

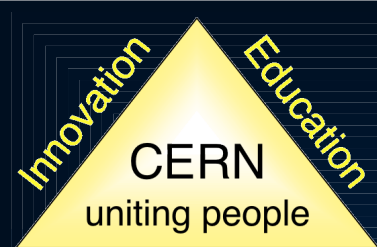
Outreach to Africa from CERN and ATLAS



African School of Fundamental
Physics and Applications

Kigali, Rwanda, 13 August 2016

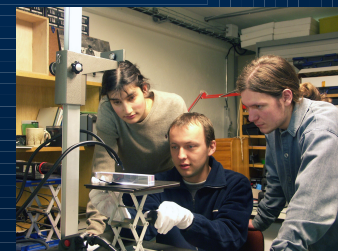
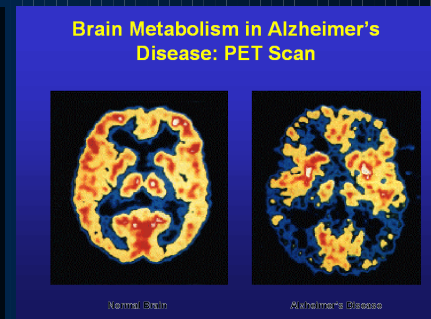
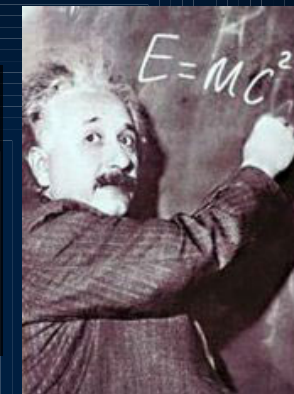
Dave Charlton
ATLAS Collaboration,
and University of Birmingham



The Mission of CERN

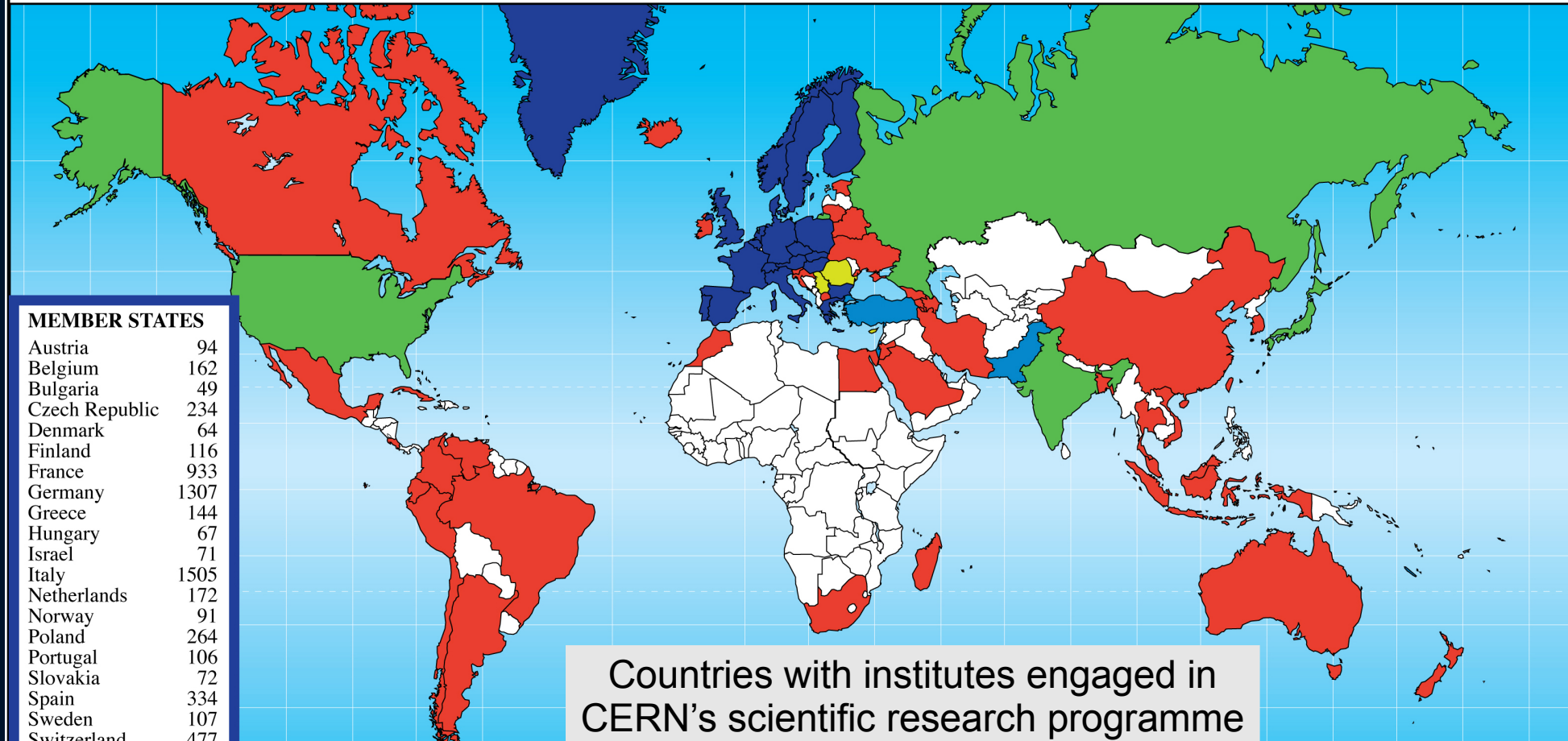
Research

- ❑ **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 cultures



Science is getting more and more global

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



MEMBER STATES

Austria	94
Belgium	162
Bulgaria	49
Czech Republic	234
Denmark	64
Finland	116
France	933
Germany	1307
Greece	144
Hungary	67
Israel	71
Italy	1505
Netherlands	172
Norway	91
Poland	264
Portugal	106
Slovakia	72
Spain	334
Sweden	107
Switzerland	477
United Kingdom	910

7279

OBSERVERS

India	187
Japan	279
Russia	980
USA	1915

3361

ASSOCIATE MEMBERS

Pakistan	36
Turkey	126

162

STATES IN ACCESSION TO MEMBERSHIP

Cyprus	11
Romania	99
Serbia	37

147

OTHERS

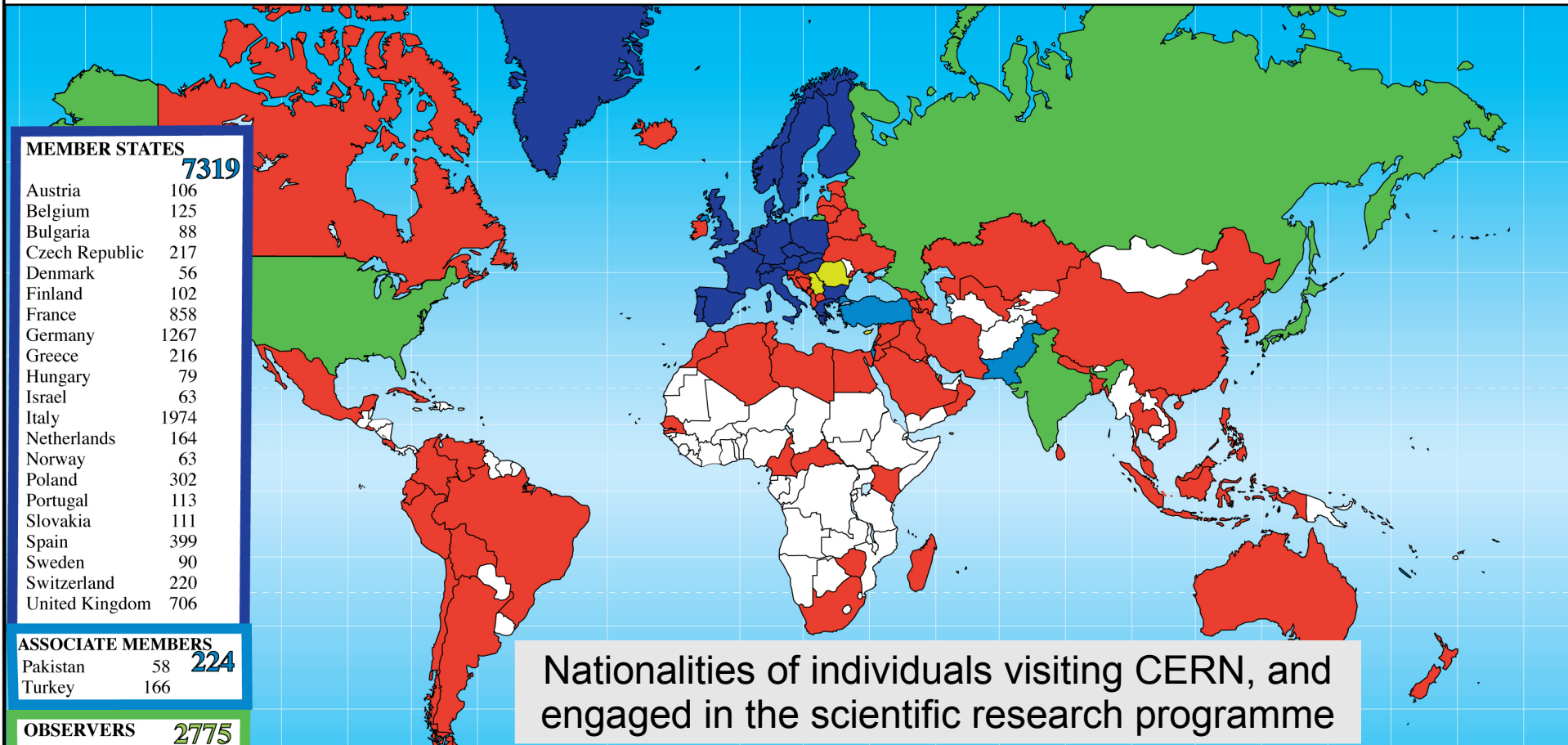
Argentina	29	China	208	Iceland	2	Mexico	64	TFYROM	2
Armenia	18	Colombia	12	Indonesia	9	Morocco	7	Ukraine	30
Australia	40	Costa Rica	1	Iran	25	New Zealand	6	Venezuela	1
Azerbaijan	4	Croatia	25	Ireland	9	Peru	3	Viet Nam	1
Bangladesh	2	Cuba	3	Jordan	2	Saudi Arabia	1		
Belarus	26	Ecuador	2	Korea	145	Singapore	1		
Brazil	151	Egypt	26	Lithuania	15	Slovenia	20		
Canada	174	Estonia	17	Madagascar	3	South Africa	47		
Chile	15	Georgia	23	Malaysia	12	Taiwan	78		
		Hong Kong	22	Malta	5	Thailand	13		

1299



Science is getting more and more global

Distribution of All CERN Users by Nationality on 12 January 2016



MEMBER STATES **7319**

Austria	106
Belgium	125
Bulgaria	88
Czech Republic	217
Denmark	56
Finland	102
France	858
Germany	1267
Greece	216
Hungary	79
Israel	63
Italy	1974
Netherlands	164
Norway	63
Poland	302
Portugal	113
Slovakia	111
Spain	399
Sweden	90
Switzerland	220
United Kingdom	706

ASSOCIATE MEMBERS **224**

Pakistan	58
Turkey	166

OBSERVERS **2775**

India	284
Japan	316
Russia	1071
USA	1104

STATES IN ACCESSION TO MEMBERSHIP **195**

Cyprus	19
Romania	131
Serbia	45

Nationalities of individuals visiting CERN, and engaged in the scientific research programme

OTHERS	Bosnia & Herzegovina	1	Ecuador	4	Kazakhstan	1	Malta	5	Qatar	1	Thailand	20
	Brazil	135	Egypt	24	Kenya	2	Mauritius	1	San Marino	1	T.F.Y.R.O.M.	2
	Albania	4	Cameroon	2	El Salvador	1	Korea, D.P.R.	4	Mexico	84	Saudi Arabia	1
	Algeria	8	Canada	154	Estonia	15	Korea Rep.	151	Montenegro	2	Senegal	1
	Argentina	24	Central African Rep.	1	Georgia	44	Latvia	1	Morocco	13	Singapore	3
	Armenia	27	Chile	20	Iceland	4	Lebanon	12	Nepal	7	Sint Maarten	1
	Australia	31	China	421	Indonesia	10	Libya	1	New Zealand	6	Slovenia	27
	Azerbaijan	11	Colombia	38	Iran	54	Lithuania	30	Oman	1	South Africa	31
	Bangladesh	7	Costa Rica	1	Iraq	1	Luxembourg	2	Palestine (O.T.)	7	Sri Lanka	3
	Belarus	50	Croatia	38	Ireland	20	Madagascar	4	Peru	6	Syria	1
	Bolivia	2	Cuba	13	Jordan	8	Malaysia	18	Philippines	4	Taiwan	56

1803

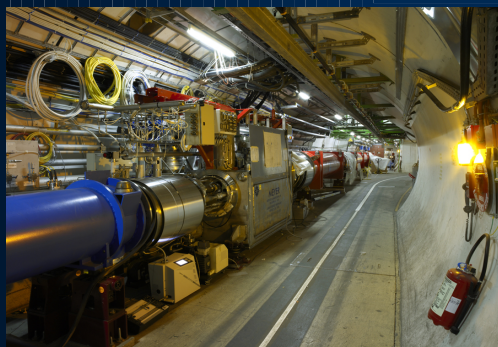


CERN: Particle Physics and Innovation

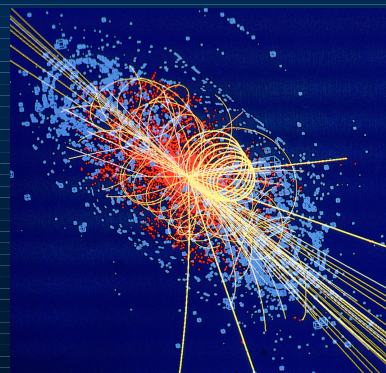
- **Interfacing** between fundamental science and key technological developments



- **CERN Technologies and Innovation**



Accelerating particle beams



Detecting particles



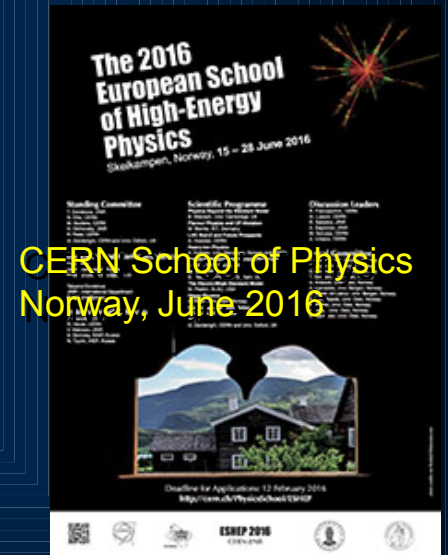
Large-scale computing (Grid)

CERN Education Activities

Scientists at CERN
Academic Training Programme



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



CERN School of Physics
Norway, June 2016

Physics Students
Summer Students Programme



CERN Teacher Schools
International and National Programmes

African School of Fundamental Physics and its Applications

Stellenbosch, South Africa
(2010)

Kumasi, Ghana
(2012)

Cheikh Anta Diop, Senegal
(2014)

Kigali, Rwanda
(2016)

THE FOURTH BIENNIAL
**AFRICAN SCHOOL OF
FUNDAMENTAL PHYSICS
AND APPLICATIONS**

East Africa Institute for Fundamental Research
University of Rwanda
Kigali, Rwanda
August 1-19, 2016

Application: asp2016-registration@cern.ch
Deadline: Open for application from **Dec 14th, 2015 to March 31st, 2016**. Bursaries and full support for selected students. Provide a CV, transcripts, letter of motivation and one recommendation letter with your **Online Application**.
Contact: asp2016-ioc@cern.ch
Website: www.africanschoolofphysics.org

Physics Topics:

- Theoretical Physics
- Particle Physics
- Nuclear Physics
- Medical Physics
- Monte Carlo Generators & Simulations
- Accelerators & Technology
- Grid Computing

International Organizing Committee:

B. Acharya (ICTP and King's College London),
K. Assamagan (BNL), **A. E. Dabrowski** (CERN),
C. Darve (ESS), **S. Muanza** (CNRS-IN2P3),
J. Ellis (King's College London), **R. Voss** (CERN)

Local Organizing Committee:

G. Bajpai (UR-College of Science & Technology),
T. Brown (Carnegie Mellon University Rwanda),
M.C. Gasingirwa (Rwanda Ministry of Education),
M. Hughes (Rwanda Ministry of Education),
B. Krogh (Carnegie Mellon University Rwanda),
M. Mbonye (UR College of Science & Technology),
S. Mboyo (UR-ICT Section),
P. Muiga (UR College of Medicine & Health Sciences),
E. Munyangabe (Ministry of Infrastructure),
B. Safari (UR College of Science & Technology),
C. Sekomo (UR College of Science & Technology),
J. Uwamahoro (UR College of Education),
B. Wellars (UR-College of Science & Technology)

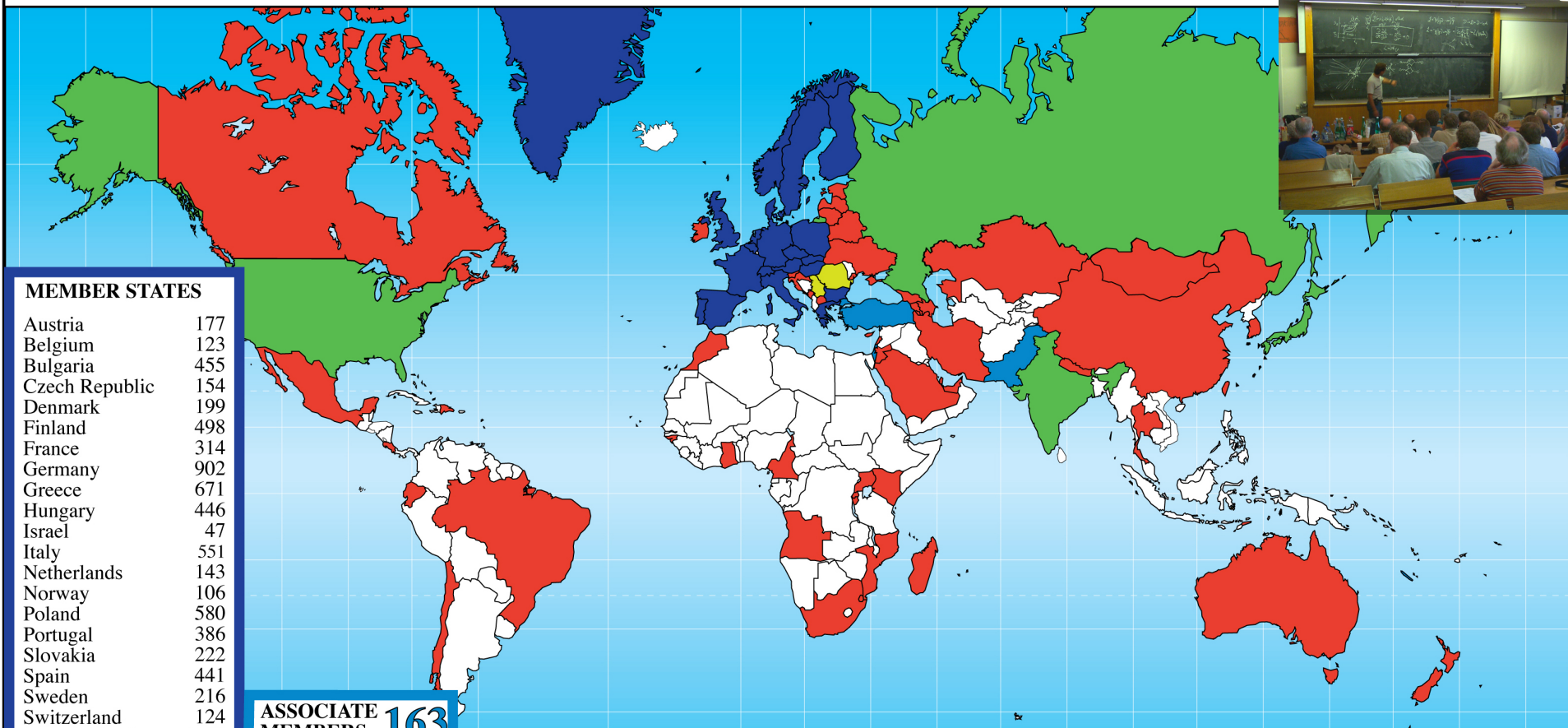
International Advisory Committee:

H. Bachacou (CEA-IRFU), **U. Bassler** (CNRS-IN2P3),
M. Campanelli (UCL), **S. Connell** (University of Johannesburg),
T. Ekelof (University of Uppsala), **L. Elouadhihi** (TJNAF),
E. G. Ferreira (USC), **J. Gray** (ASP), **H. Gordon** (BNL),
J. Govaerts (UCL), **N. Holtkamp** (SLAC), **J. Huston** (MSU),
O. Ka (UCAD), **S. Kendall** (BNL), **Y. K. Kim** (University of Chicago),
D. Kobor (JASZ), **S. C. Lee** (Academia Sinica),
G. Margaritondo (EPFL), **H. Montgomery** (TJNAF),
M. Nxumalo (NRF), **F. Quevedo** (ICTP), **L. Rivkin** (PSI & EPFL),
J. Senona (DST), **H. Severini** (University of Oklahoma),
P. Skands (Monash University), **R. D. Tabrizi** (Simon Fraser University),
C. Thiangoume (UCAD), **E. Tesemelis** (CERN), **T. Vickey** (University of Sheffield),
Z. Vilakazi (University of the Witwatersrand), **H. B. White Jr.** (Fermilab), **J. Yu** (University of Texas, Arlington)



CERN Teacher Programme

Teacher Programme Participants 1998 - 2015 (Total: 9509)



MEMBER STATES

Austria	177
Belgium	123
Bulgaria	455
Czech Republic	154
Denmark	199
Finland	498
France	314
Germany	902
Greece	671
Hungary	446
Israel	47
Italy	551
Netherlands	143
Norway	106
Poland	580
Portugal	386
Slovakia	222
Spain	441
Sweden	216
Switzerland	124
United Kingdom	1161

7916

ASSOCIATE MEMBERS **163**

Pakistan	2
Turkey	161

OBSERVERS

India	4
Japan	7
Russia	336
USA	97

444

CANDIDATES FOR ACCESSION

Romania	14
Serbia	68

82

OTHERS

Angola	7
Armenia	1
Australia	6
Azerbaijan	1
Bahrain	2
Belarus	3
Brazil	167
Burundi	2
Cameroon	4
Canada	8
Chile	3
China	2
Costa Rica	4
Croatia	23
Cyprus	10
Dominican Rep.	45
Ecuador	2
Egypt	2
Estonia	66
Georgia	104

OTHERS

Cape Verde	4
Chile	3
China	2
Costa Rica	4
Croatia	23
Cyprus	10
Dominican Rep.	45
Ecuador	2
Egypt	2
Estonia	66
Georgia	104

OTHERS

Ghana	6
Guinea Bissau	1
Iran	6
Ireland	8
Jordan	11
Kazakhstan	8
Kenya	4
Latvia	1
Lebanon	1
Lithuania	32
Madagascar	2

OTHERS

Malta	36
Mexico	14
Mongolia	1
Montenegro	14
Morocco	2
Mozambique	21
Nepal	2
New Zealand	2
Palestine (O.T.)	4
Qatar	1
Rwanda	20

OTHERS

Sao Tome	6
Saudi Arabia	1
Singapore	2
Slovenia	21
South Africa	7
South Korea	48
Swaziland	1
Taiwan	1
Thailand	12
T.F.Y.R.O.M.	12
Timor-Leste	9

OTHERS

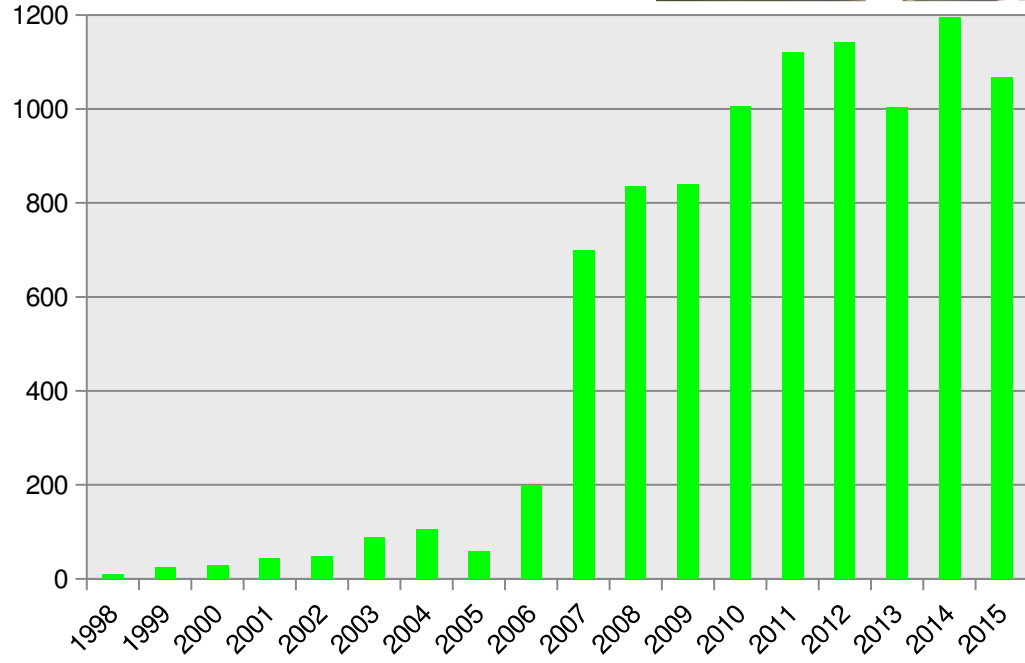
Uganda	3
Ukraine	117
U.A.E.	1

904



CERN Teacher Programme

Teacher Programme Participants 1998 - 2015 (Total: 9509)



MEMBER STATES

Austria	177
Belgium	123
Bulgaria	455
Czech Republic	154
Denmark	199
Finland	498
France	314
Germany	902
Greece	671
Hungary	446
Israel	47
Italy	551
Netherlands	143
Norway	106
Poland	580
Portugal	386
Slovakia	222
Spain	441
Sweden	216
Switzerland	124
United Kingdom	1161

ASSOCIATE MEMBERS **163**

Pakistan	2
Turkey	161

OBSERVERS

India	4
Japan	7
Russia	336
USA	97

CANDIDATES FOR ACCESSION

Romania	14
Serbia	68

OTHERS

Angola	7
Armenia	1
Australia	6
Azerbaijan	1
Bahrain	2
Belarus	3
Brazil	167
Burundi	2
Cameroon	4
Canada	8
Cape Verde	4
Chile	3
China	2
Costa Rica	4
Croatia	23
Cyprus	10
Dominican Rep.	45
Ecuador	2
Egypt	2
Estonia	66
Georgia	104
Ghana	6
Guinea Bissau	1
Iran	6
Ireland	8
Jordan	11
Kazakhstan	8
Kenya	4
Latvia	1
Lebanon	1
Lithuania	32
Madagascar	2
Malta	36
Mexico	14
Mongolia	1
Montenegro	14
Morocco	2
Mozambique	21
Nepal	2
New Zealand	2
Palestine (O.T.)	4
Qatar	1
Rwanda	20
Sao Tome	6
Saudi Arabia	1
Singapore	2
Slovenia	21
South Africa	7
South Korea	48
Swaziland	1
Taiwan	1
Thailand	12
T.F.Y.R.O.M.	12
Timor-Leste	9
Uganda	3
Ukraine	117
U.A.E.	1

7916

82

444

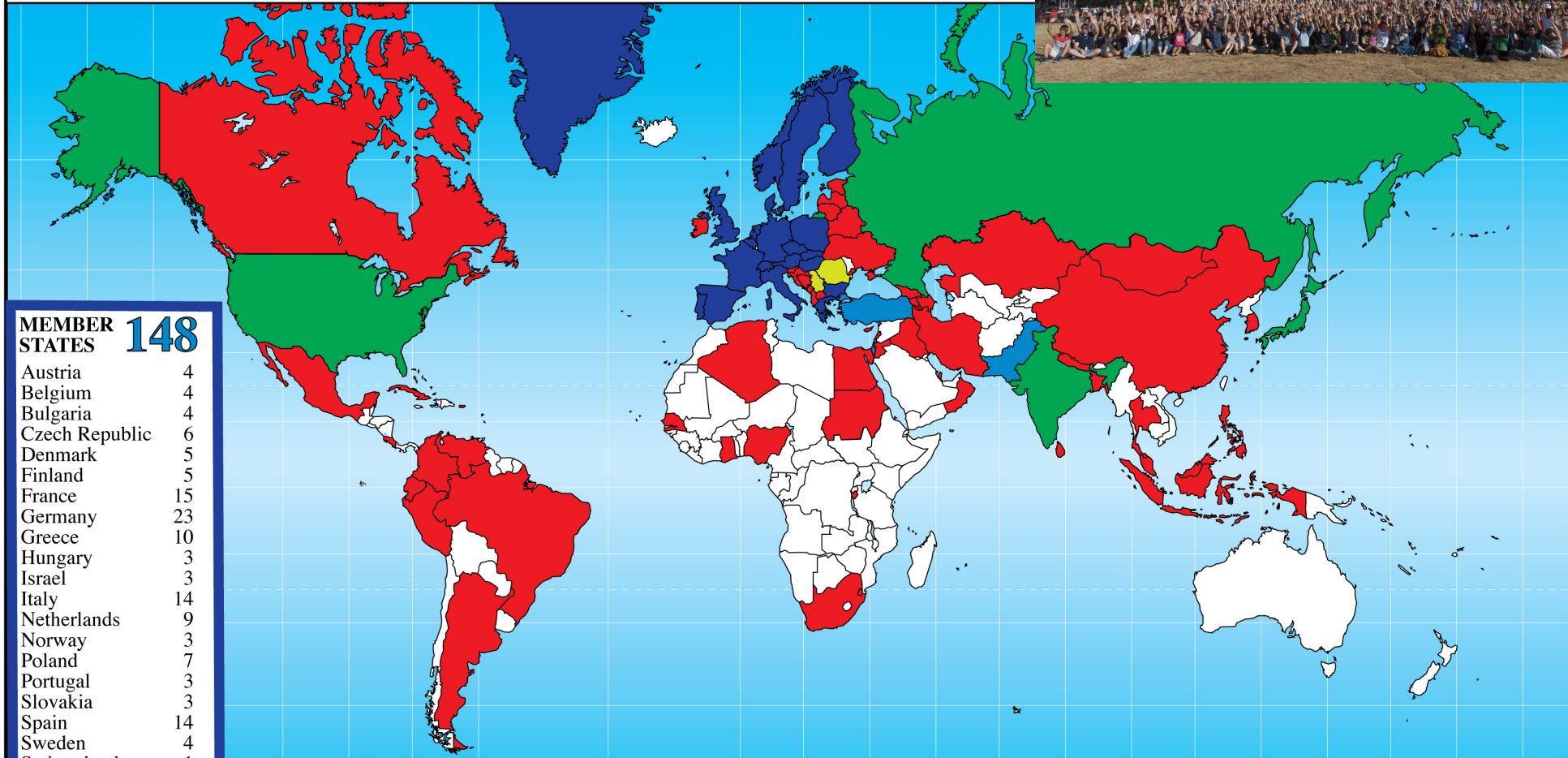
904



Summer Students 2015



Summer Students 2015



MEMBER STATES 148

Austria	4
Belgium	4
Bulgaria	4
Czech Republic	6
Denmark	5
Finland	5
France	15
Germany	23
Greece	10
Hungary	3
Israel	3
Italy	14
Netherlands	9
Norway	3
Poland	7
Portugal	3
Slovakia	3
Spain	14
Sweden	4
Switzerland	1
United Kingdom	8

ASSOCIATE MEMBERS 15

Pakistan	8
Turkey	7

OBSERVERS 44

India	13
Japan	4
Russia	9
USA	18

CANDIDATES FOR ACCESSION 9

Romania	6
Serbia	3

OTHERS

Albania	2
Algeria	4
Argentina	3
Armenia	1
Azerbaijan	1
Bangladesh	1
Belarus	1
Bosnia	1
Brazil	2

Brunei	2
Burundi	1
Canada	3
China	12
Colombia	1
Costa Rica	2
Croatia	2
Cuba	1
Cyprus	1
Ecuador	1

Egypt	2
Estonia	2
Georgia	1
Ghana	1
Gibraltar	1
Indonesia	1
Iran	2
Iraq	1
Ireland	1
Jordan	1

Kazakhstan	1
Korea	1
Latvia	1
Lebanon	3
Lithuania	2
Malaysia	3
Malta	4
Mexico	1
Mongolia	2
Montenegro	1

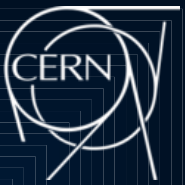
Nepal	1
Nigeria	1
Oman	1
Palestine	1
Peru	1
Philippines	1
Puerto Rico	1
Qatar	1
Singapore	2
Slovenia	1

South Africa	2
Sri Lanka	1
Sudan	1
Thailand	3
T.F.Y.R.O.M.	3
Ukraine	1
Venezuela	1

105



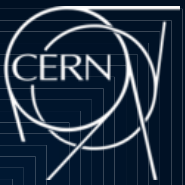
Africa – CERN Collaboration



- **CERN** is open to collaboration with qualified and interested **scientists from any country**
 - Co-operation agreements with Algeria, Egypt, Morocco, South Africa, Tunisia
 - Contacts with individual scientists from many other countries
- **CERN** provides access to **training programmes** to help capacity-building
 - Physics, engineering, information technology
 - Summer students, high-school teachers...
 - Example: Agreement signed with Minister of Education, Rwanda, in 2010 to facilitate training of students and teachers
- **Open access to scientific information**
 - Training in digital library techniques
- **UNESCO** offers support through **IBSP programme**



CERN-UNESCO Schools for Digital Libraries



Kigali, Rwanda
(2009)

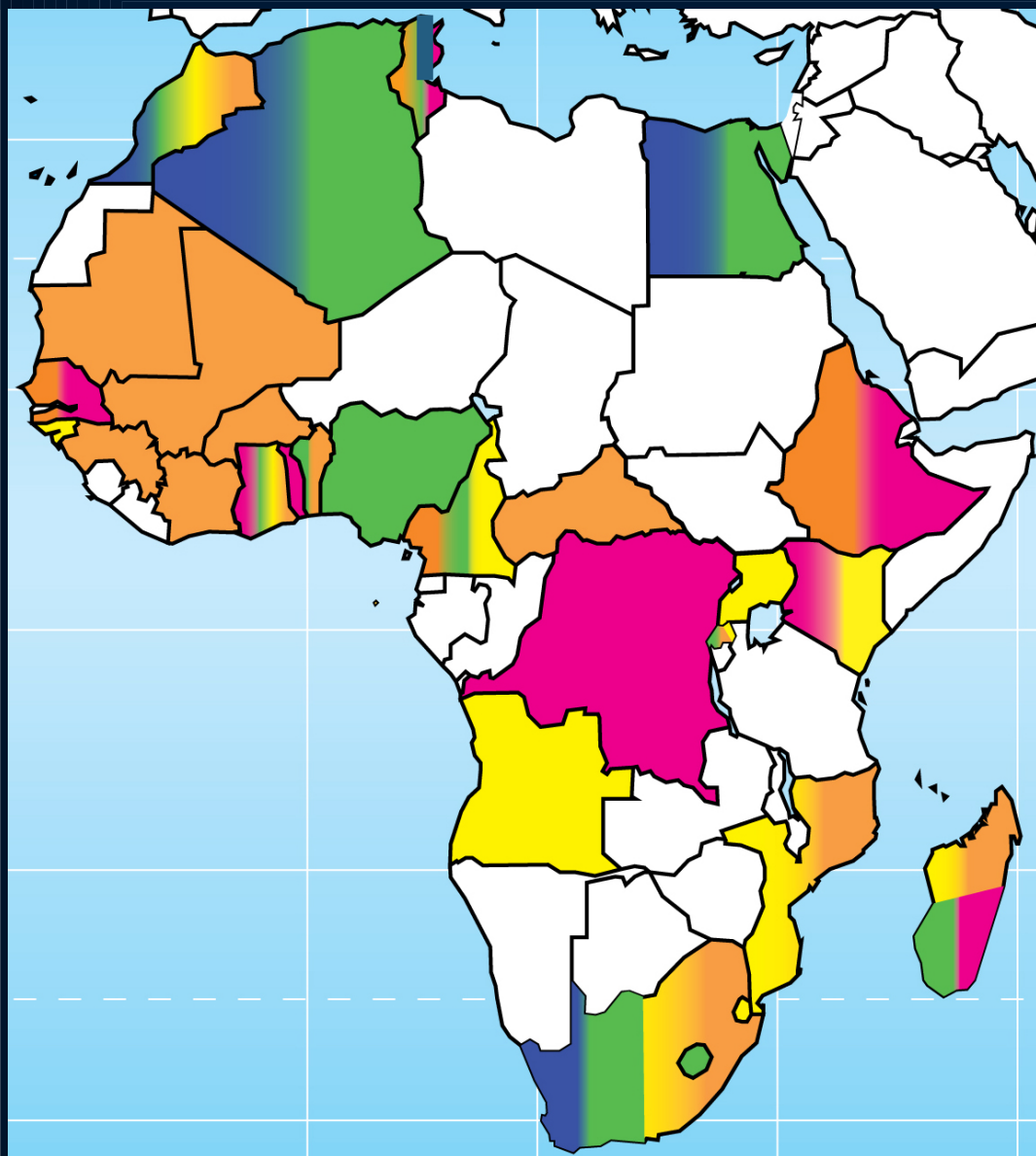
Rabat, Morocco
(2010)

Dakar, Senegal
(2011)

Kumasi, Ghana
(2016)



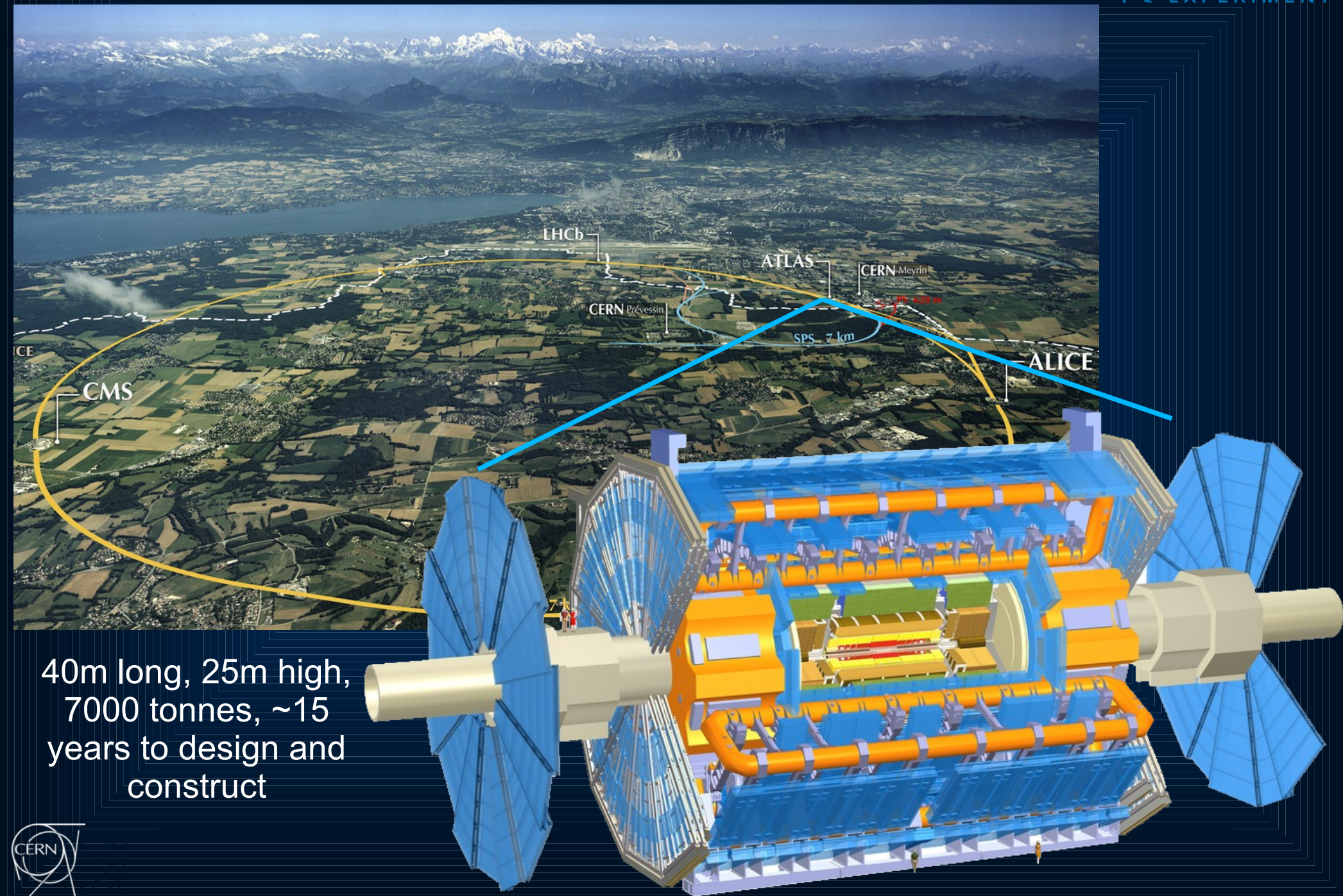
Africa – CERN Collaboration



- International Cooperation Agreements
- Other Scientific Contacts
- IT Contacts
- Summer Students
- High School Teachers
- Digital Libraries



ATLAS – an LHC Detector



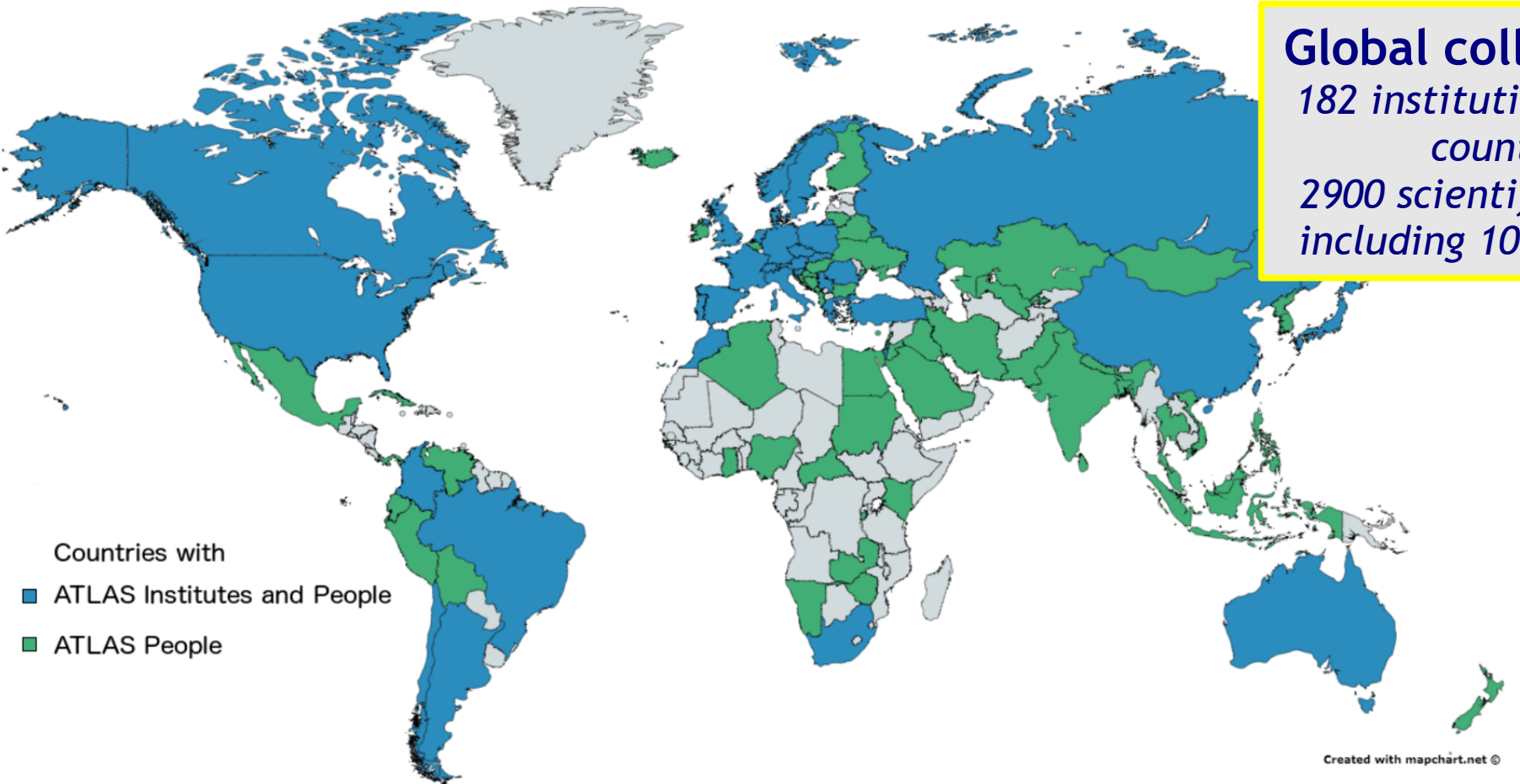
40m long, 25m high,
7000 tonnes, ~15
years to design and
construct



The ATLAS Collaboration



Global collaboration
182 institutions from 38 countries
2900 scientific authors, including 1000 students



Countries with

- ATLAS Institutes and People
- ATLAS People

Created with mapchart.net ©

Adelaide, Albany, Alberta, NIKHEF Amsterdam, Ankara, LAPP Ancecy, Argonne NL, Arizona, UT Arlington, Athens, NTU Athens, UT Austin, Baku, IFAE Barcelona, Belgrade, Bergen, Berkeley LBL and UC, HU Berlin, Bern, Birmingham, UAN Bogota, Bologna, Bonn, Boston, Brandeis, Bratislava/SAS Kosice, Brazil Cluster, Brookhaven NL, Buenos Aires, Bucharest, Cambridge, Carleton, CERN, Chinese Cluster, Chicago, Chile, Clermont-Ferrand, Columbia, NBI Copenhagen, Cosenza, AGH UST Cracow, IFJ PAN Cracow, SMU Dallas, UT Dallas, DESY, Dortmund, TU Dresden, JINR Dubna, Duke, Edinburgh, Frascati, Freiburg, Geneva, Genoa, Giessen, Glasgow, Göttingen, LPSC Grenoble, Technion Haifa, Harvard, Heidelberg, Hiroshima IT, Hong Kong CUHK/HKU/HKUST, NTHU Hsinchu, Indiana, Innsbruck, Iowa SU, Iowa, UC Irvine, Istanbul Bogazici, KEK, Kobe, Kyoto, Kyoto UE, Kyushu, Lancaster, UN La Plata, Lecce, Lisbon LIP, Liverpool, Ljubljana, QM London, RH London, UC London, Louisiana Tech, Lund, UA Madrid, Mainz, Manchester, CPPM Marseille, Massachusetts, MIT, Melbourne, Michigan, Michigan SU, Milano, Minsk NAS, Minsk NCPHEP, Montreal, McGill Montreal, **RUPHE Morocco**, FIAN Moscow, ITEP Moscow, MPhI Moscow, MSU Moscow, Munich LMU, MPI Munich, Nagasaki IAS, Nagoya, Naples, New Mexico, New York, Nijmegen, Northern Illinois University, BINP Novosibirsk, NPI Petersburg, Ohio SU, Okayama, Oklahoma, Oklahoma SU, Olomouc, Oregon, LAL Orsay, Osaka, Oslo, Oxford, Paris VI and VII, Pavia, Pennsylvania, Pisa, Pittsburgh, CAS Prague, CU Prague, TU Prague, IHEP Protvino, Rome I, Rome II, Rome III, RAL-STFC, DAPNIA Saclay, Santa Cruz UC, Sheffield, Shinshu, Siegen, Simon Fraser Burnaby, SLAC, **South Africa Cluster**, Stockholm, KTH Stockholm, Stony Brook, Sydney, Sussex, AS Taipei, Tbilisi, Tel Aviv, Thessaloniki, Tokyo ICEPP, Tokyo MU, Tokyo Tech, Toronto, Trento, TRIUMF, Tsukuba, Tufts, Udine/ICTP, Uppsala, UI Urbana, Valencia, UBC Vancouver, Victoria, Warwick, Waseda, Washington, Weizmann Rehovot, FH Wiener Neustadt, Wisconsin, Wuppertal, Würzburg, Yale, Yerevan

ATLAS Outreach to Africa



The LHC Collaborations (ALICE, ATLAS, CMS and LHCb) each have outreach programmes

ATLAS' programme includes

- Masterclasses typically for high-school students, held at universities, with video link-ups to CERN
 - In Africa, so far Maghreb countries, Egypt and South Africa
- “Virtual Visits” from universities/science centres, with live link-up to physicists in ATLAS Control Room
- Open Data release for education – primarily intended for physics undergraduates
- “ATLAS@home”
- Close collaboration with ICTP *Physics without Frontiers* programme through ATLAS Outreach co-Coordinator Dr Kate Shaw

ATLAS Virtual Visits



<http://atlas-live-virtual-visit.web.cern.ch/atlas-live-virtual-visit/>

Typically these are held at universities or science centres, with local activities plus a connection to the ATLAS Control Room at CERN as a highlight

A Virtual Visit is primarily a chance to learn about particle physics. One (or more) virtual guide introduces himself and his role, and then briefly explains what is CERN, LHC and the ATLAS experiment. This is followed by a description of his location, what's and why's. Then, the local organizer passes the microphone to the audience and the virtual guide answers questions. We find the latter to be the most important part of the visit.

The maximum duration of a Virtual Visit is 1 hour.

Participants interact with the virtual guide, who speaks their language and is - as often as possible - a physicist from their country, thanks to a tool called Vidyo. Others can follow the visit on the web, through the event specific pages created on this site.

A few weeks notice is required, for organisation and to test the setup, bandwidth etc.

ATLAS Virtual Visits



<http://atlas-live-virtual-visit.web.cern.ch/atlas-live-virtual-visit/>



The Soweto Science Centre, South Africa

Share on



07 August 2014 - 15:00 CET in English

National Science Week (4-9 August 2014), is an initiative of the Department of Science and Technology (DST). It is a countrywide celebration of science run in all nine provinces of South Africa simultaneously at multiple sites per province. In particular, Gauteng province regional events will be hosted at the Soweto Science Centre by the University of Johannesburg. The event is expected to be well attended by learners, teachers the media, the general public, policy makers and many stakeholders in the area of Science and Technology. The Soweto Science Centre has made a measurable impact in the academic performance of schools in its feeder region, and it is an increasingly a successful vehicle for science communication. This year, for the first time, the activities will include a virtual tour of ATLAS. The virtual tour will be preceded by public lectures on High Energy Physics at ATLAS.



11:14 | 29:41 | HD | Speaker icon | Full screen icon

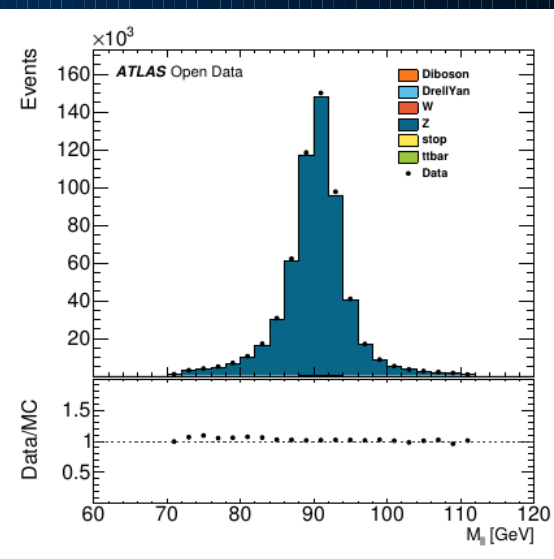
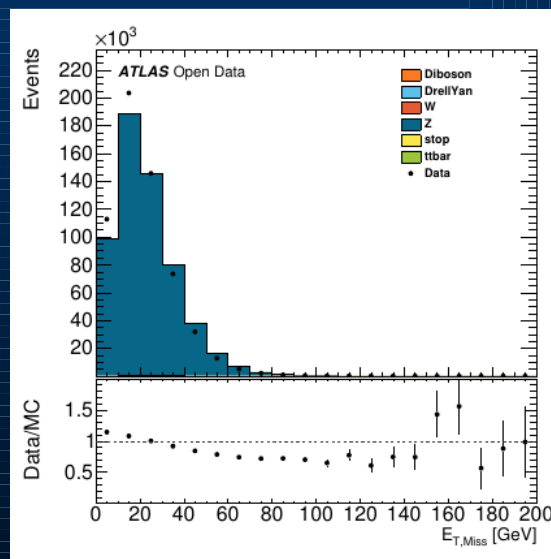


ATLAS Open Data



ATLAS has released a part of the 2012 data sample, together with the tools and simulated data samples needed to make studies with the data

- Target audience is primarily *university undergraduate* physics students
- <http://opendata.atlas.cern/>
- Full documentation of the contents
- Example physics analysis routines included
- Students can write or extend existing analysis routines with Python programming language
- Whole package fits on a USB stick



Access Open Data from the ATLAS Experiment at CERN

The [ATLAS](#) data from 100 trillion proton collisions is now public! This marks the world's first open release of 8 TeV data, gathered from the [Large Hadron Collider](#) in 2012.

ATLAS Open Data guides you through how to visualise the data, how to download and use the data, and even provides open-source software for you to make your own discoveries. **Check the introductory video and get started now!**



Introduction Video

opendata.atlas.cern

Note! [ATLAS Open Data](#) is primarily aimed at University students, postgraduate and external researchers. Please read more in [Target section](#)

Closing Words

CERN is open to collaboration with qualified and interested scientists from any country

- Can provide access to training programmes
- Scientific outputs are now all Open Access

ATLAS and the other LHC experiments provide substantial Outreach and Education Resources, which may be useful for schools and undergraduates

- <http://atlas.cern/resources/education>
- Virtual visits can be arranged

Contact: atlas-outreach-virtual-visit-team@cern.ch



The screenshot shows the ATLAS website's 'Resources' page. The header includes the ATLAS logo and navigation links for 'Discover' and 'Resources'. The main content area is titled 'Resources' and contains a sub-section for 'Education'. Under 'Education', there are three categories: 'Primary Students (7-12 Years)', 'Secondary Students (13 Years and Up)', and 'University Level'. Each category has a brief description of available resources and links to specific programs. A green arrow points from the text in the main slide to the URL 'http://atlas.cern/resources/education' in the 'Primary Students' section of the screenshot.

Resources Read, view, listen, and download [multimedia](#), [activities](#), [educational programmes](#)

Education

Primary Students (7-12 Years)
CERN has multimedia material at [CERNland](#), which includes educational games. The [LHC Game](#) is also a great way to learn about accelerators.

Secondary Students (13 Years and Up)
High school and university students can use ATLAS event analysis tools ([HYPATIA](#), [HYPATIA Online](#), [MINERVA](#), [CAMELIA](#)) for the interactive investigation of data collected by the experiment to make discoveries like physicists do. Such programmes can be run independently or in the framework of [International Masterclasses](#).

The [Lancaster Particle Physics Package](#) (LPPP) gives a brief introduction to particle physics for students 16-18 years of age (accessible to other age groups, as well).

Educational games and materials can also be found at CERN's [Education Site](#) and [QuarkNet](#).

University Level

Undergraduate and graduate students may be interested in CERN's academic programmes:

- [Summer School Programme](#)
- [OpenLab Student Programme](#)
- [Academic Training Lectures](#)

Graduate Level (Master or PhD)



Contacts – CERN

Co-operation Agreement

Charlotte Warakaulle (Charlotte.Lindberg.Warakaulle@cern.ch) and
Emmanuel Tsesmelis (Emmanuel.Tsesmelis@cern.ch)

Non-Member State Summer Student Programme

Emmanuel Tsesmelis (Emmanuel.Tsesmelis@cern.ch)

See also: <https://jobs.web.cern.ch/join-us/studentships-summer-non-member-state-nationals>
(Currently not open for applications, but will be open again for summer 2017 later this year)

High School Teachers

Sascha Schmeling (Sascha.Schmeling@cern.ch)

Contacts – ATLAS

Spokesperson

Dave Charlton (Dave.Charlton@cern.ch)

Outreach Coordinators

Kate Shaw and Claire Bourdarios-Adam (atlas-outreach-coordinators@cern.ch)