



LHCb

ATLAS

CERN Meyrin

CERN Prévessin

SPS 7 km

PS 6.28 km

ALICE

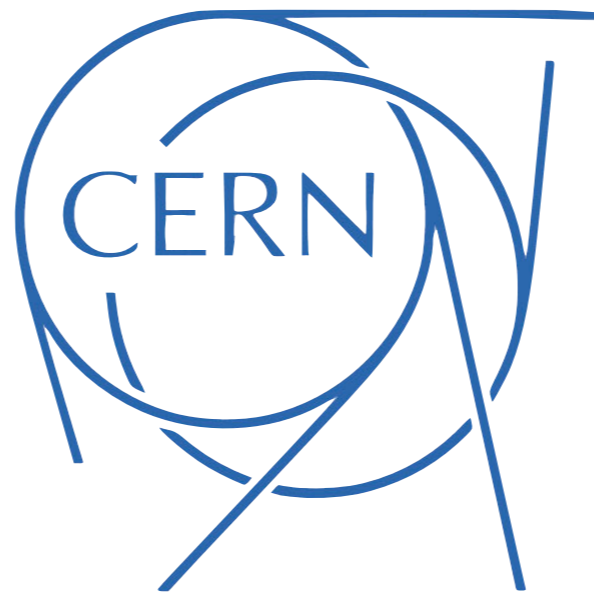
SUISSE
FRANCE

CMS

Retour d'expérience du HST Program

Konrad Jende, French Teacher Programme 2014

LHC 27 km



Retour d'expérience du HST Program

Konrad Jende, French Teacher Programme 2014

Outline

1. History of the High School Teacher Programme
2. HST Resources
3. Experiences from 17 editions
4. CERN Resources in Education
5. Outlook

1. History of the High School Teacher Programme

participants of HST1998



participants of HST2000



first row (from left to right):
organizers Jose Salicio Diez & Michelangelo Mangano

1. History of the High School Teacher Programme



morning: Summer Student Lecture Programme
afternoon: discussion sessions, physics teaching resources of the world wide web, workshops on how to great webpages, design lesson plans, compare syllabi of countries



2002: <http://indico.cern.ch/event/334159/overview>
2003: <http://indico.cern.ch/event/a031572/>
2004: <http://indico.cern.ch/event/a042016/>
2005: <http://indico.cern.ch/event/a051051/>
2006: <http://indico.cern.ch/event/3324/>
2007: <http://indico.cern.ch/event/16623/>
2008: <http://indico.cern.ch/event/35996/>
2009: <http://indico.cern.ch/event/61942/>
2010: <http://indico.cern.ch/event/96344/>
2011: <http://indico.cern.ch/event/144034/>
2012: <http://indico.cern.ch/event/193928/>
2013: <http://indico.cern.ch/event/257353/>
2014: <http://indico.cern.ch/event/318730/>


1. History of the High School Teacher Programme


High School Teachers 2014


chaired by Konrad Jende (CERN, Education Group)


from Sunday, 6 July 2014 at **17:00** to Saturday, 26 July 2014 at **08:00** (Europe/Zurich)
at **CERN**



Material:

[Derivation of momentum and energy - Gron1](#) 

[Energy and Momentum Units in Particle Physics](#) 

[Neutrino data - Gron4](#) 

[Photon energy and the expanding universe - Gron3](#) 

[Relativistic mechanics and mass - Gron5](#)  

[Slides](#)   




Video Services

Vidyo public room : [High_School_Teachers_2014](#) [More Info](#) | [Join Now!](#)

Administrative Support: Maureen Prola-Tessaur (33-R-028) *Email:* maureen.prola-tessaur@cern.ch *Telephone:* +41 76 487 5947

[Go to day](#) ▾

Sunday, 6 July 2014

- 17:00 - 17:45 **Welcome Reception 45'** (Restaurant 1)
Speakers: Rolf Landua (CERN), Mr. Konrad Jende (CERN, Education Group), Maureen Prola-Tessaur (CERN), Julia Woithe (CERN & Universitaet Kaiserslautern (DE))
- 17:45 - 19:15 **Discover CERN Treasure Hunt 1h30'**
Speaker: Mr. Konrad Jende (CERN, Education Group)
- 19:15 - 20:30 **Dinner**
- 20:30 - 21:15 **Introducing remarks 45'** (60-6-015 - Room Georges Charpak (Room F))
Speaker: Mr. Konrad Jende (CERN, Education Group)
Material: [Slides](#)   

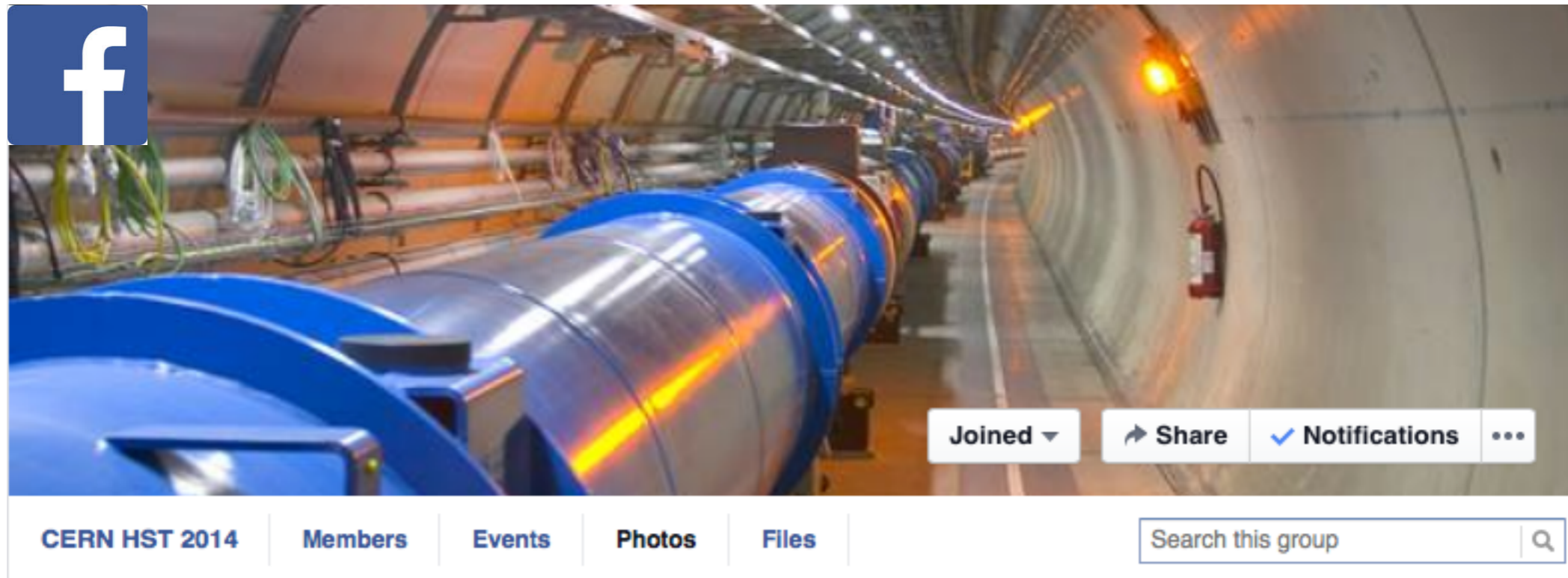
1. History of the High School Teacher Programme



1. History of the High School Teacher Programme



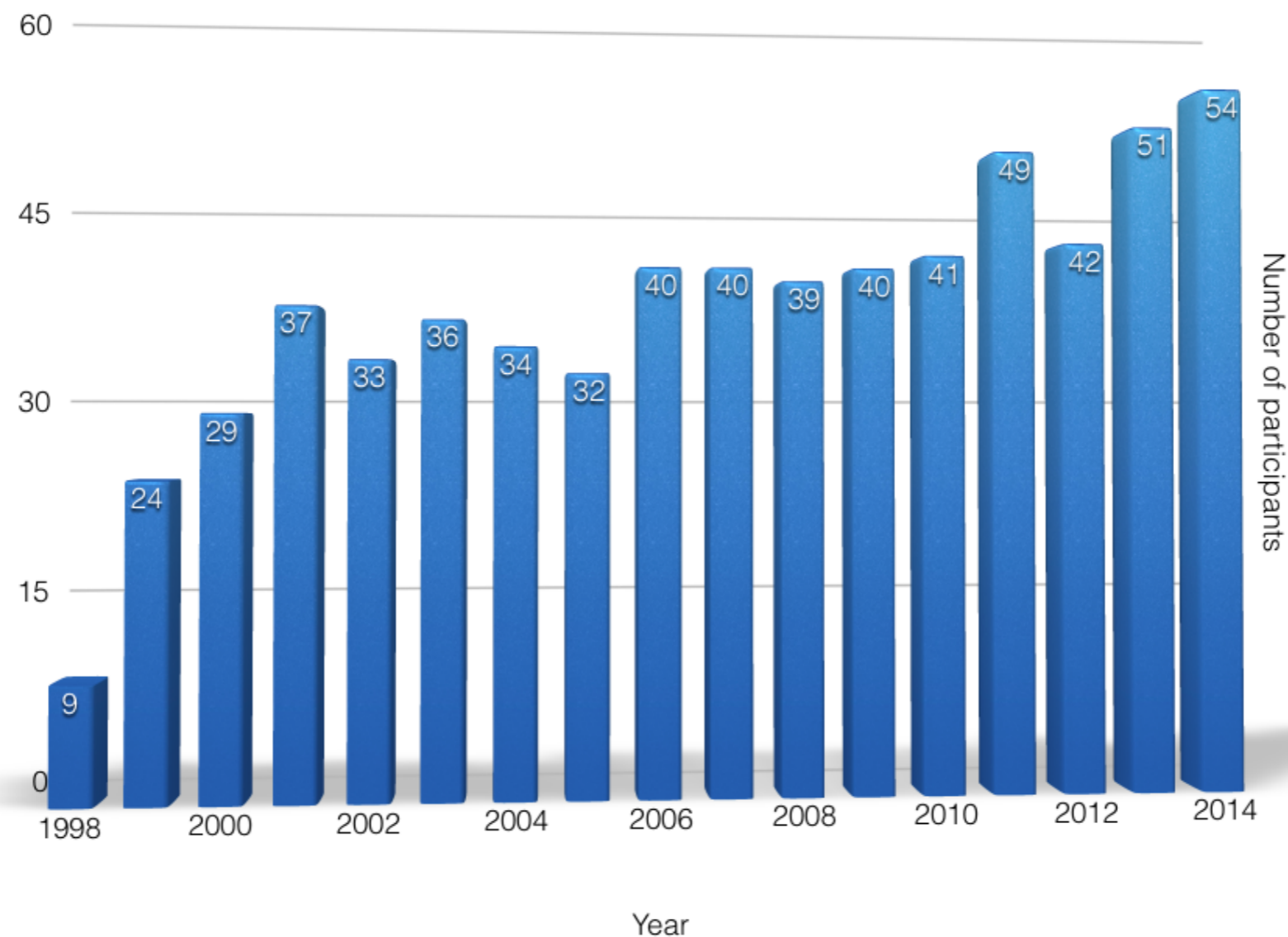
1. History of the High School Teacher Programme



1. History of the High School Teacher Programme

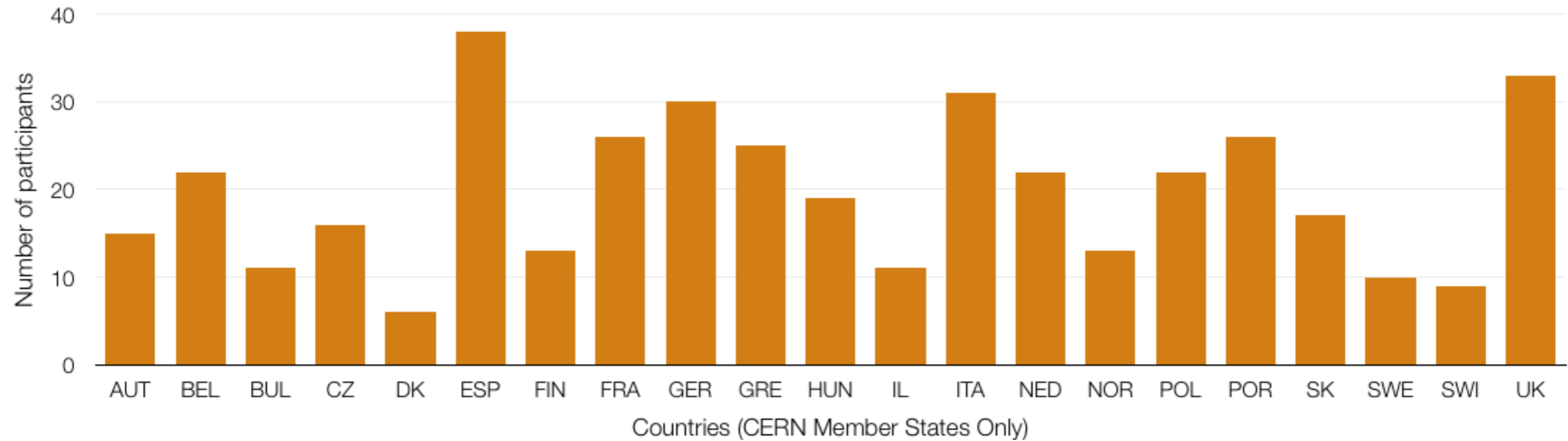
Number of participants in CERN's High School Teacher Programme

1998 - 2014

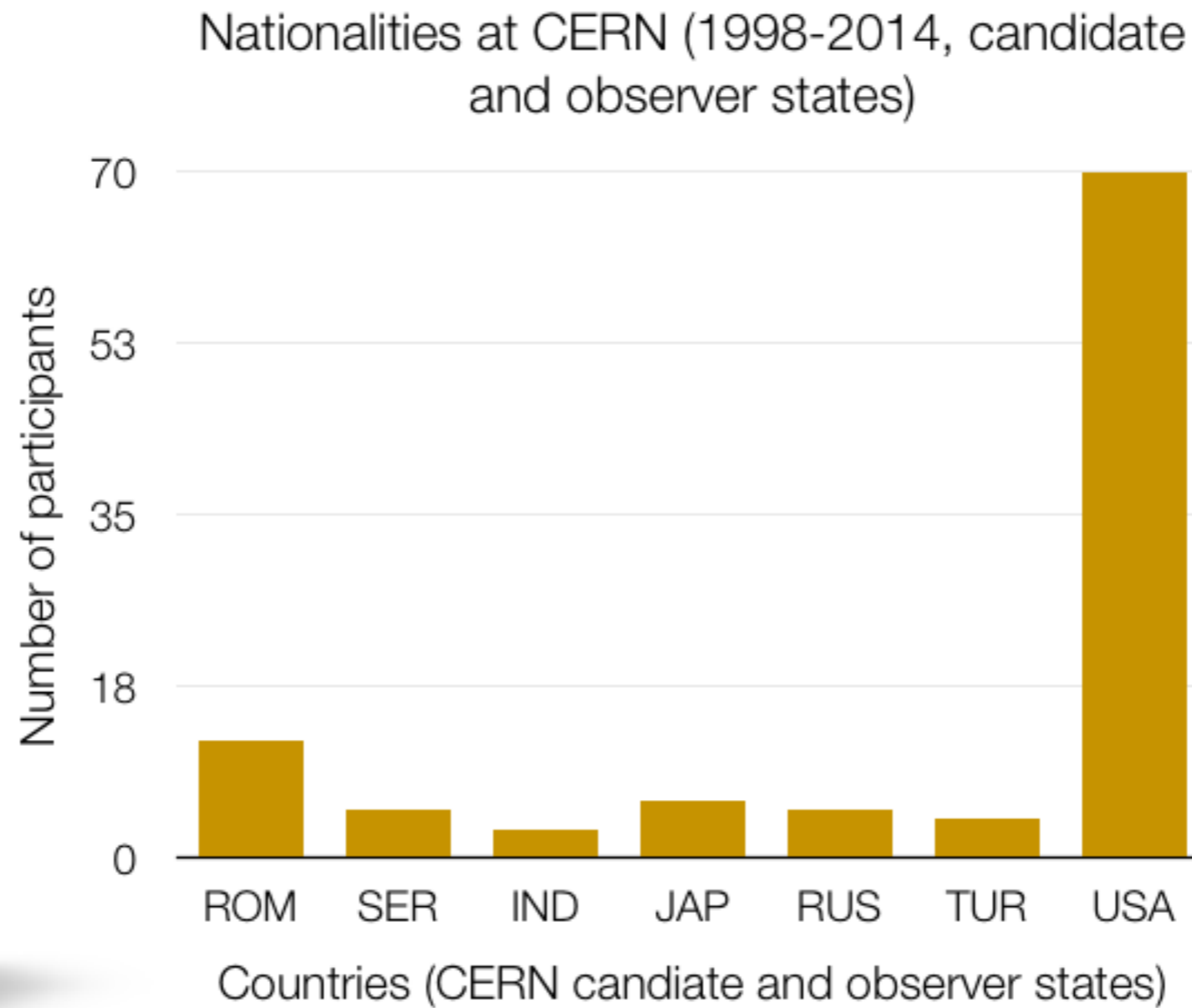


1. History of the High School Teacher Programme

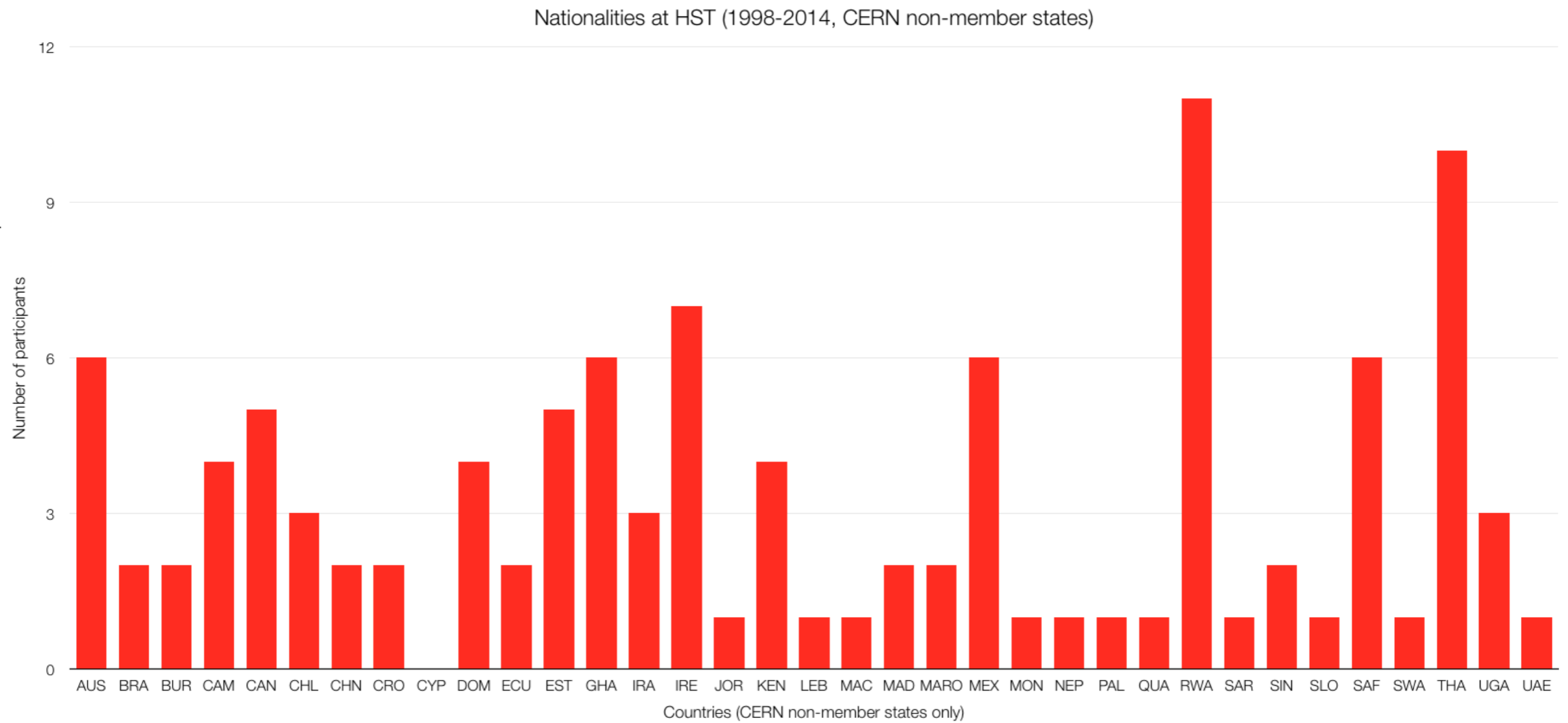
Nationalities at HST (1998 - 2014, member states only)



1. History of the High School Teacher Programme



1. History of the High School Teacher Programme



1. History of the High School Teacher Programme

Publications

1998: <http://teachers.web.cern.ch/teachers/hst/1998/1998.htm>

1998: http://bullarchive.web.cern.ch/bullarchive/9833/art1/Text_E.html

2000: http://bullarchive.web.cern.ch/bullarchive/0031/Art1/Text_E.html

2000: <http://arxiv.org/abs/physics/0005021v1>

2001: <http://cds.cern.ch/record/45182?ln=en>

2009: <http://cds.cern.ch/journal/CERNBulletin/2009/32/News%20Articles/1195729?ln=en>

<http://www.scienceinschool.org/print/1043>

http://www.scienceinschool.org/repository/docs/issue13_cernhst.pdf

2014: <http://cds.cern.ch/journal/CERNBulletin/2014/31/News%20Articles/1743537?ln=en>

2014: <http://home.web.cern.ch/students-educators/updates/2014/07/inspiring-science-education-middle-east>

2. HST Resources



High School Teachers at CERN



WWW.CERN.CH [TEACHING MATERIALS](#) [HST PROGRAMMES](#)
[VISITING CERN](#) [LINKS & BOOKS](#) **HOME**

The main goal of this site is to document the work done by the participants of the programme and to collect material useful for classroom activities and public education in physics, which is then available for everyone.

NEWS

Applications for HST2014 are now being accepted

FOR MORE INFORMATION PLEASE FOLLOW THE LINK BELOW

HST TEACHING MATERIALS

- [Accelerators](#)
- [Bubble chambers](#)
- [Build a Cloud Chamber](#)
- [Feynman diagrams](#)
- [Detectors](#)
- [Experiments](#)
- [About CERN and HEP](#)
- [General Physics](#)
- [Syllabus review](#)



PHYSICS LINKS

- [General Physics](#)
- [Particle Physics](#)
- [Research Organizations](#)
- [Books and Journals](#)
- [CERN's Educational Page](#)

VISITING CERN

- [Microcosm](#)
- [CERN websites](#)

HST PROGRAMMES

[1998](#), [1999](#), [2000](#), [2001](#),
[2002](#), [2003](#), [2004](#), [2005](#),
[2006](#), [2007](#), [2008](#), [2009](#),
[2010](#), [2011](#), [2012](#), [2013](#),
[2014](#)

[SITEMAP](#) [WORKING AREA](#)

2. HST Resources

TASK 1

In the LHC ring there are 2835 bunches in each ring which will collide with each other once in each detector. How many collisions of bunches are there in

- a) one second,
- b) one run which will last about 10 hours.

2. HST Resources

Solution 1

The bunches travel at nearly the speed of light so they meet every

$$\frac{27 \cdot 10^3 m}{\frac{2835}{3 \cdot 10^8 m/s}} = 3.175 \cdot 10^{-8} s$$

so the frequency of collisions is

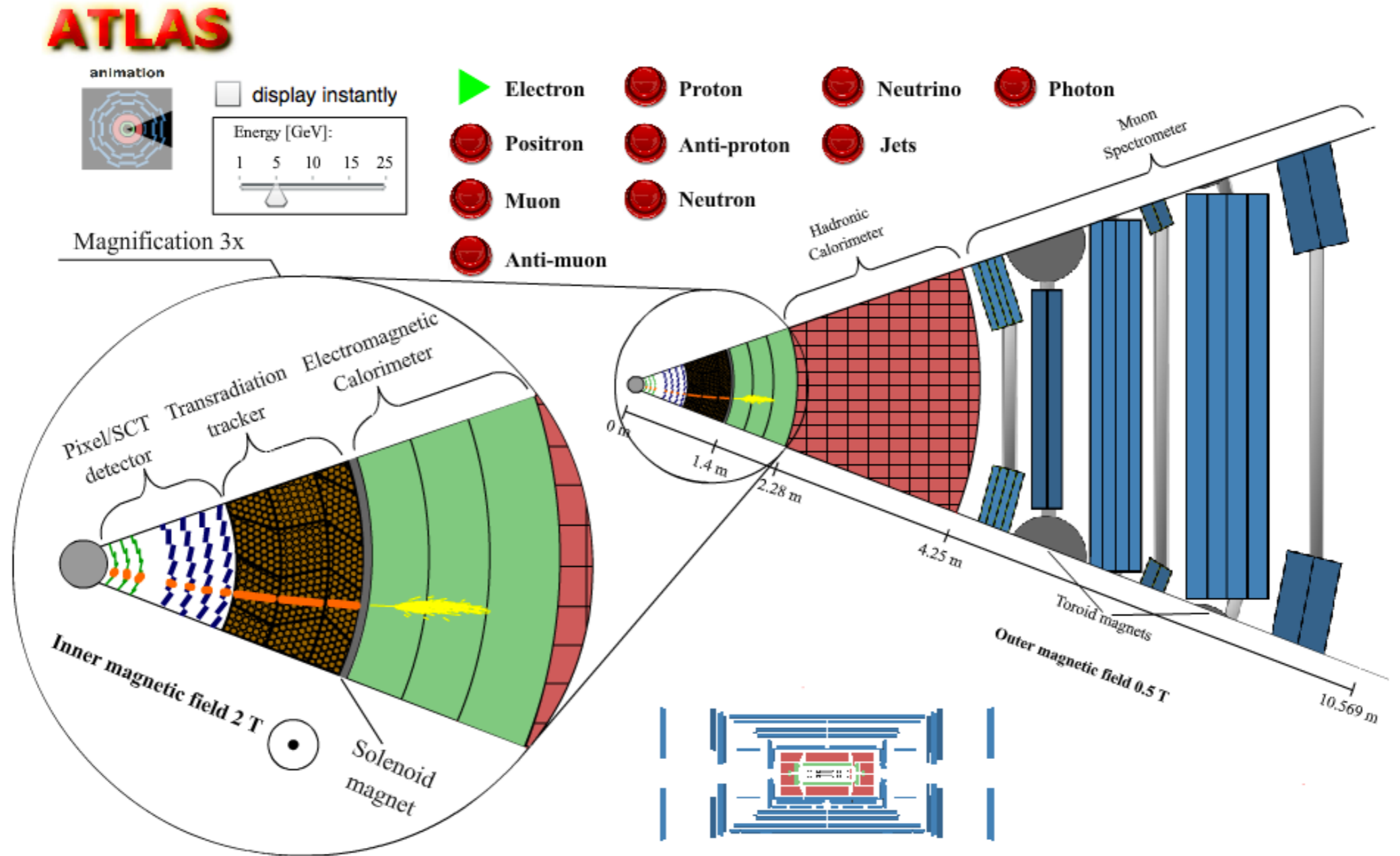
$$\frac{1}{3.175 \cdot 10^{-8} s} = 32 MHz$$

It should be 40 MHz, but there are some holes in the beam in other words some bunches are missing. This is the reason for the pacman effect, that will be eating the beam little by little, because those bunches that are not colliding will behave in a strange way and somehow eat the other bunches or make more holes to the beam.

And in 10 hours there will be about $32 \cdot 10^6 \frac{1}{s} \cdot 10 \cdot 3600 s \approx 1,2 \cdot 10^{12}$ collisions

The data that will be collected from the collisions corresponds to the amount of about 10000 Britannica Encyclopaedia per one second.

2. HST Resources



2. HST Resources



2. HST Resources

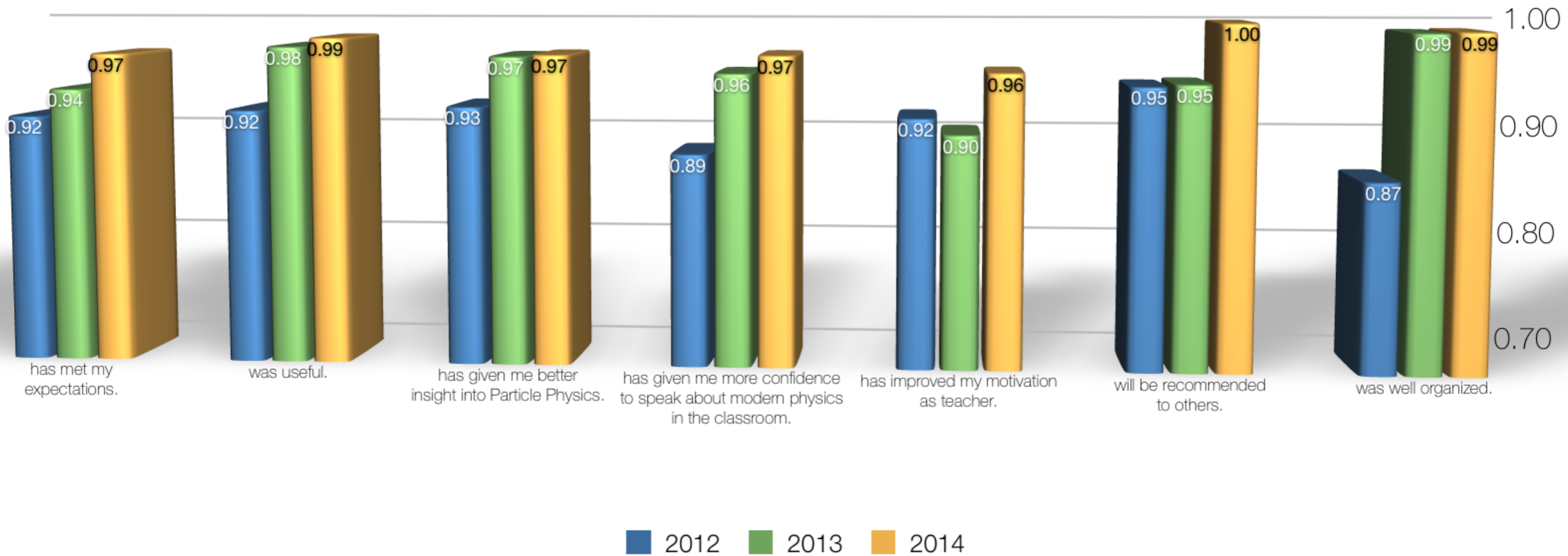


2. HST Resources



3. Experiences from 17 editions

The High School Teachers Programme



3. Experiences from 17 editions

Teachers want to come back!!!

Teachers want to stay connected!!!

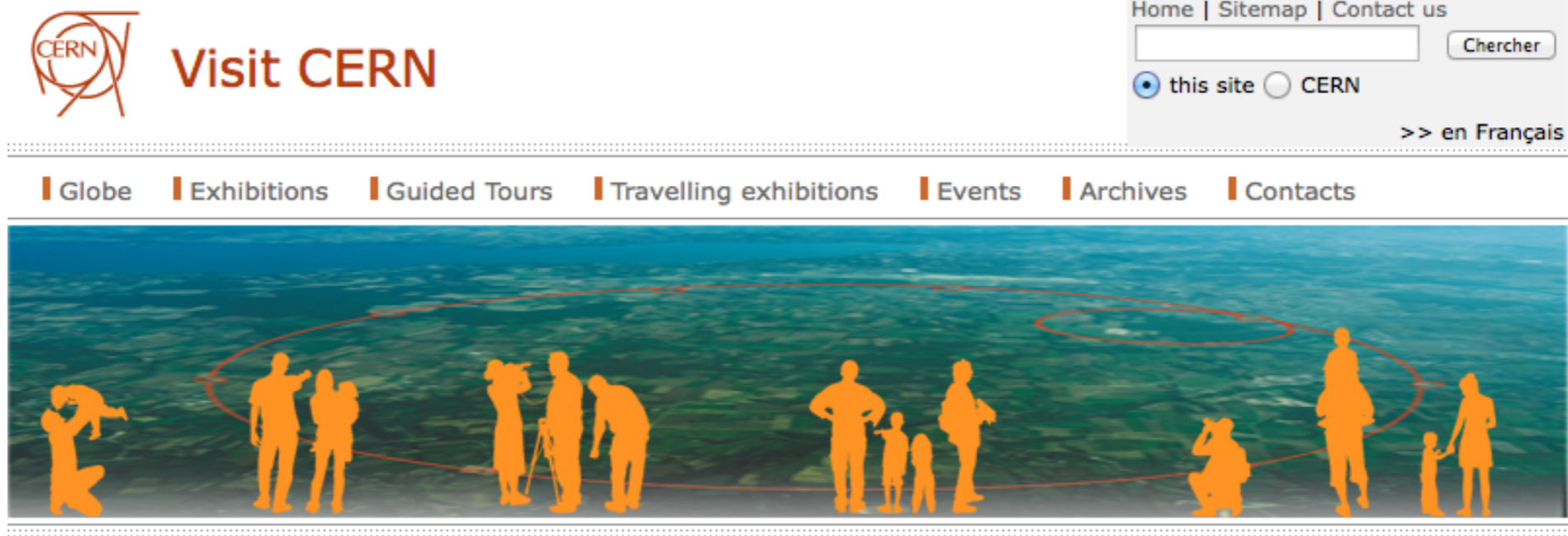
Teachers want to share knowledge!!!

3. Experiences from 17 editions

Teachers want to come back!!!

But how?

3. Experiences from 17 editions



Come and learn about fundamental research and see inside the world's largest particle physics laboratory. Feel free to visit our permanent exhibitions and experience CERN's scientific adventure on your own. Book and take part at one of our guided tours and discover the secrets of matter.



Exhibitions

The Microcosm exhibition near the CERN reception tells the story of CERN's scientific adventure.



Guided tours

Come and learn about fundamental research by looking inside the world's largest particle physics laboratory.

3. Experiences from 17 editions

1/2 day visit

simple formula:

presentation (1h) + 2 visits +

exhibition (Microcosm+Globe)

+

(for school groups only and as of 2015)

S'Cool LAB visit

Magnettest Facility (SM18), Low Energy Ion Ring (LEIR), Antiproton Decelerator (AD), ATLAS Visitor Centre (AVC), Data Centre, CERN Control Center (CCC), Alpha Magnetic Spectrometer POCC, COMPASS, CMS visitor centre, LHCb exhibition + CAST, ALICE exhibition

3. Experiences from 17 editions

FAQ

1. Can we use the CERN hotel? NO!
2. Where to go instead? [Geneva Youth Hostel](#)

3. Experiences from 17 editions

Group visit request form

[Teacher programme registration form](#)

Please use this form to request a visit to CERN. You will receive an answer within 5 working days.

Please note that all fields are mandatory.

Group name *

Please use a name that easily identifies your group, for example a school name.

Country *

Preferred language *

Number of participants (min 8) *

Remember to include all accompanying persons here.

Preferred date and start time *

3. Experiences from 17 editions

Teachers want to stay connected!!!

But how?

3. Experiences from 17 editions

Through mailing lists, facebook groups, e-mail, website(s), activities, events, follow-up activities, conferences ...

3. Experiences from 17 editions

Teachers want to share knowledge!!!

But how?

4. CERN Resources in Education



The screenshot displays the CERN Education website interface. At the top left is the CERN logo and the word "Education". To the right is a navigation menu with links for "Home", "Contact us", and "CERN Home", along with a search bar and radio buttons for "this site" (selected) and "All CERN". Below the navigation is a horizontal menu with "Teacher Programmes", "Teaching Resources", and "Visit CERN". A large photograph of three students wearing headphones is featured in the center. Below the photo, the "Teaching Materials" section lists several resources, including "Cosmic Ray Teaching Module [In German] NEW", "The Amazing World of Atoms NEW", "Antimatter Teaching Module NEW", "From the Big Bang to the LHC NEW", "CERN Particle Physics", "Cosmology", "Principles of Experimental Physics", "Introduction to Accelerators", "Applications", and "Multimedia material". The "Teaching Resources" section contains a paragraph explaining that these materials are designed to help teachers introduce modern physics to middle and high school students through various formats like presentations, lectures, and games. The footer of the page reads "Copyright CERN 2007 - Web Communications, DSU-CO".

Home | Contact us | CERN Home

Search

this site All CERN

Teacher Programmes | Teaching Resources | Visit CERN

Teaching Materials

- Cosmic Ray Teaching Module [In German] **NEW**
- The Amazing World of Atoms **NEW**
- Antimatter Teaching Module **NEW**
- From the Big Bang to the LHC **NEW**
- CERN Particle Physics
- Cosmology
- Principles of Experimental Physics
- Introduction to Accelerators
- Applications
- Multimedia material

Teaching Resources

The Teaching Materials presented here will allow teachers to introduce topics in modern physics to middle and high school students, and to do so in interesting and novel ways. In addition to the new Antimatter Teaching Module (a series of lesson plans, background materials and extension topics on antimatter, aimed at students 14-15 years), these materials include presentations, recorded lectures, teaching materials, movies, animations, games, posters, photos, games and ideas for practical activities in the classroom. All this material is available for free when used for educational purposes.

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4. CERN Resources in Education

 **High School Teachers at CERN** 

WWW.CERN.CH [TEACHING MATERIALS](#) [HST PROGRAMMES](#)
[VISITING CERN](#) [LINKS & BOOKS](#) 

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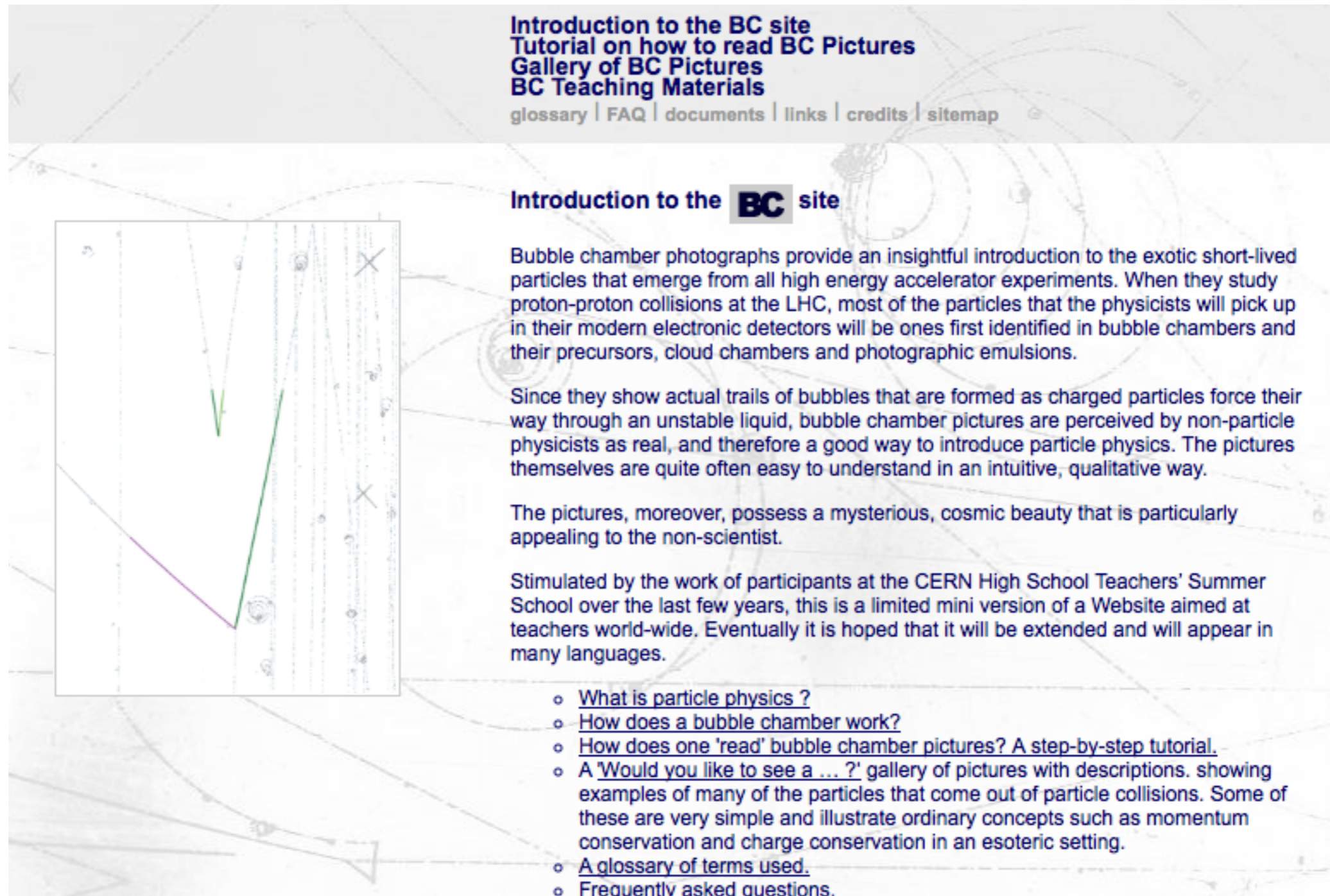
HST PROGRAMMES
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[2010](#), [2011](#), [2012](#), [2013](#),
[2014](#)


The First Z Particle 30th April 1983 (CERN Photo)

VISITING CERN
[Microcosm](#)
[CERN websites](#)

[SITEMAP](#) [WORKING AREA](#)

4. CERN Resources in Education



Introduction to the BC site
Tutorial on how to read BC Pictures
Gallery of BC Pictures
BC Teaching Materials
glossary | FAQ | documents | links | credits | sitemap

Introduction to the **BC** site

Bubble chamber photographs provide an insightful introduction to the exotic short-lived particles that emerge from all high energy accelerator experiments. When they study proton-proton collisions at the LHC, most of the particles that the physicists will pick up in their modern electronic detectors will be ones first identified in bubble chambers and their precursors, cloud chambers and photographic emulsions.

Since they show actual trails of bubbles that are formed as charged particles force their way through an unstable liquid, bubble chamber pictures are perceived by non-particle physicists as real, and therefore a good way to introduce particle physics. The pictures themselves are quite often easy to understand in an intuitive, qualitative way.

The pictures, moreover, possess a mysterious, cosmic beauty that is particularly appealing to the non-scientist.

Stimulated by the work of participants at the CERN High School Teachers' Summer School over the last few years, this is a limited mini version of a Website aimed at teachers world-wide. Eventually it is hoped that it will be extended and will appear in many languages.

- [What is particle physics ?](#)
- [How does a bubble chamber work?](#)
- [How does one 'read' bubble chamber pictures? A step-by-step tutorial.](#)
- [A 'Would you like to see a ... ?' gallery of pictures with descriptions. showing examples of many of the particles that come out of particle collisions. Some of these are very simple and illustrate ordinary concepts such as momentum conservation and charge conservation in an esoteric setting.](#)
- [A glossary of terms used.](#)
- [Frequently asked questions.](#)

4. CERN Resources in Education

The screenshot shows the CERN website's Multimedia section. At the top left is the CERN logo with the text "YEARS/ANS CERN". To the right are language options "EN" and "FR", and navigation links for "NEWS", "EVENTS", "MULTIMEDIA", and "MENU". The main banner features a folder icon and the text "Multimedia Discover all the photos and videos of the CERN60 celebrations and download your posters, wallpaper and much more!". Below the banner, a breadcrumb trail reads "CERN 60 > Multimedia > CERN exhibitions content". A sidebar on the left lists "CERN60 RESOURCES" and "CERN EXHIBITION CONTENTS" with sub-items: Overview, Physics, LHC Accelerators, Experiments, Computing, Knowledge Transfer, and History. The main content area is titled "CERN exhibitions content" and contains two cards. The "Overview" card shows a satellite map of the CERN site with labels for CMS, LHC (Large Hadron Collider), ALICE, ATLAS, and LHC2, and a "VIEW CONTENT" link. The "Physics" card displays various particle symbols (quarks, leptons, Higgs boson, photons, neutrinos) and a "VIEW CONTENT" link.

4. CERN Resources in Education



International Particle Physics Outreach Group

[Login / Sign-up / FAQs](#)

[HOME](#) | [ABOUT](#) | [MEMBERS](#) | [RESOURCES](#) | [MASTERCLASSES](#)

[HOME](#) > [RESOURCES](#)

Resources

Activities

- Cart Demonstration
- Classroom Activity
- Facilitated Activity
- Presentation
- Game
- Display

Programs & Events

- Science Fair / Science Festival
- Science Camp
- Science Shows & Performances
- Symposium / Conference
- Classroom Outreach Program
- Multi-Media Contest

Media

- Audio / Podcast
- Film / Video
- Animation - real event
- Animation - simulated event
- Images
 - Photos
 - Illustrations
 - Event Displays (static)
 - Plots
- Computer game
- Non-game Interactives / Virtual Tours
- Website

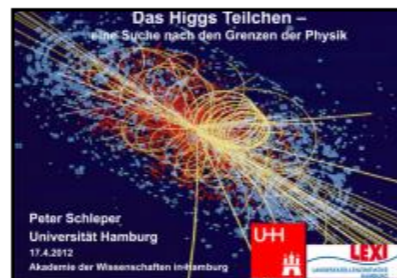
Learning Topics



- ▶ Physics
- ▶ Technology
- ▶ International Collaboration
- ▶ Broader Impacts

LATEST

FEATURED



Search by

Learning Topic

- Any -

Audience

- Any -

Item Type

- Any -

Availability

- Any -

Duration

- Any -

Language

- Any -

Key Words

GO

Resources in your language

[English](#) [French](#) [German](#)
[Italian](#) [Portuguese](#) [Spanish](#)

[more](#)

Filter by audience

6 to 9 years

4. CERN Resources in Education

The screenshot shows the ATLAS Experiment website. At the top, there is a navigation bar with links for Home, Info, Multimedia, Blogs, Links, Visit ATLAS, Contact, Collaboration Site, Store, Press, and Student/Teachers. Below this is a news section with a featured article titled "Live Science: First Glimpse of Higg_". The main content area is divided into several sections: "ATLAS Briefings" with two graphs showing energy distributions; "ATLAS News" featuring a portrait of Kerstin Tackmann and an announcement about her winning the Young Scientist Prize; "ATLAS Run Status" showing luminosity data for Proton-Proton, Proton-Lead, and Lead-Lead collisions; "LHC shut down for upgrades" with a restart date of April 2015; "ATLAS Science & Art" with links to Discovery Quest, ATLAS eTours, and Art in ATLAS; "About ATLAS" with a section on "Mapping the Secrets of the Universe"; and "Higgs Multimedia Material" with a video player for "The ATLAS Story".

The screenshot shows the CMS Experiment website. The top navigation bar includes "Compact Muon Solenoid experiment at CERN's LHC" and "CMS" logo. There are buttons for "PUBLIC WEBSITE" and "COLLABORATION WEBSITE". A search bar is located in the top right. Below the navigation is a main banner for "Observation of a New Particle with a Mass of 125 GeV" dated 4 July 2012, featuring a particle detector visualization. To the right of the banner is a sidebar with "Introducing CMS" and a list of links including "Englert and Higgs get the Nobel", "Observation of a New Particle with a Mass of 125 GeV", "Physics Results", "CMS Detector", and "About CMS". Below the banner are sections for "General News" (CHIPP Prize 2014 to Marco Peruzzi) and "Physics News" (Recent results in the search for supersymmetry). On the far right, there are vertical navigation menus for "CMS Live", "CMS Links", "Multimedia", "Movies", "Physics Results" (with a graph), "Photographs", and "Images of collisions".

5. Outlook

Save the dates!!!

programme dates: 5 - 25 July 2015

application period: 1 Dec 2014 - 15 Feb 2015



Des questions?



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