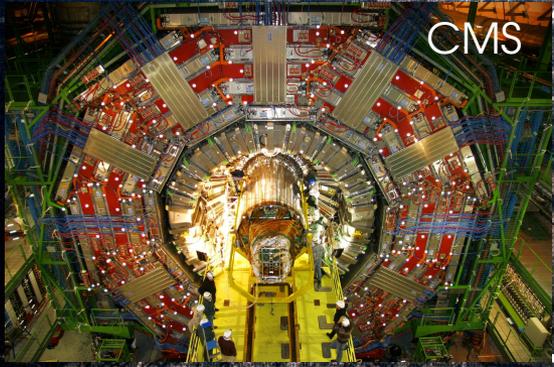
Hubble



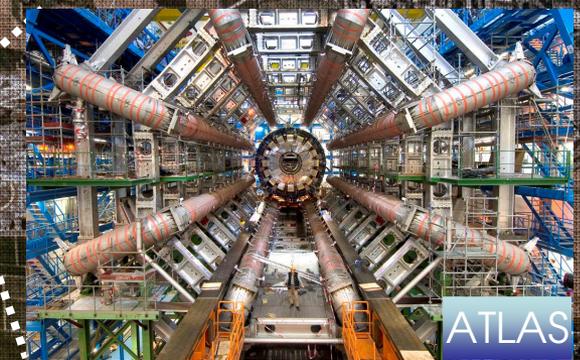
WMAP

Enter a New Era in Fundamental Science

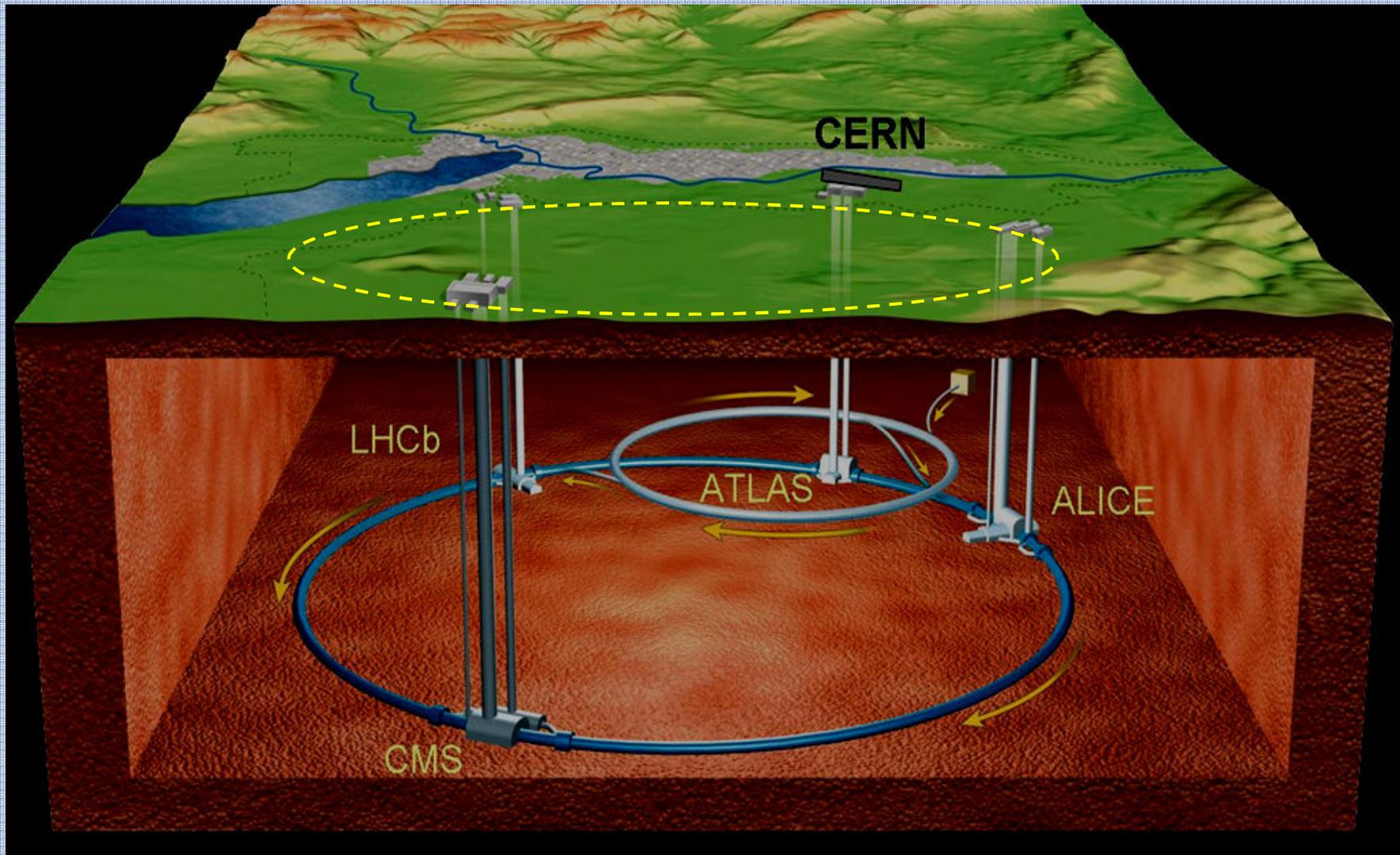
Start-up of the Large Hadron Collider (LHC), one of the largest and truly global scientific projects ever, is the most exciting turning point in particle physics.



Exploration of a new energy frontier
Proton-proton collisions at $E_{CM} = 14 \text{ TeV}$

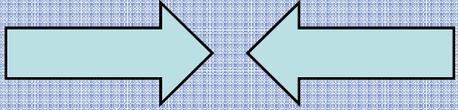


LHC – Large Hadron Collider



LHC - Large Hadron Collider

7 TeV + 7 TeV



Luminosity =
 $10^{34} \text{cm}^{-2} \text{sec}^{-1}$



Primary targets:

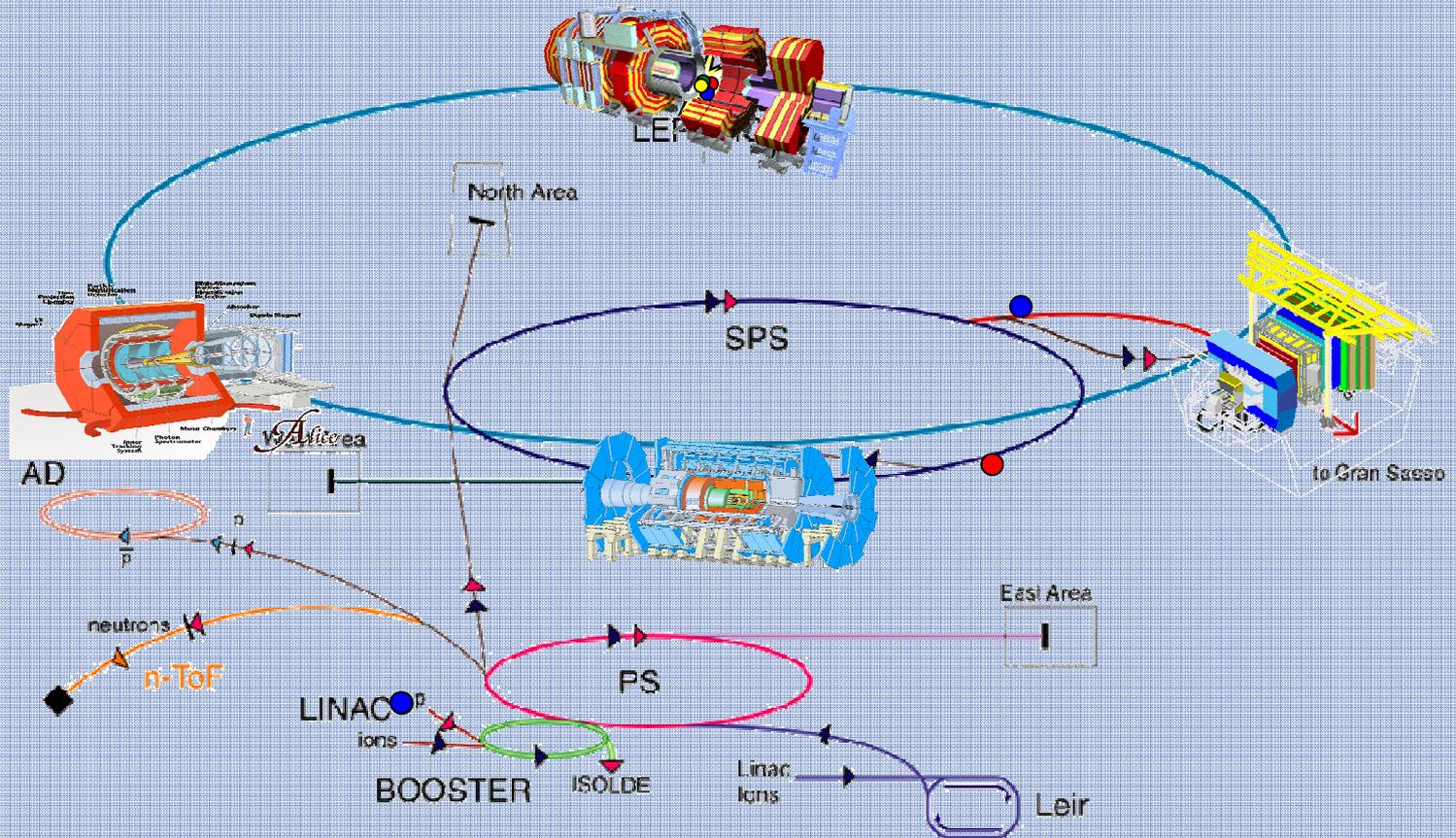
- Origin of mass
- Nature of Dark Matter
- Primordial Plasma
- Matter vs Antimatter

The LHC results will determine the future course of High Energy Physics

The large Hadron Collider

Collision of proton beams...

...observed in giant detectors



▶ p (proton)
▶ ion
▶ neutron

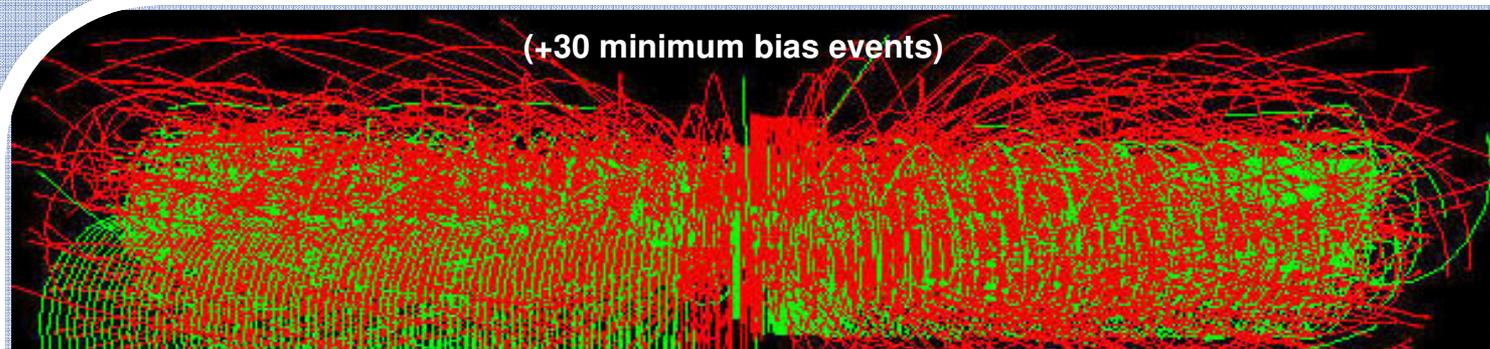
▶ \bar{p} (antiproton)
▶ \rightarrow proton/antiproton conversion
▶ neutrino

AD Antiproton Decelerator
PS Proton Synchrotron
SPS Super Proton Synchrotron

LHC Large Hadron Collider
n-ToF Neutron Time of Flight
CNGS Cern Neutrinos Gran Sasso

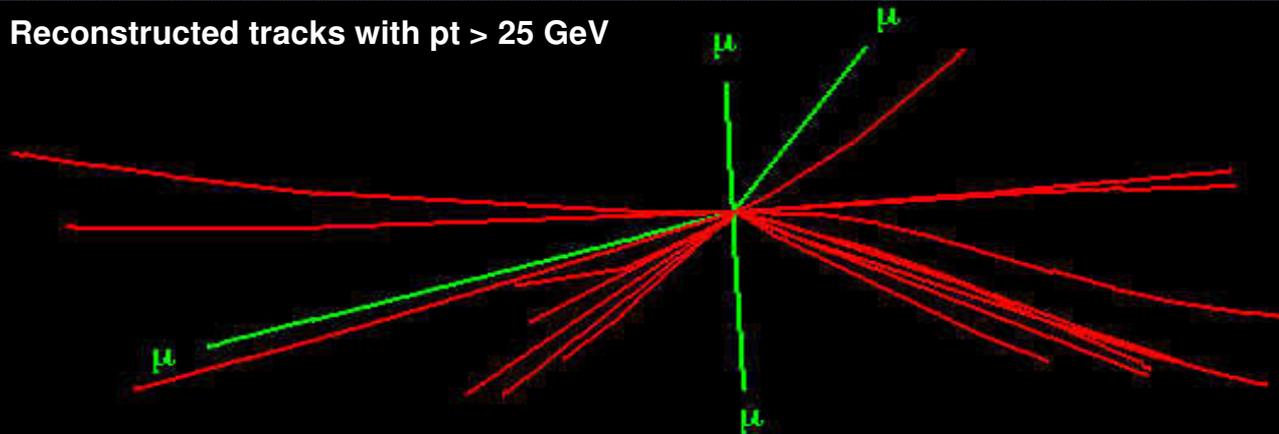


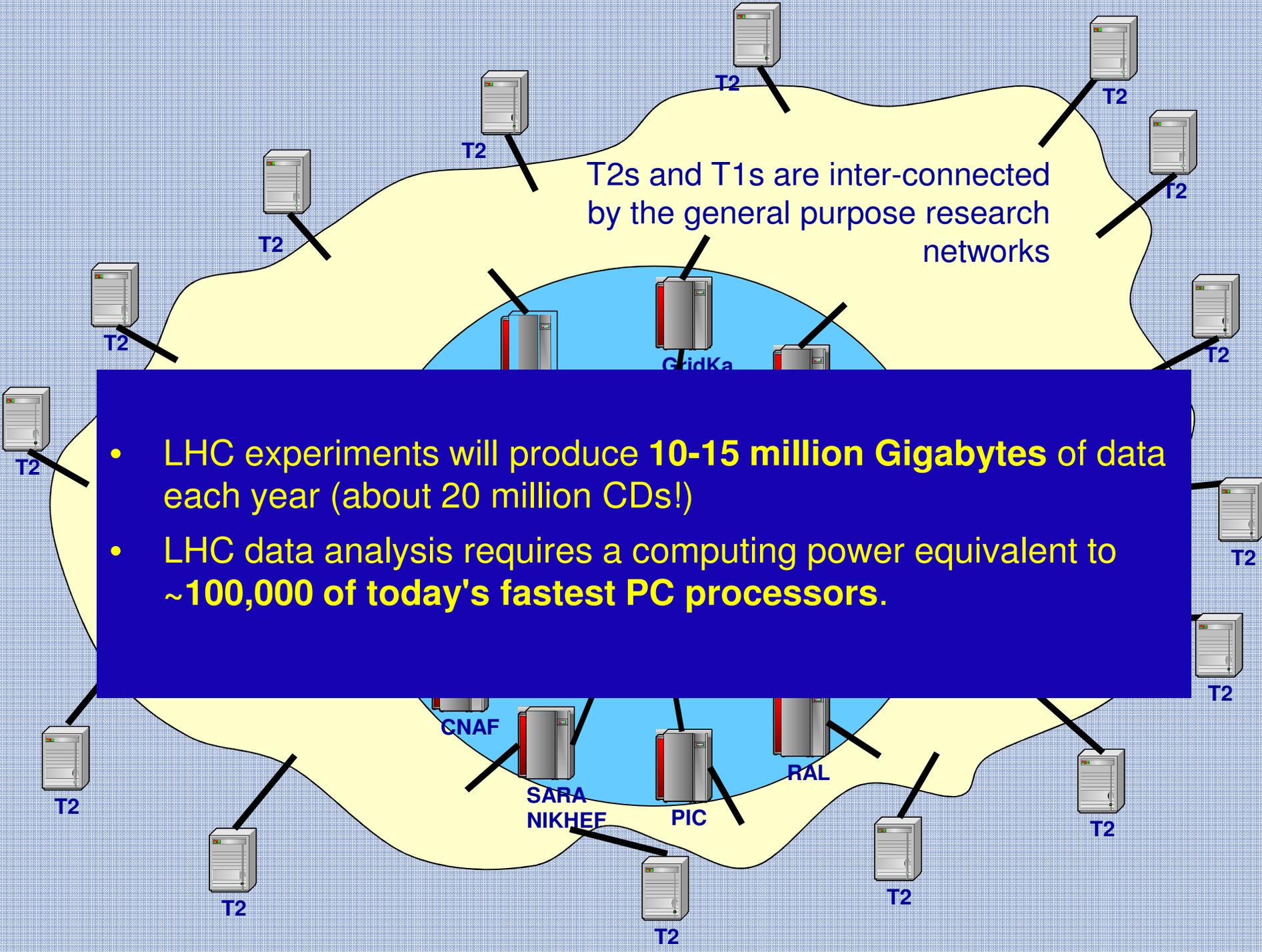
- Searching for new particles requires **selection and analysis** of enormous quantity of data from LHC detectors



New particle ???

Reconstructed tracks with $p_t > 25$ GeV







The Worldwide LHC Computing Grid

The LHC physics data analysis service distributed across the world

- CERN, 11 large *Tier-1* centres, over 200 *Tier-2* centres



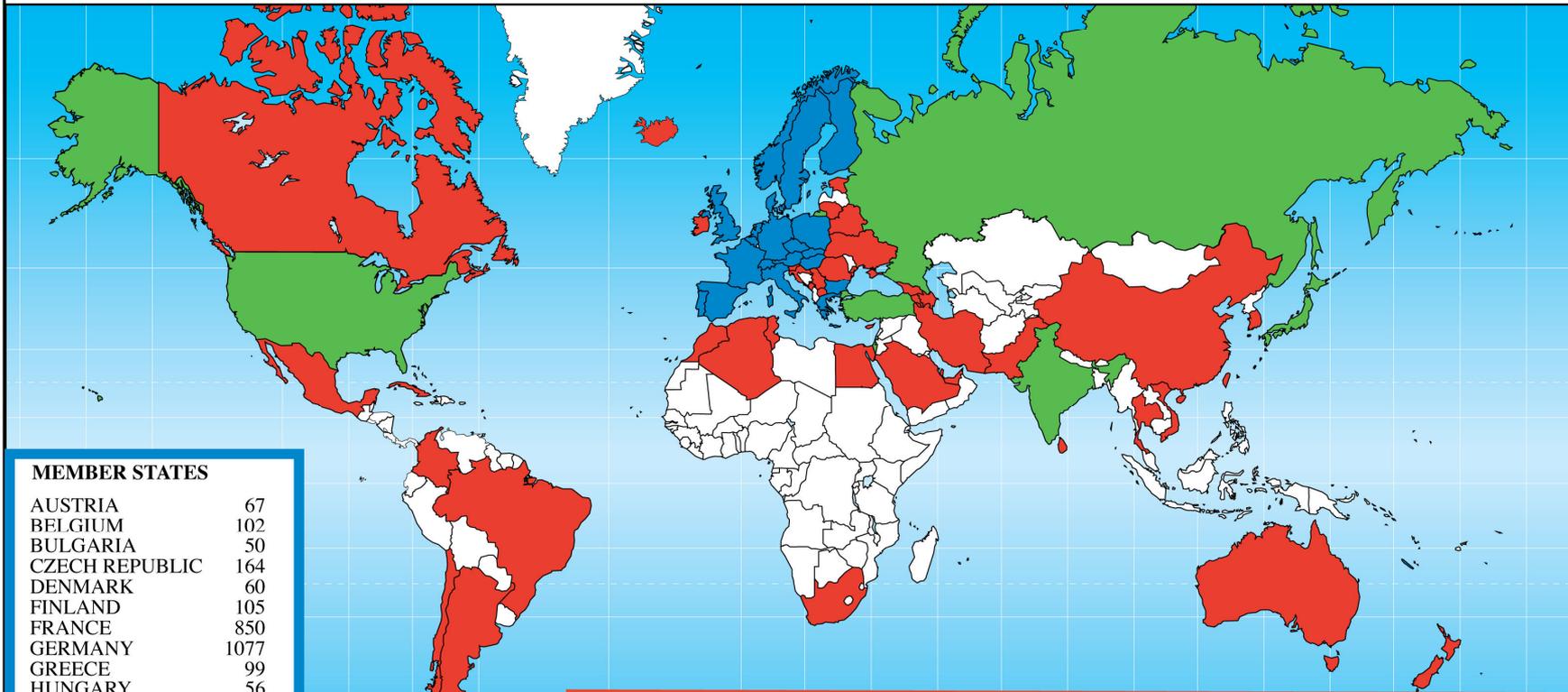
CERN in Numbers



- 2256 staff
- ~700 other paid personnel
- ~10 000 users
- Budget (2009) 1100 MCHF

- **20 Member States:** Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.
- **1 Candidate for Accession to Membership of CERN:** Romania
- **8 Observers to Council:** India, Israel, Japan, the Russian Federation, the United States of America, Turkey, the European Commission and Unesco

Distribution of All CERN Users by Nation of Institute on 2 July 2009



MEMBER STATES

AUSTRIA	67
BELGIUM	102
BULGARIA	50
CZECH REPUBLIC	164
DENMARK	60
FINLAND	105
FRANCE	850
GERMANY	1077
GREECE	99
HUNGARY	56
ITALY	1419
NETHERLANDS	167
NORWAY	78
POLAND	171
PORTUGAL	117
SLOVAKIA	54
SPAIN	286
SWEDEN	71
SWITZERLAND	336
UNITED KINGDOM	731

6060

OBSERVER STATES

INDIA	110
ISRAEL	53
JAPAN	175
RUSSIA	877
TURKEY	62
USA	1620

2897

OTHER STATES

ALGERIA	1	COLOMBIA	11	MACEDONIA (F.Y.R.O)	3	SOUTH AFRICA	9
ARGENTINA	8	CROATIA	21	MALTA	3	SRI LANKA	1
ARMENIA	15	CUBA	3	MEXICO	29	THAILAND	1
AUSTRALIA	16	CYPRUS	8	MONTENEGRO	1	TUNISIA	1
AZERBAIJAN	1	EGYPT	1	MOROCCO	5	UKRAINE	17
BELARUS	20	ESTONIA	12	NEW ZEALAND	7	U.A.E.	1
BRAZIL	69	GEORGIA	11	PAKISTAN	21	VIETNAM	1
CANADA	146	ICELAND	1	QATAR	1		
CHILE	2	IRAN	11	ROMANIA	56		
CHINA	72	IRELAND	13	SAUDI ARABIA	2		
CHINA (TAIPEI)	49	KOREA	56	SERBIA	18		
		LITHUANIA	15	SLOVENIA	16		

756

Contribution to LHC from Non-Member States

- **Over 40 Non-Member States have been participating in LHC construction**
- **Some 35 non-Member States contribute significantly to the worldwide LHC computing Grid**

Contribution of CIS countries to LHC

(CIS - Содружество Независимых Государств, СНГ)

Important contribution of the Russian Federation

Estimated value for CERN: LHC Experiments & Accelerator – 160 MCHF

Highly appreciated contribution of other CIS countries.

Important role of JINR - Dubna in creating LHC collaborations with CIS countries →

**Armenia, Azerbaijan, Belarus,
Georgia, Ukraine (and also other JINR Members!)**

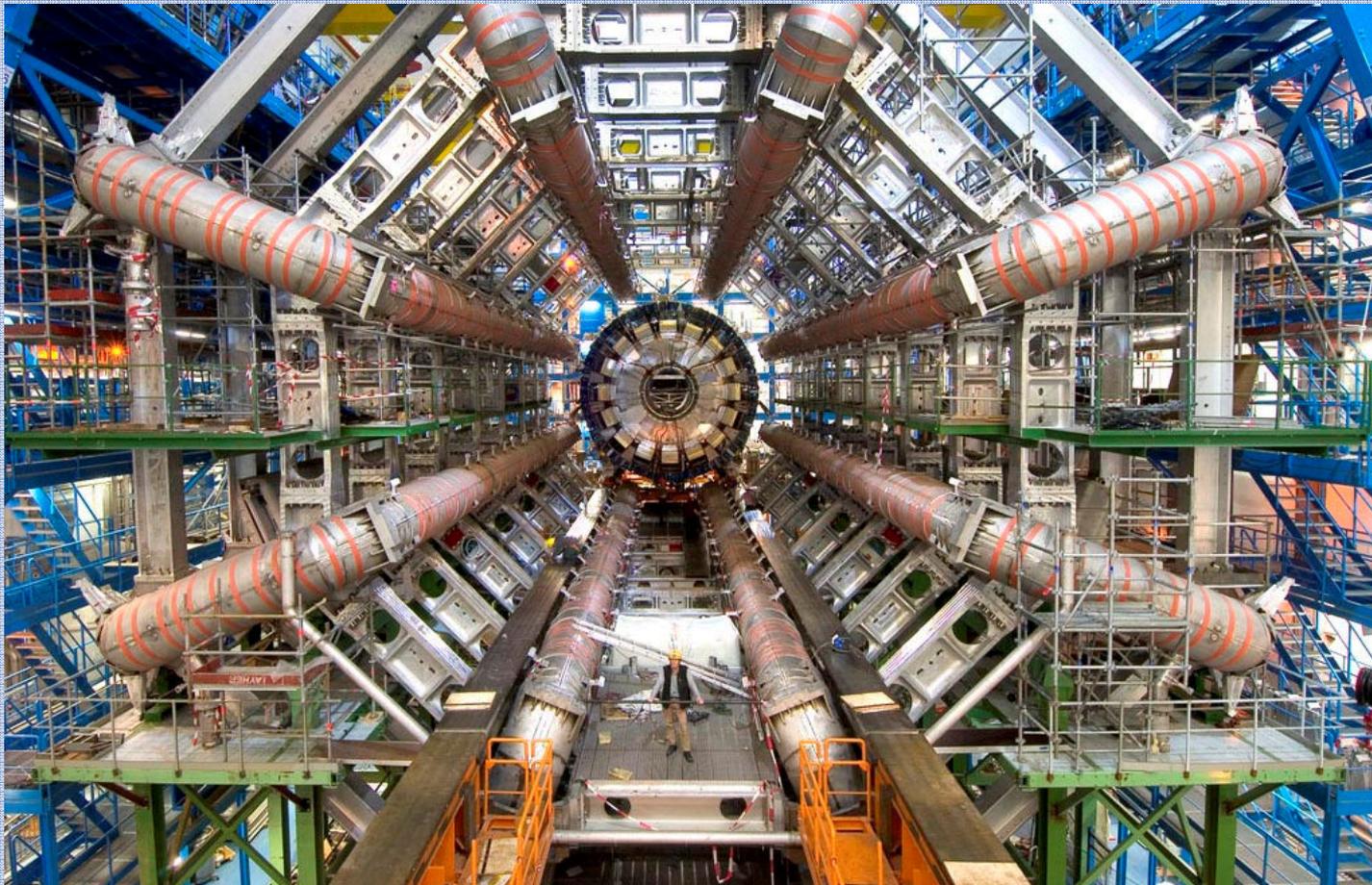
Example: Russia-Dubna Member States (RDMS) collaboration within CMS

Contribution of CIS countries to LHC

(CIS = Содружество Независимых Государств, СНГ)



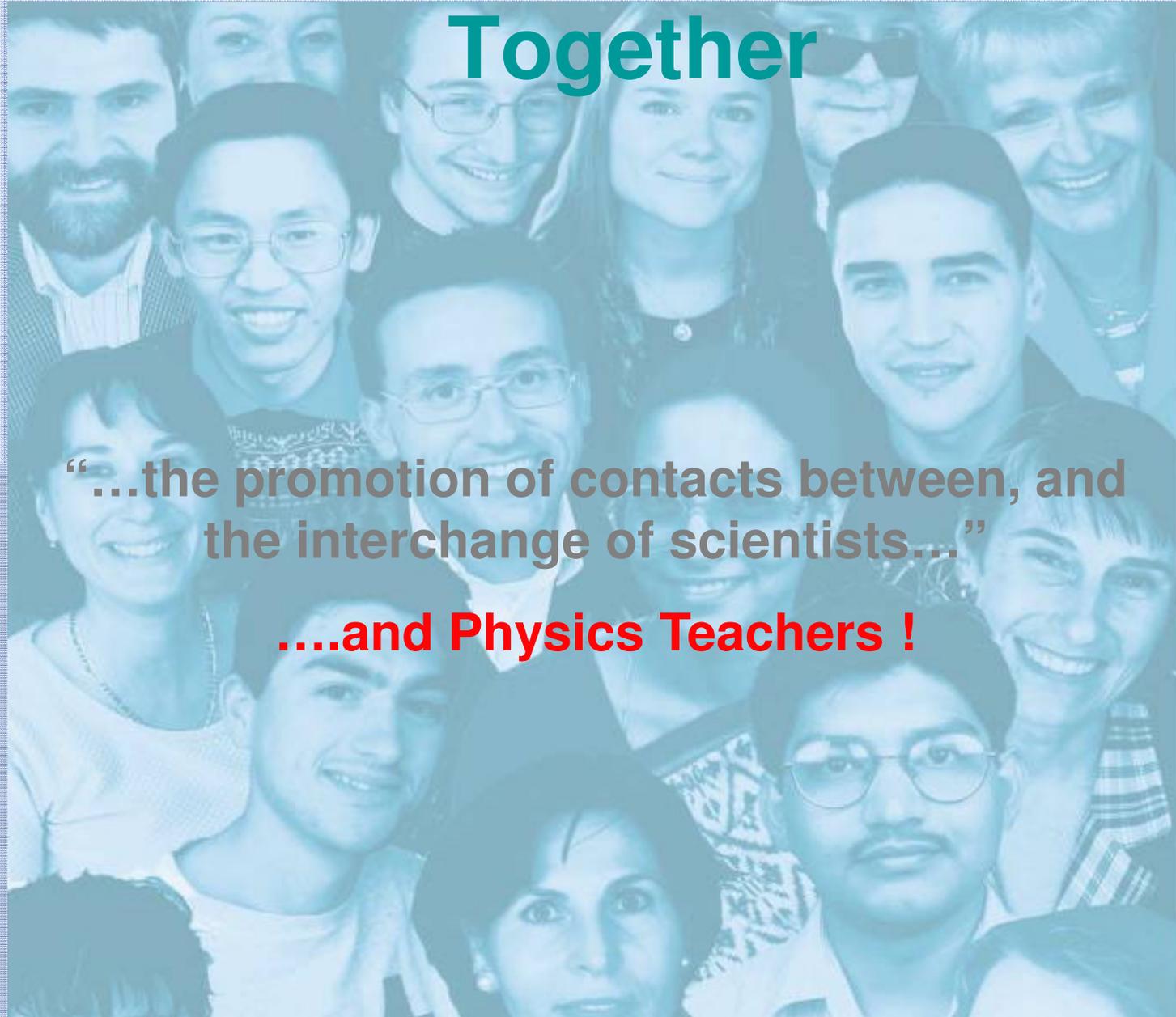
Physicists and engineers from CIS countries have notably contributed to the construction of all LHC experiments (ATLAS, ALICE, CMS, LHCb) and to the LHC accelerator



Science Bringing Nations Together

“...the promotion of contacts between, and
the interchange of scientists...”

....and Physics Teachers !





Thank you!
Спасибо!