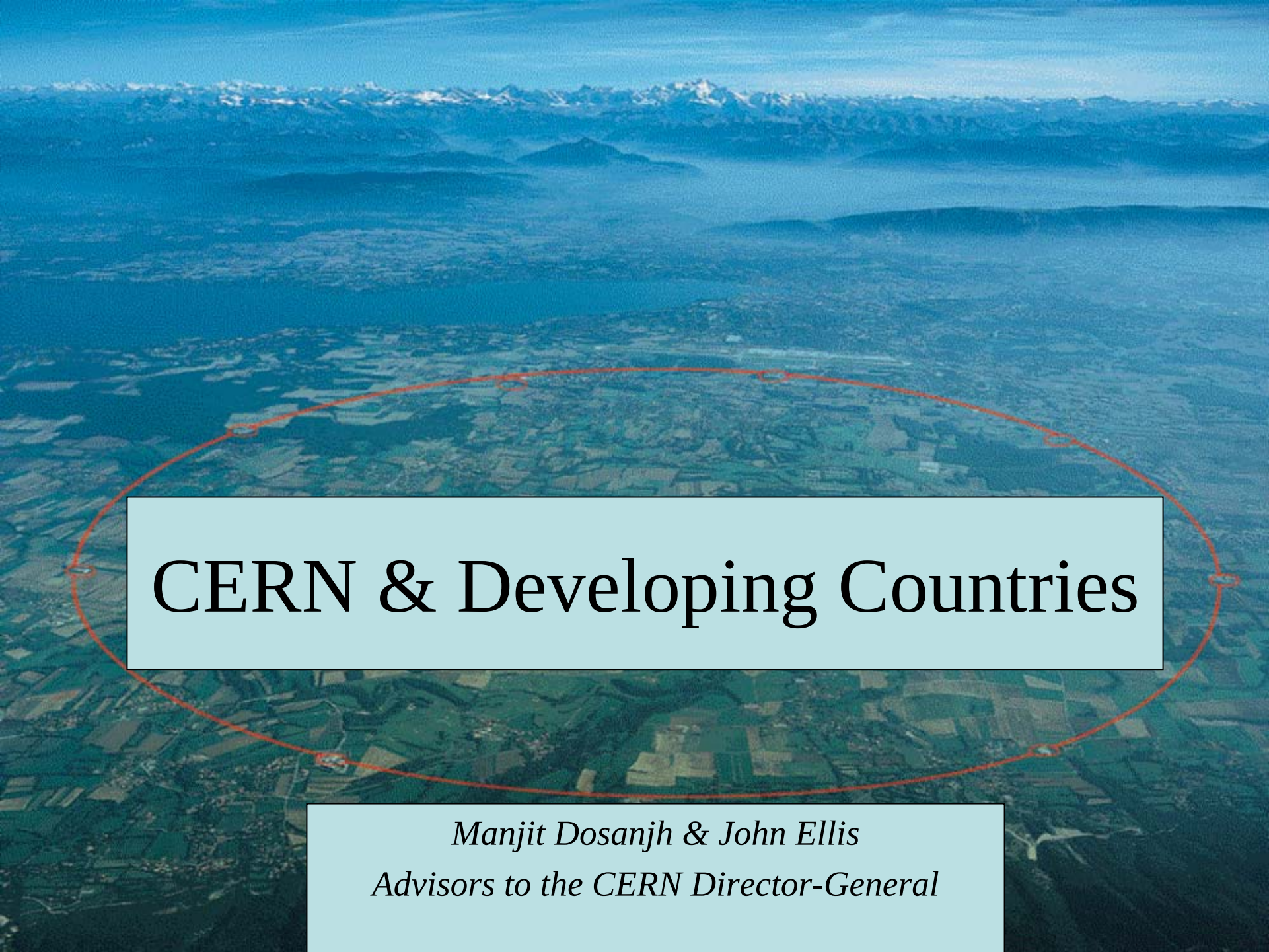


CERN & Developing Countries

Manjit Dosanjh & John Ellis

Advisors to the CERN Director-General

CERN's Basic Missions

- **Scientific research**

  & discovery!

- **Technological innovation**

  Spin-offs & industrial collaboration

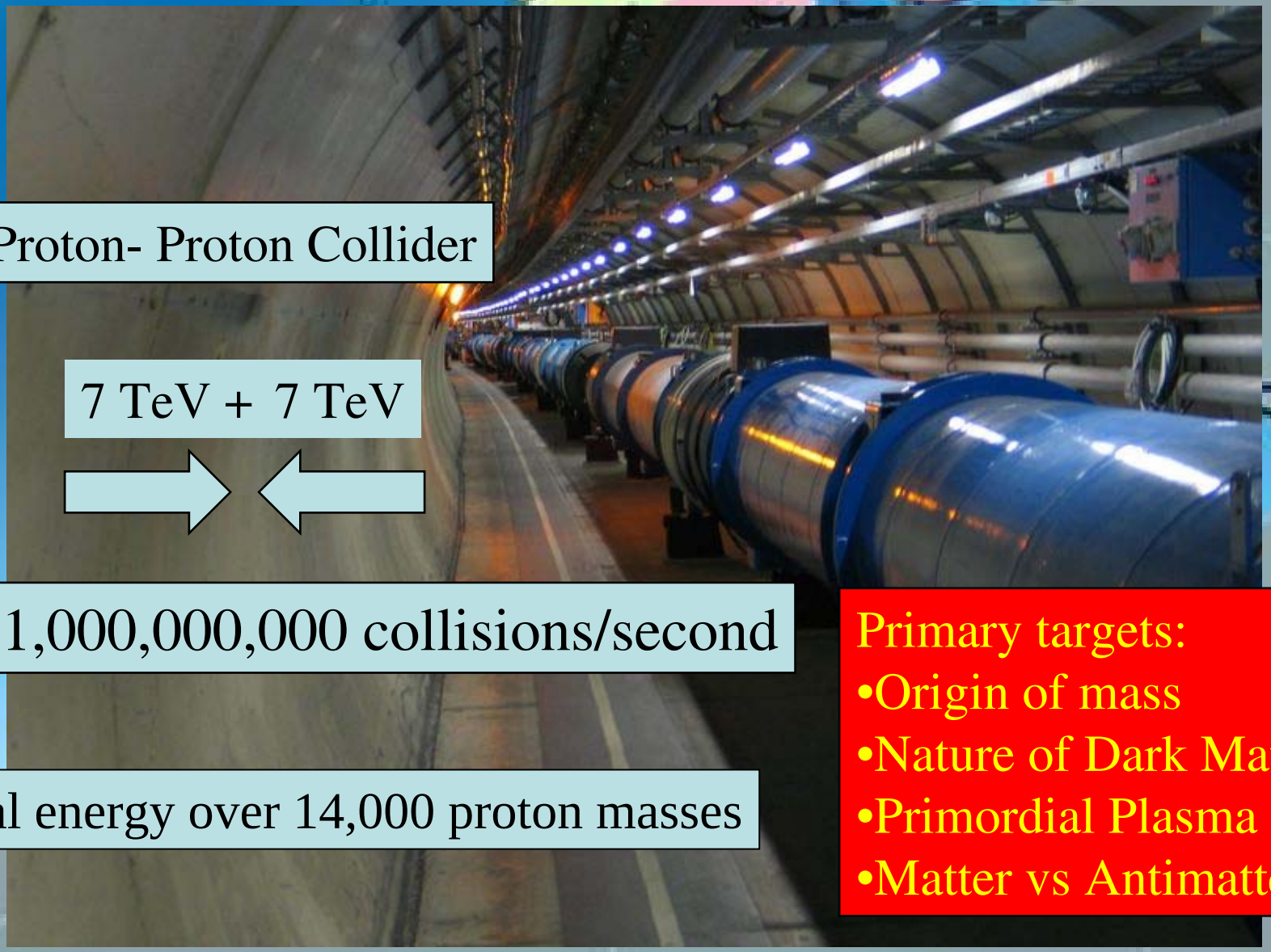
- **Advanced training**

  Many aspects of human resource development

- **International collaboration**

  Member and non-member states

The Large Hadron Collider (LHC)



Proton- Proton Collider

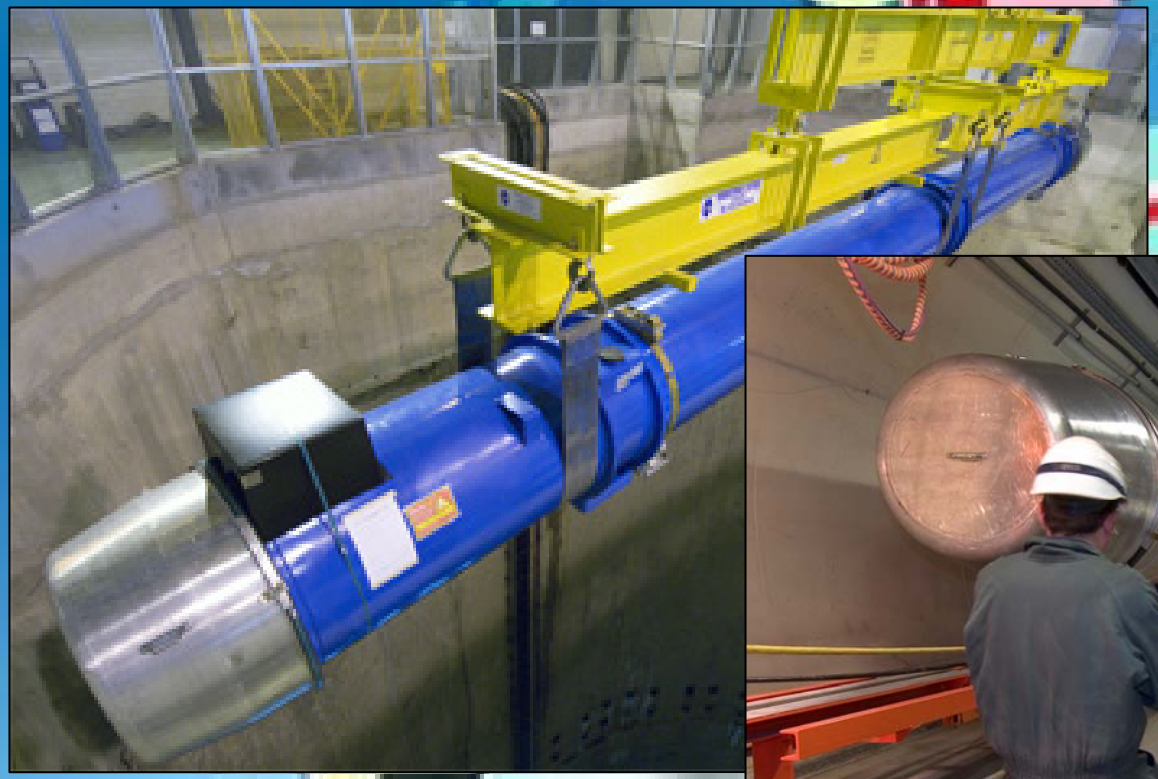
7 TeV + 7 TeV

1,000,000,000 collisions/second

Total energy over 14,000 proton masses

Primary targets:
- Origin of mass
- Nature of Dark Matter
- Primordial Plasma
- Matter vs Antimatter

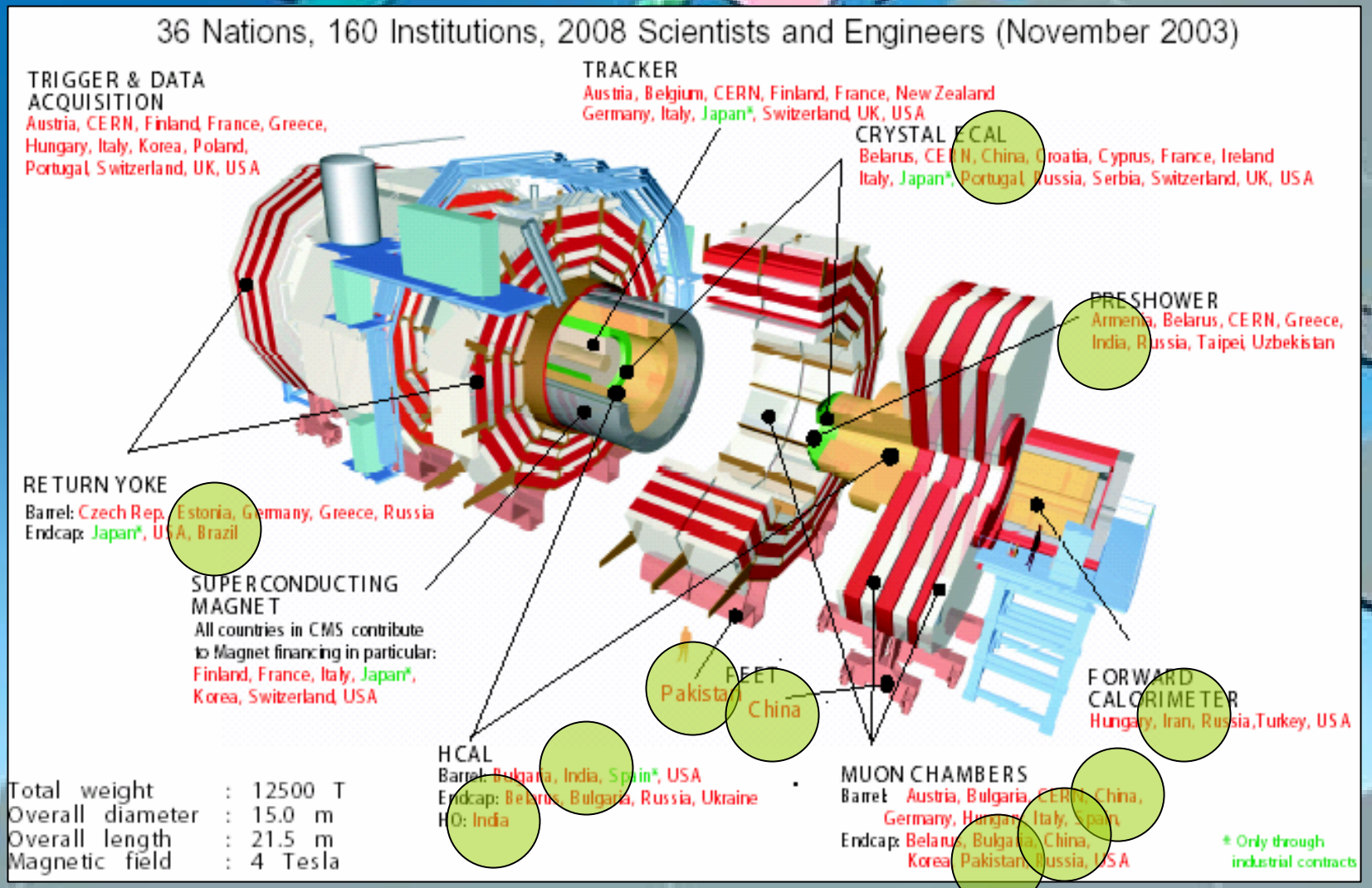
Installation of LHC Magnets



Commissioning in 2007: full energy in 2008

Contributions to LHC accelerator from:
Canada, India, Japan, Russia, US, Pakistan

CMS Collaboration



CERN's Basic Missions

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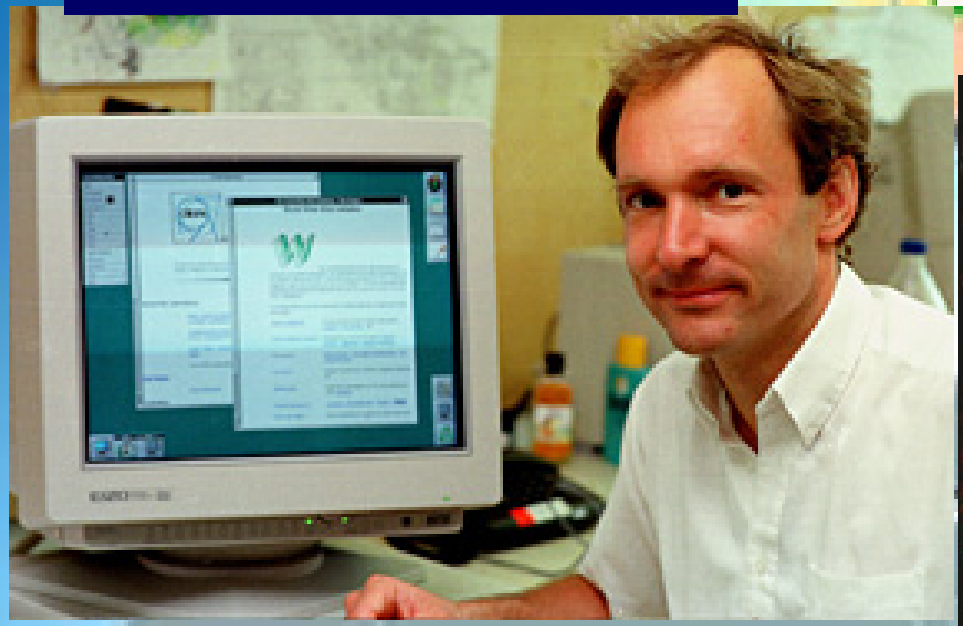
The Birthplace of the World-Wide Web

The first server at CERN

Tim Berners-Lee the inventor



The first download in California

1991

LHC data challenge

- 40 million collisions per second
- After filtering, 100 collisions of interest per second
- 10^{10} collisions recorded each year

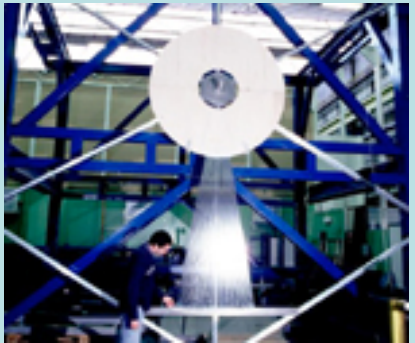
~10 Petabytes/year of data
~10 000 times the world annual book production,
~20km CD stack

CMS

LHCb

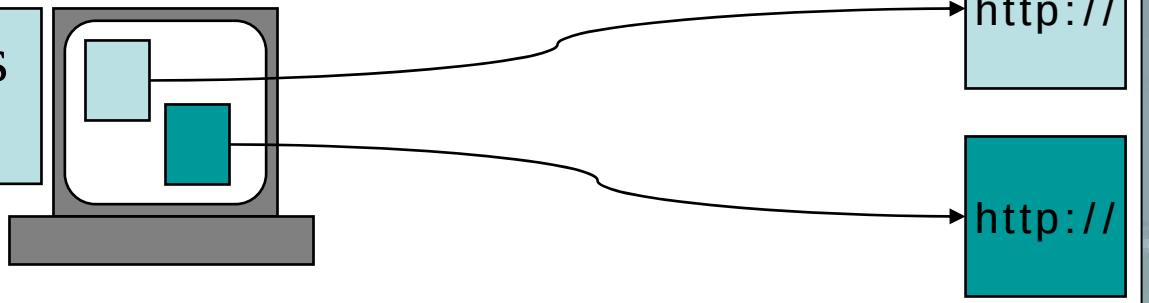
ATLAS

ALICE

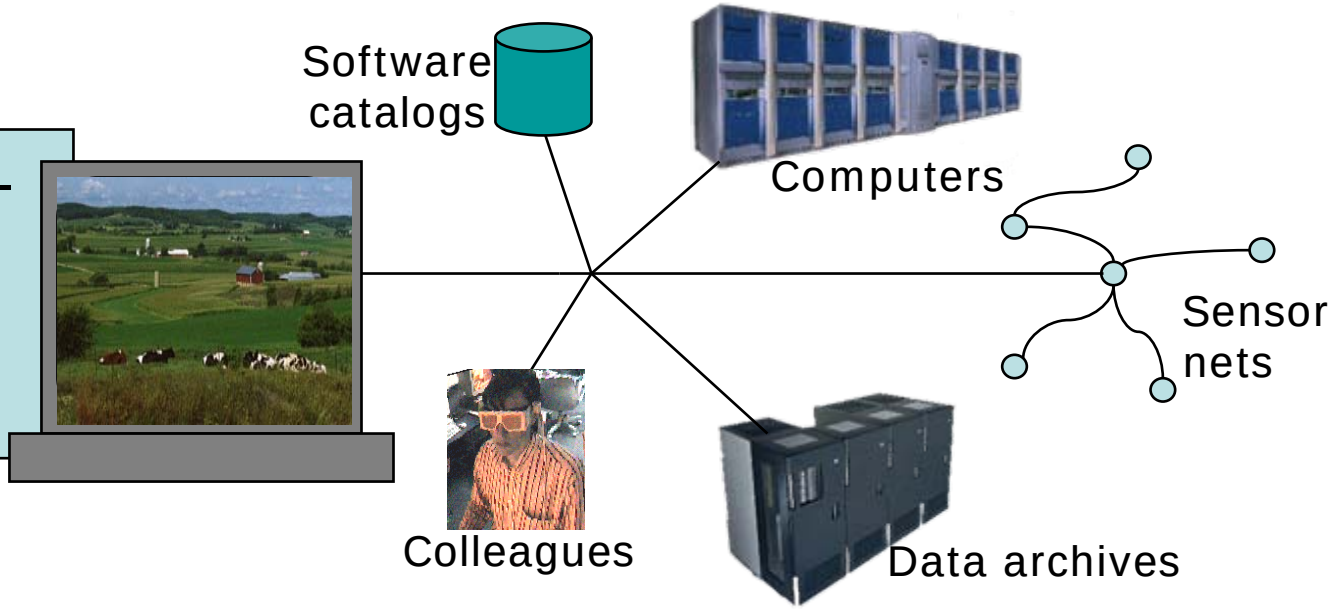


From the Web to the Grid

Web: Uniform access to HTML documents



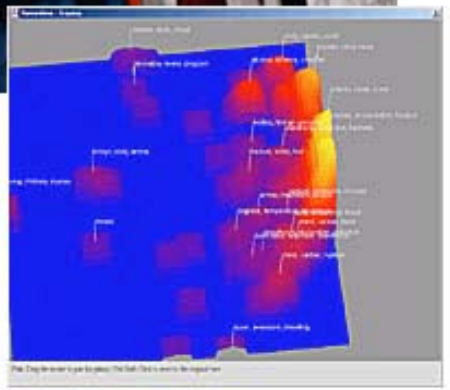
Grid: Flexible, high-performance access to all significant resources



On-demand creation of powerful virtual computing systems

The Grid is also useful for …

- **Medical/Healthcare** *(imaging, diagnosis and treatment)*
- **Bioinformatics** *(study of the human genome and proteome to understand genetic diseases)*
- **Nanotechnology** *(design of new materials from the molecular scale)*
- **Engineering** *(design optimization, simulation, failure analysis and remote Instrument access and control)*
- **Natural Resources and the Environment** *(weather forecasting, earth observation, modelling and prediction of complex systems, earthquakes)*



Potential benefits for developing countries

CERN's Basic Missions

- **Scientific research**

  & discovery

- **Technological development**

  Spin-offs & industrial collaboration

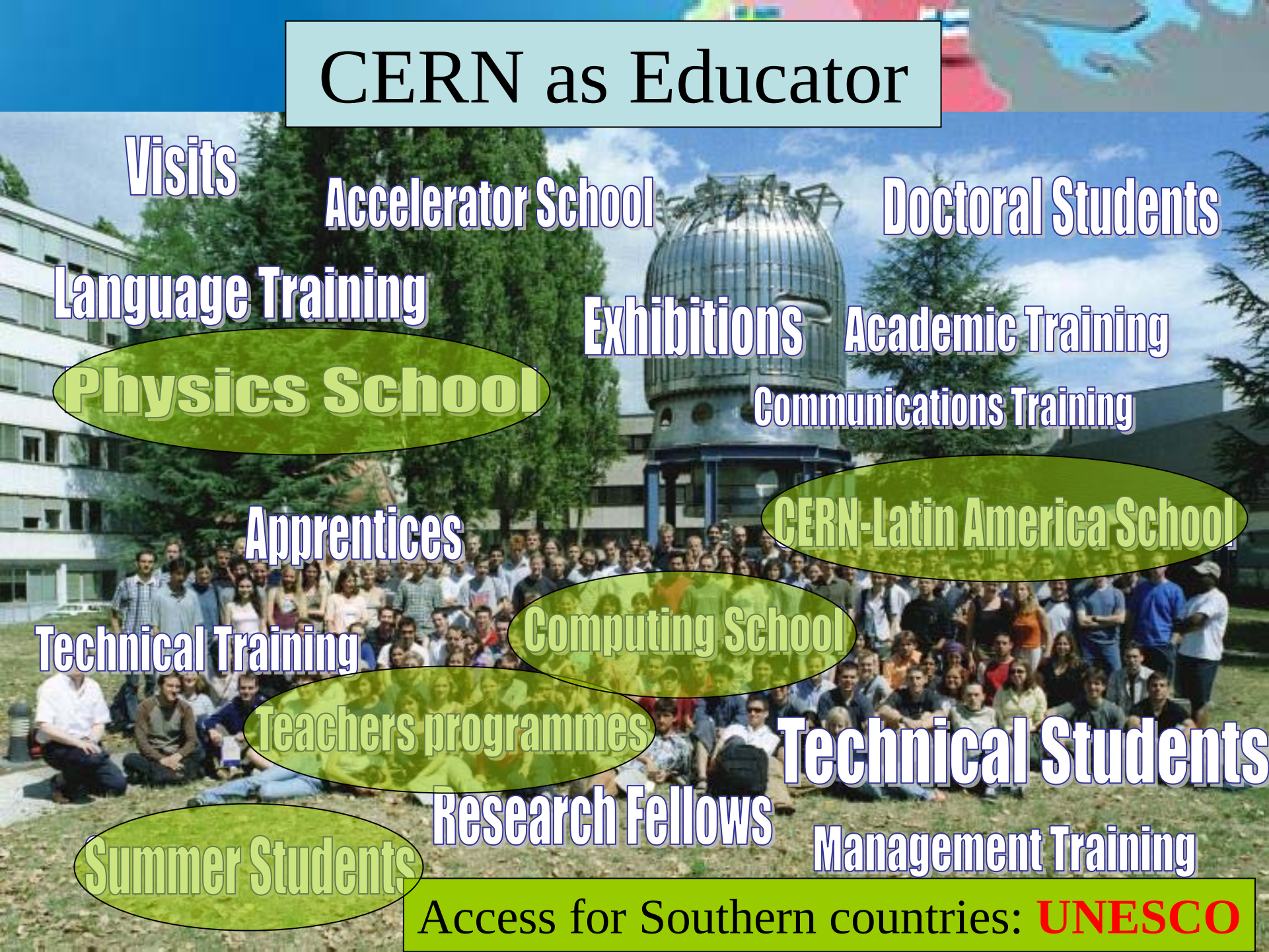
- **Training**

  Many aspects of human resource development

- **International collaboration**

  Member and non-member states

CERN as Educator



Access for Southern countries: **UNESCO**

Summer 2007

- Summer undergraduate student programme:
  - 123 students from 20 Member States
  - 85 students from 32 Non-Member States, e.g.,
  - Armenia, Azerbaijan, China, Ecuador, India, Iran, Madagascar, Malaysia, Mexico, Palestine, South Africa, Sri Lanka, Syria, Turkey, UAE, Vietnam
- High-school teacher programme participants
  - Brazil, Madagascar, Mexico, South Africa

With (partial) support from UNESCO

CERN's Basic Missions

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  & discovery

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Levels of Collaboration with CERN

- **Full Members**

  20 European countries

- **Associate Membership**

  open to non-European countries

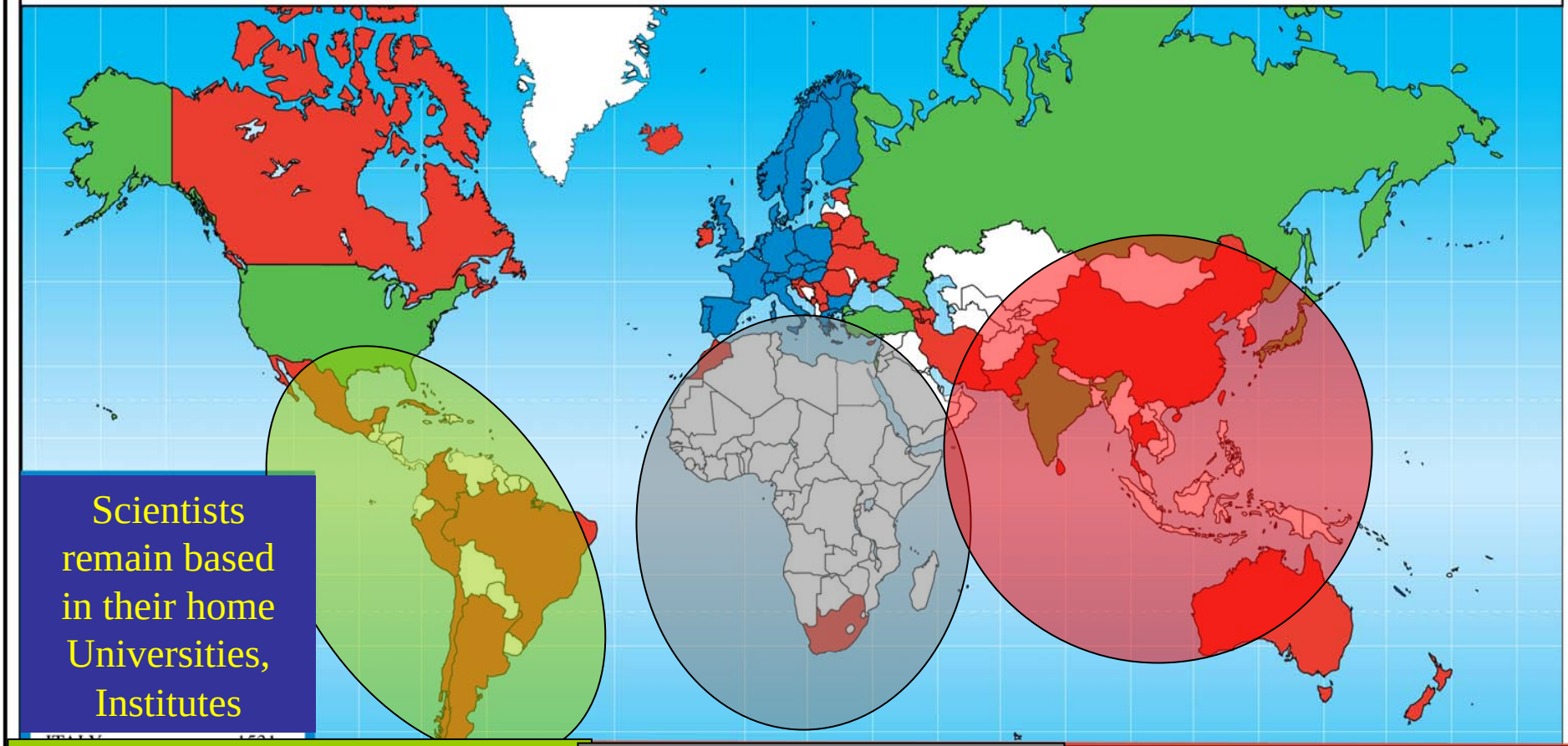
- **Observer States**

  India, Israel, Japan, Russia, Turkey, US

- **Cooperation Agreements**

  with 35 non-member states

Distribution of All CERN Users by Nation of Institute on 17 July 2007



Scientists remain based in their home Universities, Institutes

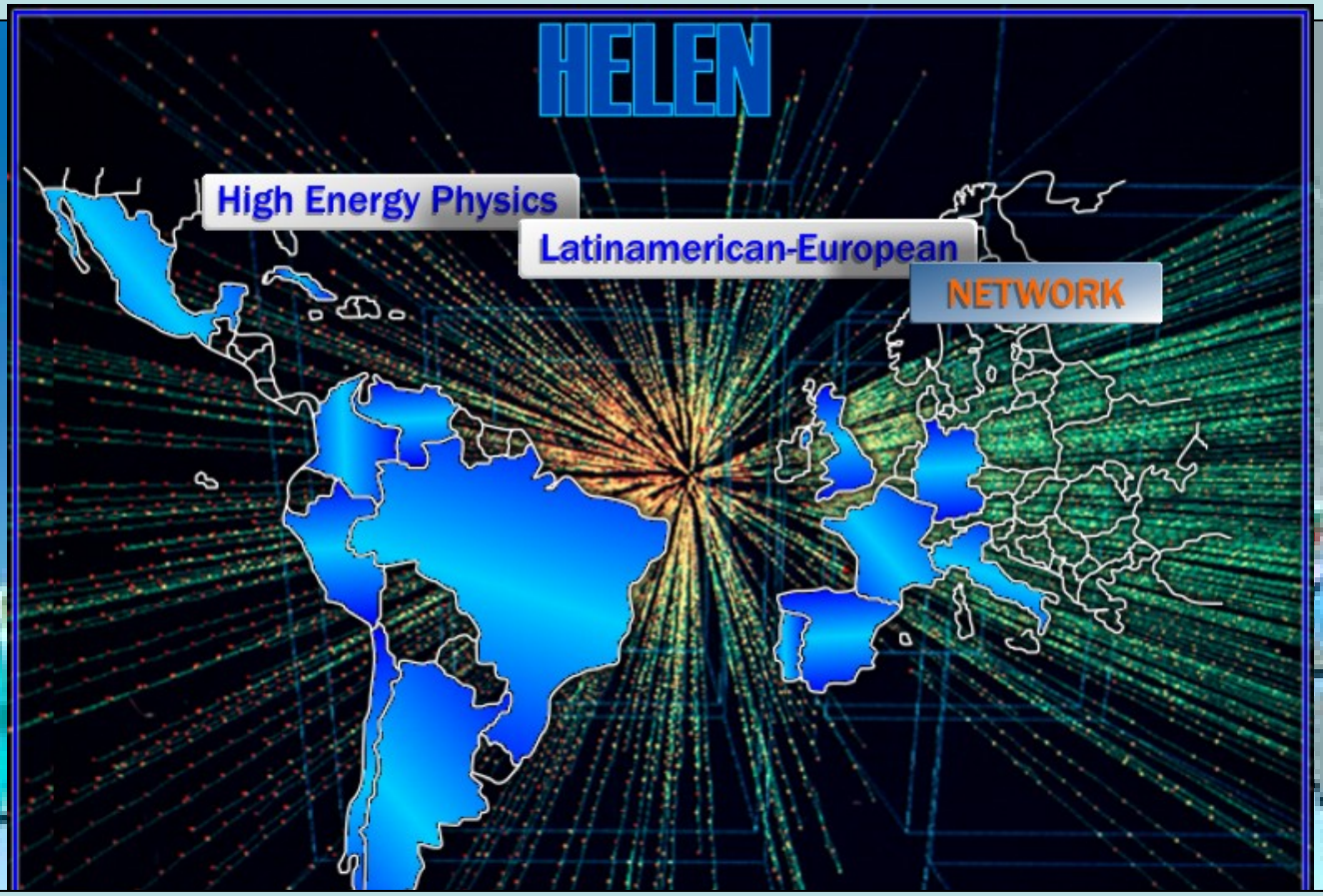
Latin America:
Cooperation Agreements with 8 countries
HELEN network funded by EU

Africa:
Cooperation Agreements with 3 countries

Asia & Australasia:
3 Observer States Cooperation Agreements with 10 countries

Development of Latin America / CERN Collaboration

HELEN Network funded by EU



Scientific visits: Latin America ↔ Europe:
Dramatic push to collaboration: students, …

Potential model for other regions: Africa, Middle East?

ICTP and CERN

- Initiative by Prof. Sreenivasan
- Co-operation Agreement signed in 2006
- Collaboration on LHC physics:
  - Studentships (Palestine, Sri Lanka, …)
  - Postdoctoral fellowships (Algeria, …)
  - Associateships for professors

  to work on LHC experiments and related theory
- ICTP team accepted into ATLAS Collaboration as part of cluster with INFN, Udine
- Also collaboration on scientific meetings, open access

UNESCO-IBSP and CERN

- Project proposal to UNESCO-IBSP 2006
  - *Schools of Physics and Computing, and related meetings*
  - *High Energy Physics Training Network between African Universities and Institutes, CERN and ICTP*
  - *School Teachers Programme*
  - *Establish and network electronic libraries and repositories for African universities and scientific institutes*
- Prototype started in July 2007 for teachers and electronic libraries with small seed money

Virtual Collaboration Space

- Evaluation of remote collaboration tools
  - Audio/Video conferencing
  - Content management
  - Teaching and learning tools (white board…)
- Use with limited bandwidth
- Ease of use: *test in Colombia, Madagascar, Russia, Vietnam, …*
- Integration of tools in a single space

AFRICA@home: Volunteer computing for Africa

What is AFRICA@home?

- There is a **huge potential** for volunteer computing to contribute to solving pressing **health and environmental issues** facing the developing world.
- AFRICA@home aims to address such issues by providing a common framework for volunteer computing projects that address **African needs.**
- An important goal of AFRICA@home is to involve **African students and African universities** in the development and running of these volunteer computing projects.
- The first application being developed AFRICA@home concerns **malaria epidemiology.**

Open Access

- “Sponsoring Consortium for Open Access Publishing in Particle Physics” (SCOAP)
- The task force considers sponsoring through a consortium the most promising and sustainable business model for particle physics
- Partners:
  - Funding agencies supporting particle physics
    - Funding for experimental papers could be channeled through major laboratories (CERN, DESY, LNF Frascati, Fermilab, SLAC, KEK, IHEP Beijing, …) or collaborations
  - Non-HEP funding agencies providing generic support to OA
  - Libraries

Abdus Salam:
"*in the final analysis, creation, mastery and utilization of modern science and technology is basically what distinguishes the South from the North. On science and technology depend the standards of living of a nation*"

Calestous Juma, Millennium project Task Force Science, Technology: "*It is inconceivable that the eight Millennium Development Goals can be achieved by 2015 without a focused science, technology and innovation policy*"