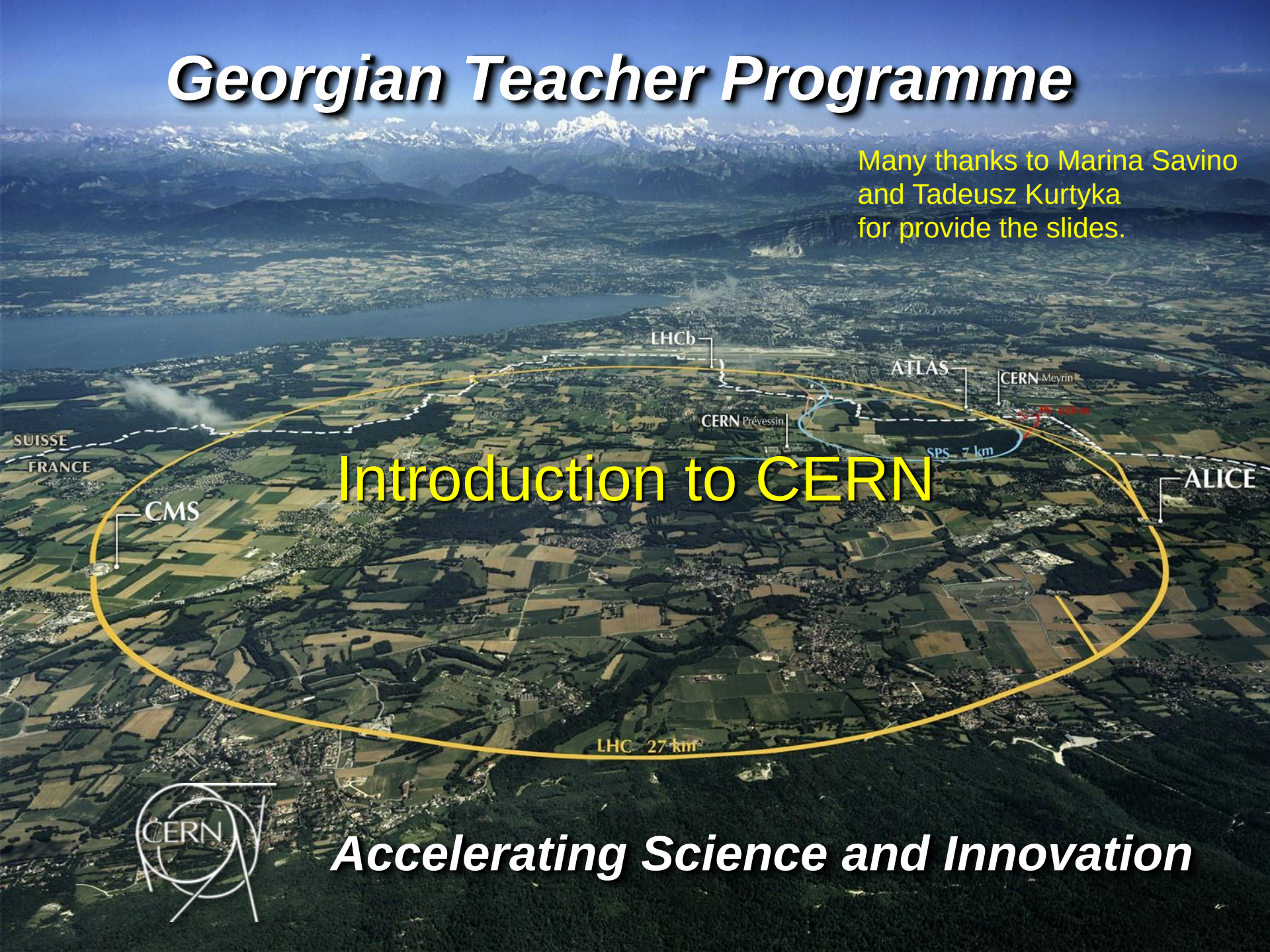
Georgian Teacher Programme

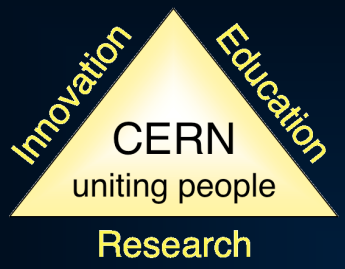
Many thanks to Marina Savino and Tadeusz Kurtyka for provide the slides.



Introduction to CERN

CERN

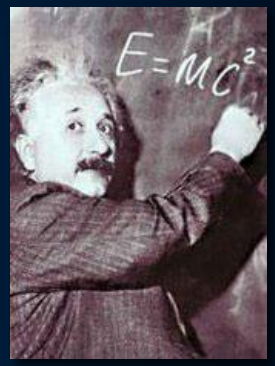
Accelerating Science and Innovation



The Mission of CERN

- **Push forward** the frontiers of knowledge

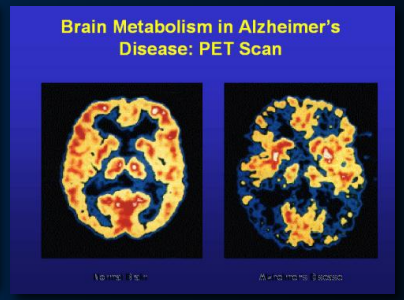
  E.g. the secrets of the Big Bang ... what was the matter like within the first moments of the Universe's existence?



- **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

CERN was founded 1954: 12 European States

"Science for Peace"

Today: 20 Member States

~ 2300 staff
~ 1050 other paid personnel
> 11000 users

Budget (2012) ~1000 MCHF

Member States: Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, the Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom

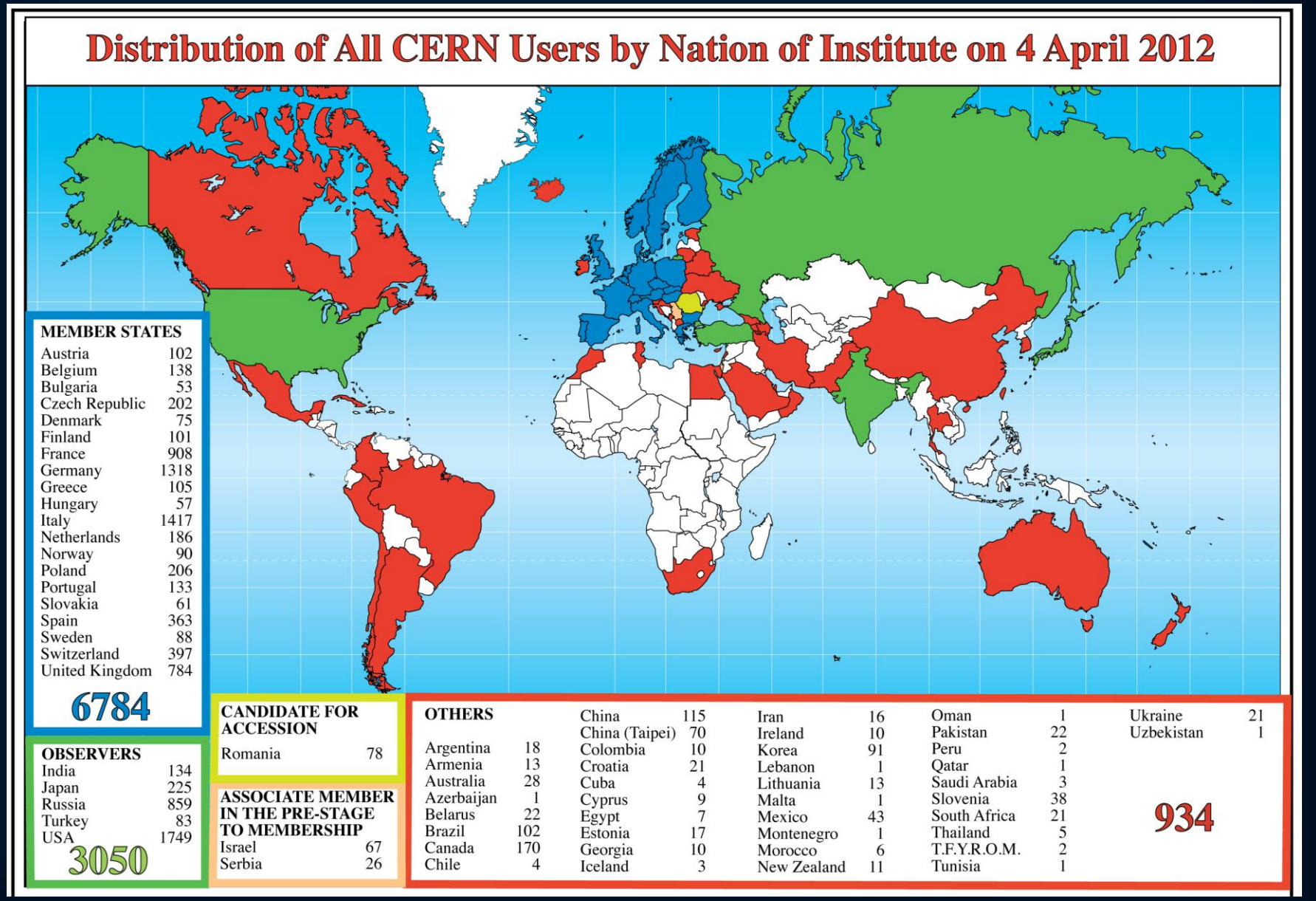
Candidate for Accession: Romania

Associate Members in the Pre-Stage to Membership: Israel, Serbia

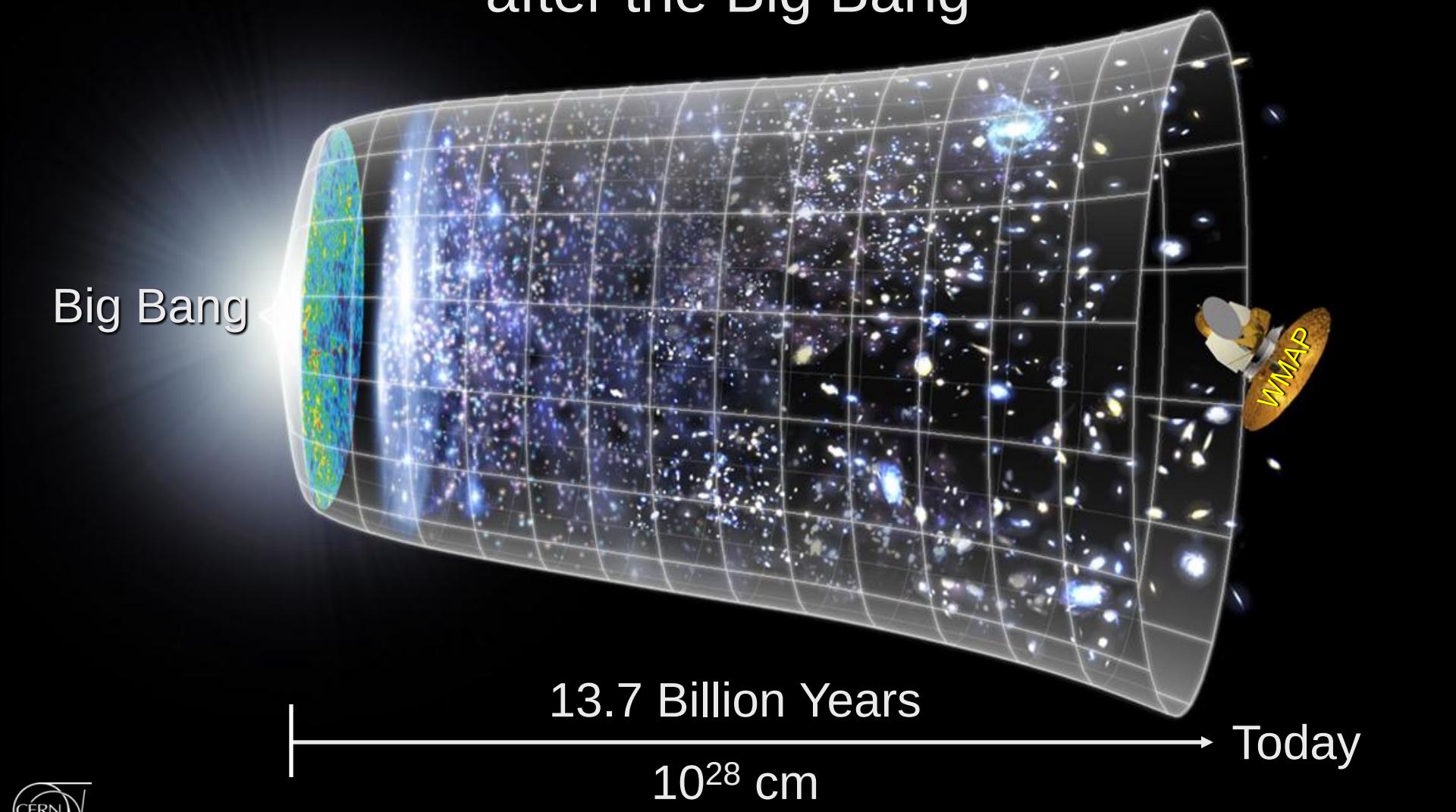
Applicant States: Cyprus, Slovenia, Turkey

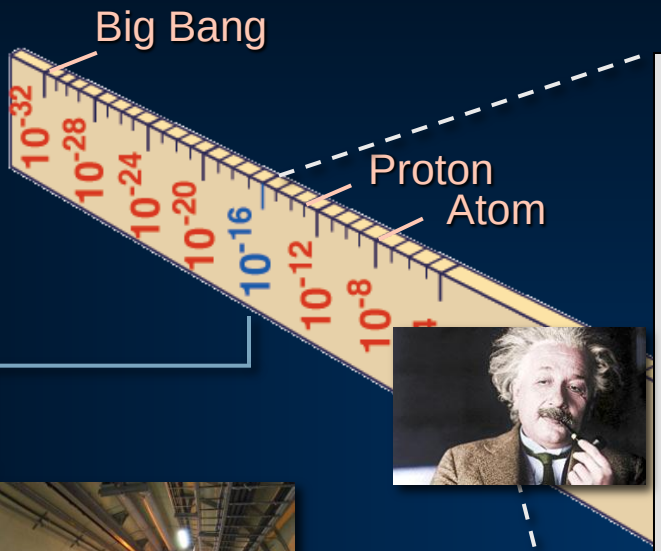
Observers to Council: India, Japan, the Russian Federation, the United States of America, Turkey, the European Commission and UNESCO

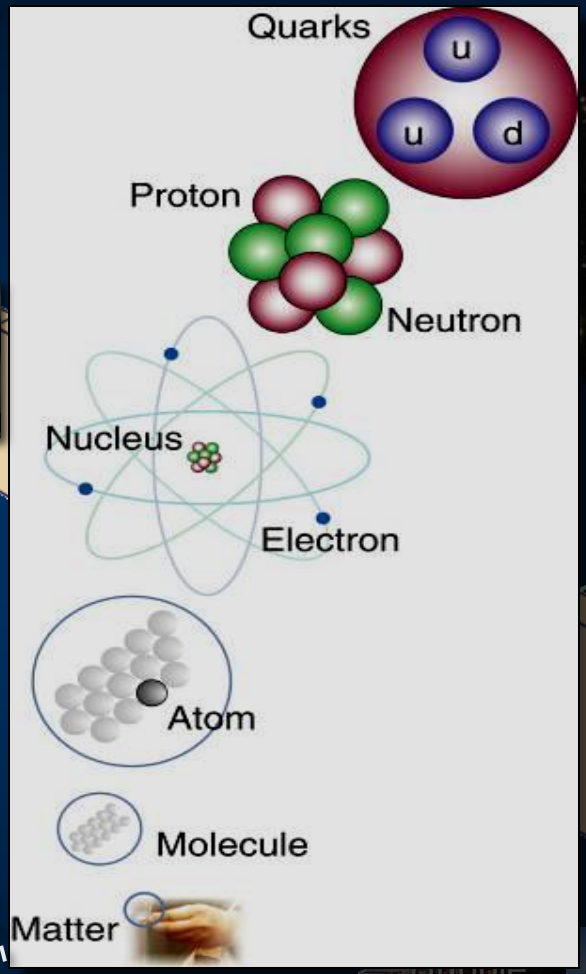
Science is getting more and more global



Next Scientific Challenge:
to understand the very first moments of our Universe after the Big Bang

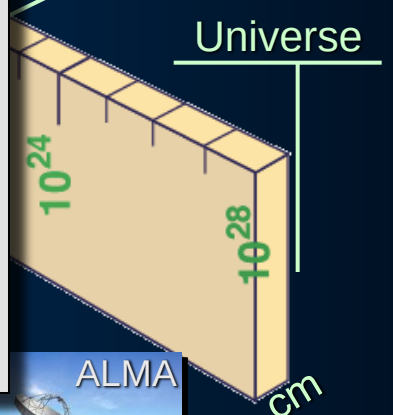


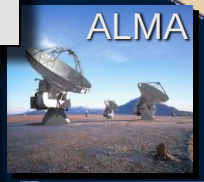


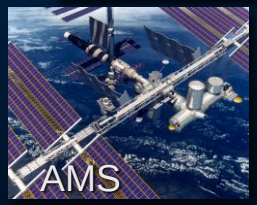


LHC

Super-Microscope

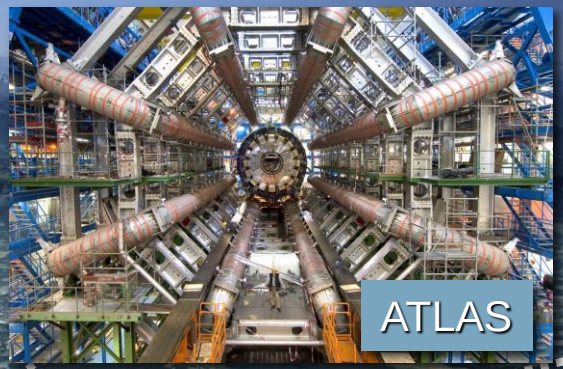


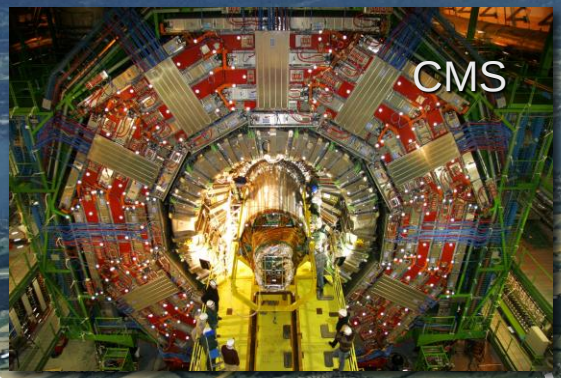




Study physics laws of first moments after Big Bang
increasing Symbiosis between Particle Physics,
Astrophysics and Cosmology

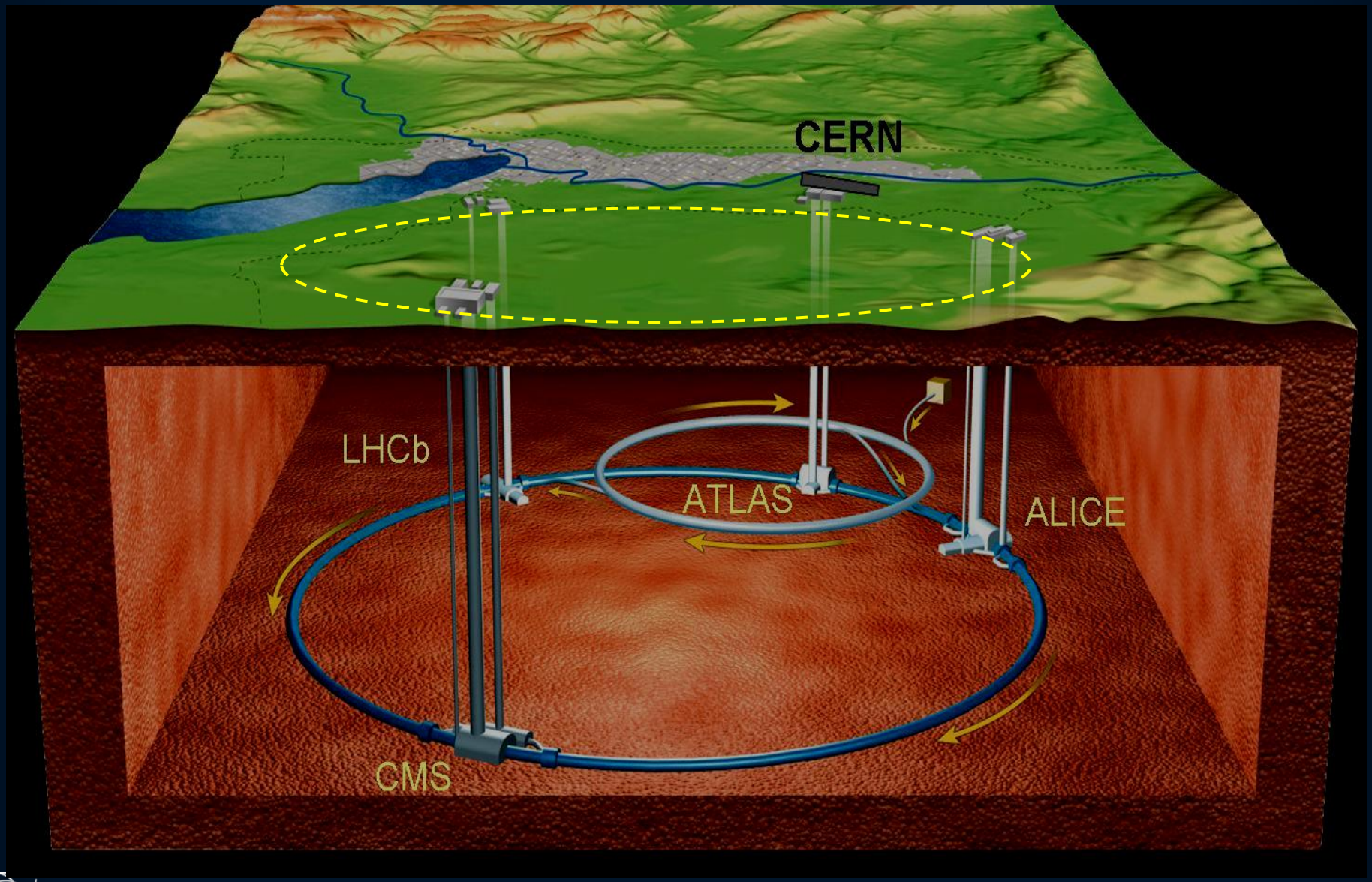
Enter a New Era in Fundamental Science





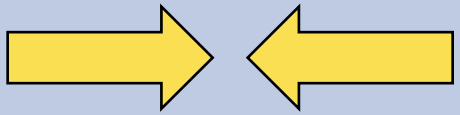
Since March 2010 exploration of a new energy frontier
in p-p and Pb-Pb collisions

LHC – Large Hadron Collider



LHC - Large Hadron Collider

4 TeV + 4 TeV



Tera=10**12

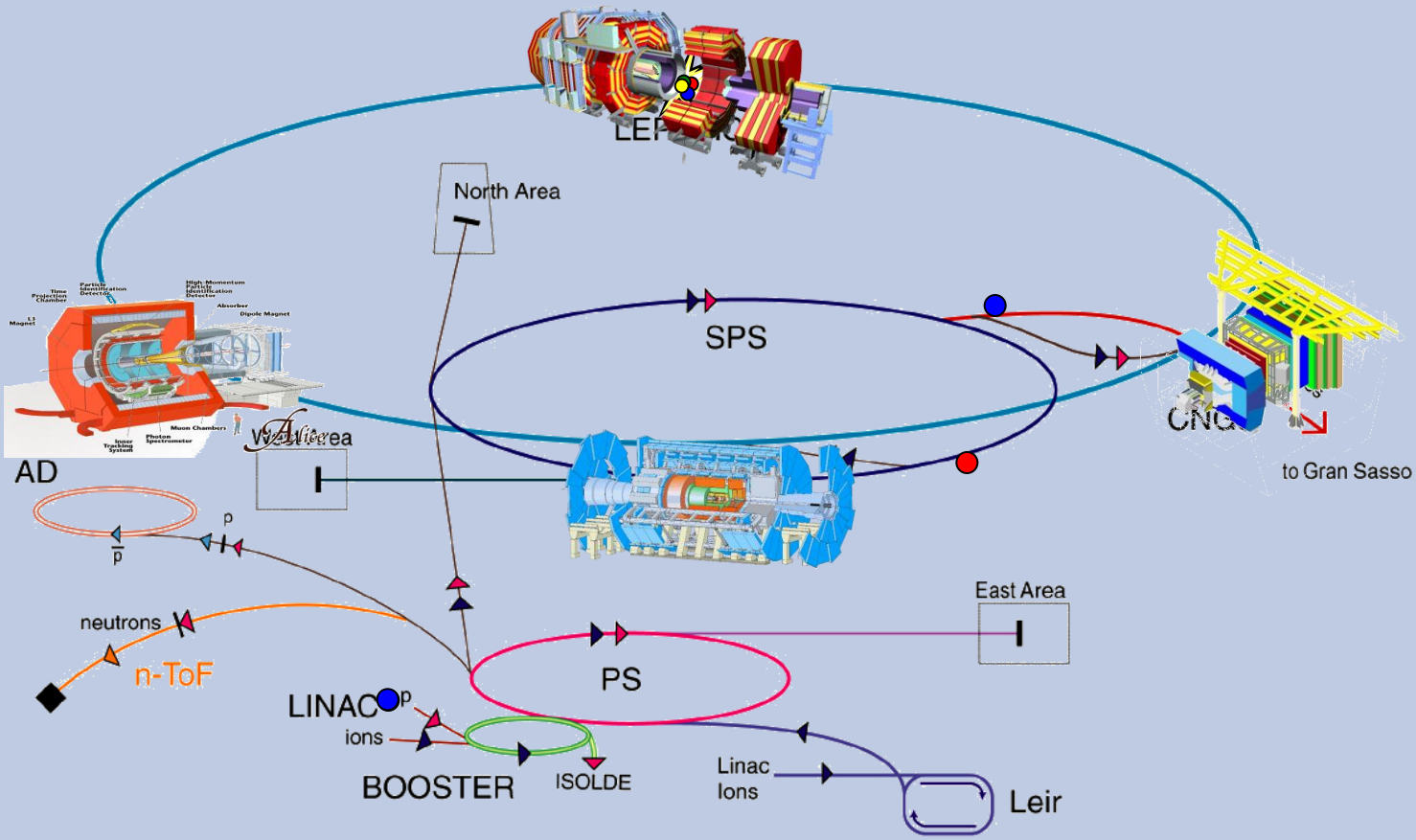
Luminosity = $10^{34}cm^{-2}sec^{-1}$

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

Large Hadron Collider

Collision of proton beams… …observed in giant detectors

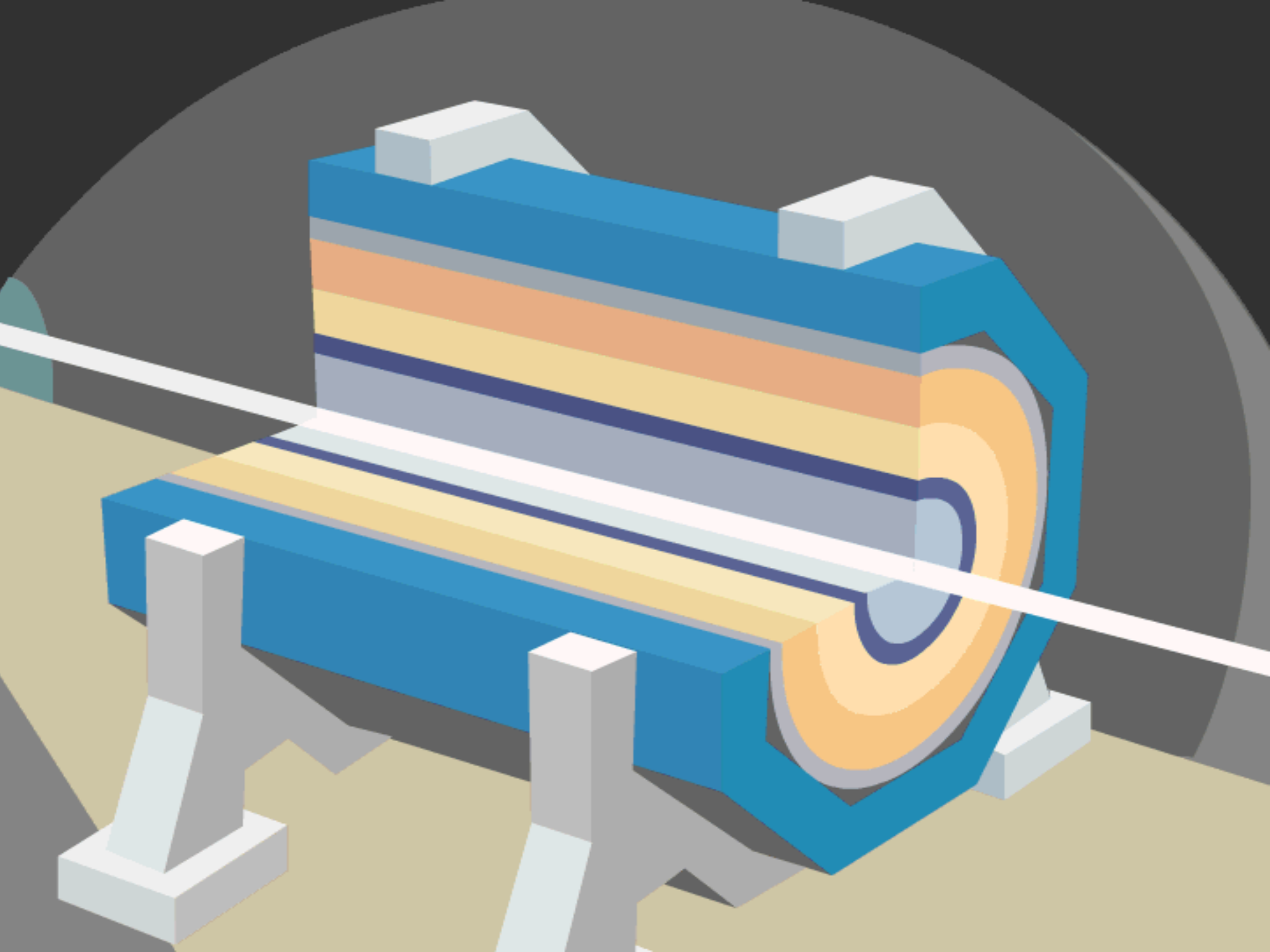


p (proton)
ion
neutron

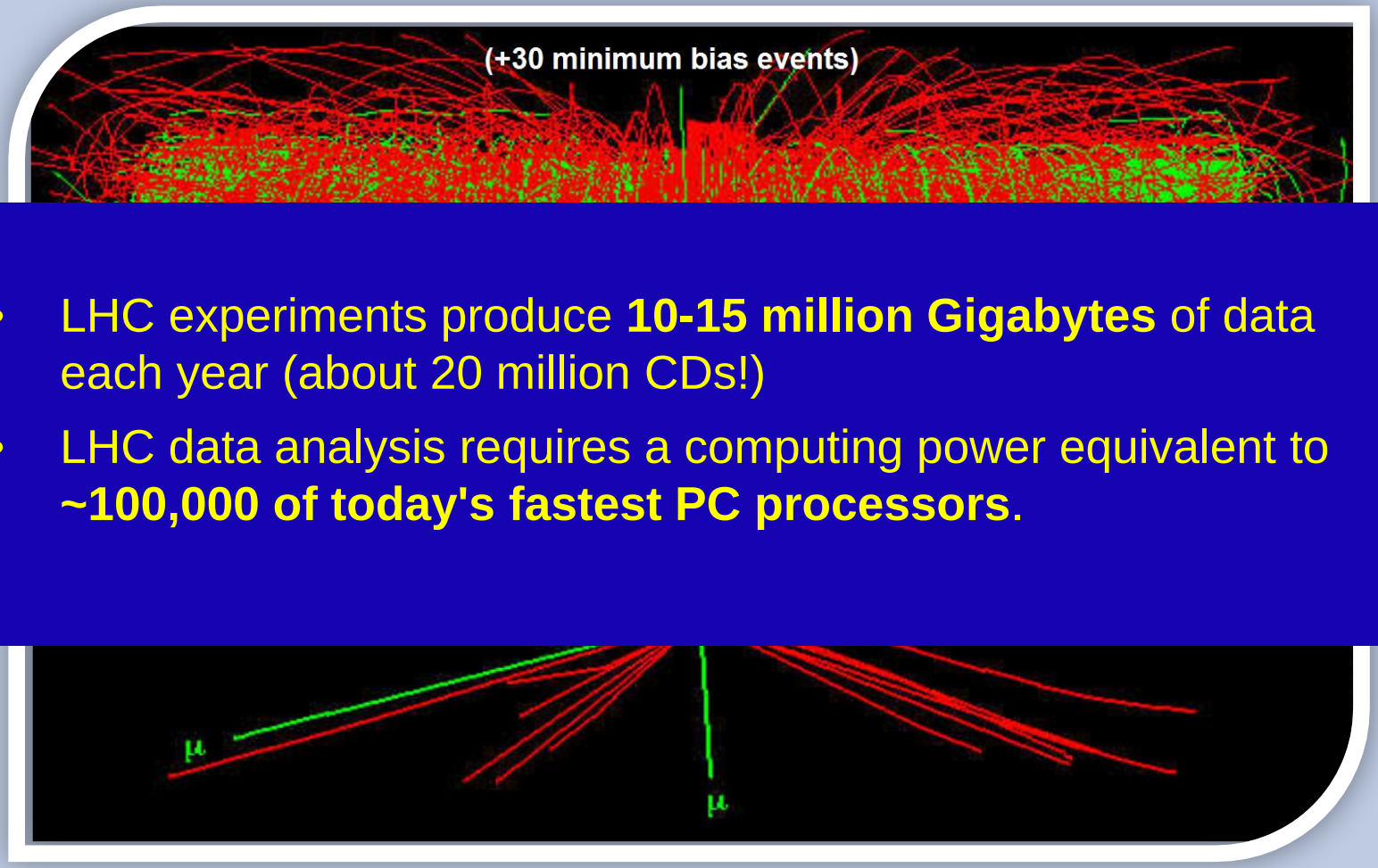
$\bar{p}$ (antiproton)
proton/antiproton conversion
neutrino

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

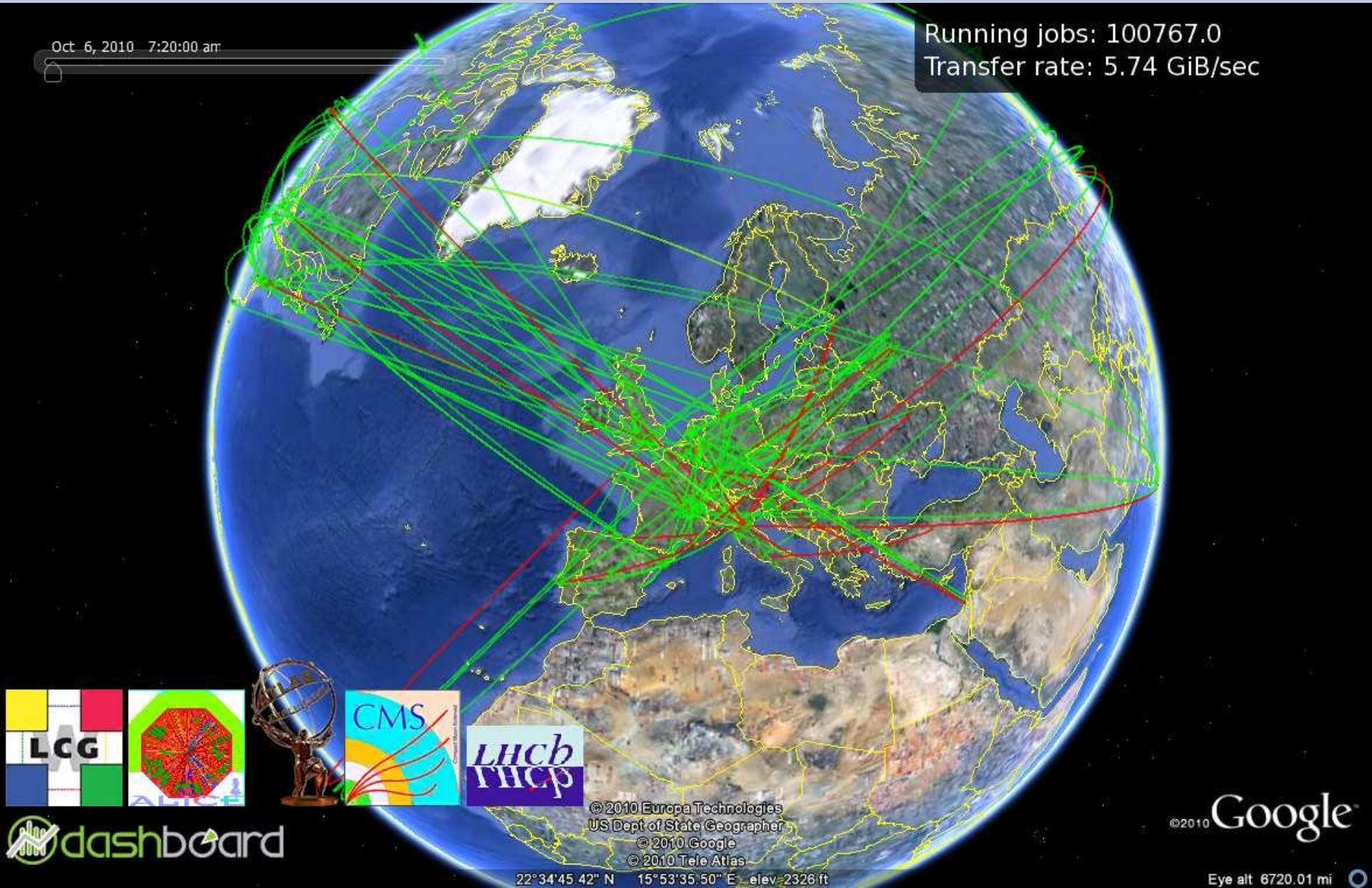


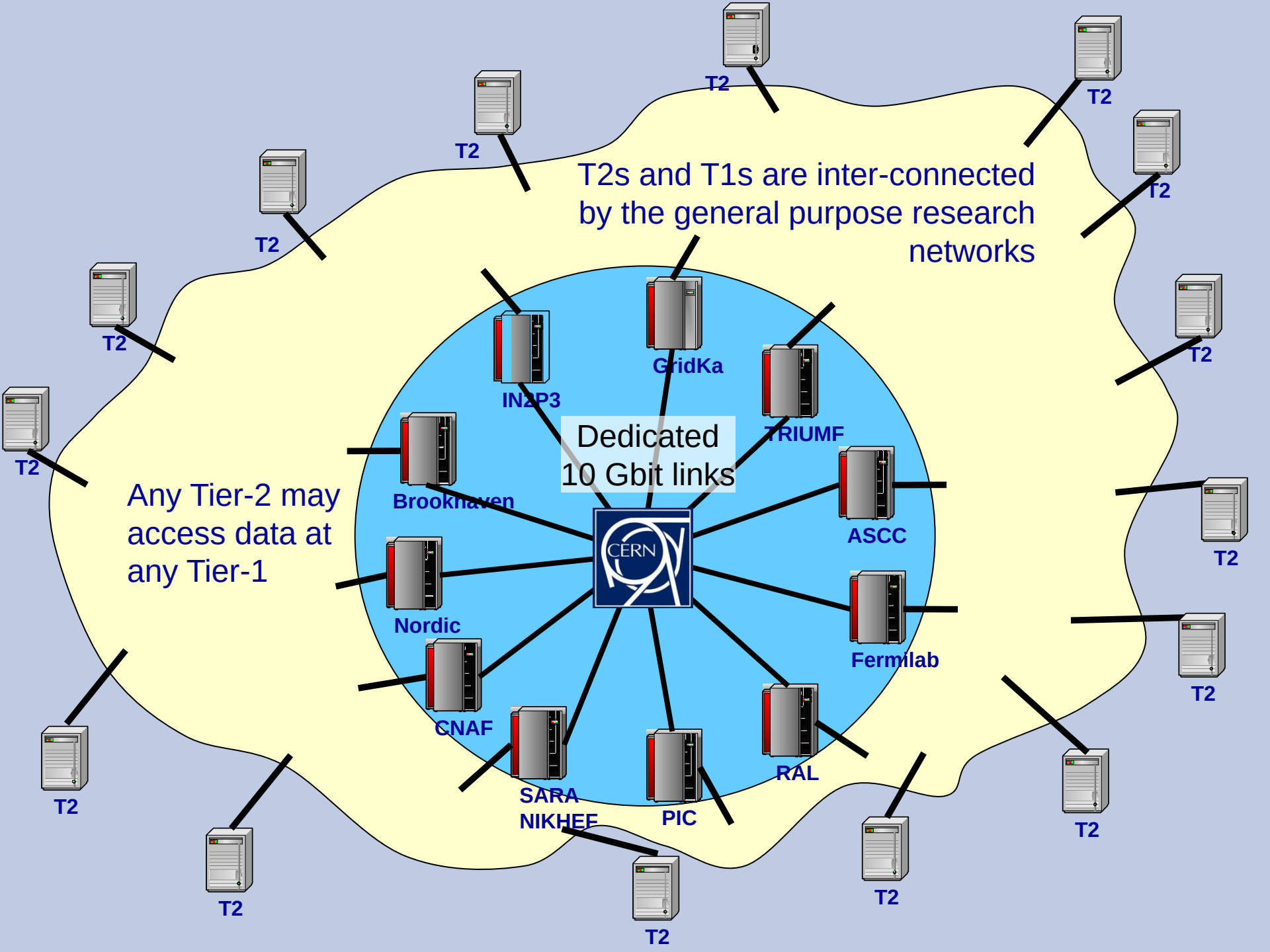
❑ Searching for new particles requires selection and analysis of enormous quantity of data from LHC detectors



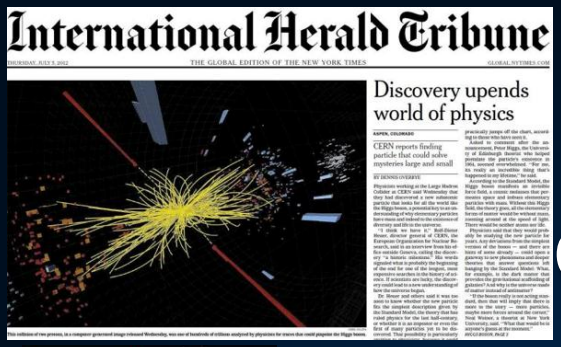
- LHC experiments produce **10-15 million Gigabytes** of data each year (about 20 million CDs!)
- LHC data analysis requires a computing power equivalent to **~100,000 of today's fastest PC processors**.

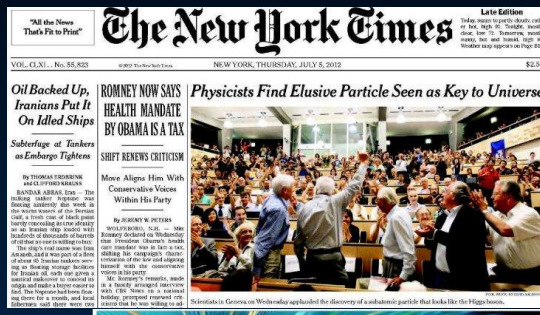
LCG-LHC Computing GRID




T2s and T1s are inter-connected by the general purpose research networks
Any Tier-2 may access data at any Tier-1
Dedicated 10 Gbit links
CERN
GridKa
IN2P3
TRIUMF
Brookhaven
ASCC
Nordic
Fermilab
CNAF
RAL
SARA
NIKHEF
PIC
T2

4 JULY 2012
CERN Press conference


International Herald Tribune
THE GLOBAL EDITION OF THE NEW YORK TIMES
Discovery upends world of physics
CERN reports finding particle that could solve mysteries large and small

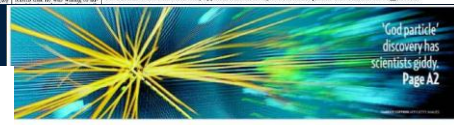

The New York Times
Late Edition
Oil Backed Up, Iranians Put It On Idled Ships
Subterfuge at Tankers as Embargo Tightens
ROMNEY NOW SAYS HEALTH MANDATE BY OBAMA IS A TAX
SHIFT RENEWS CRITICISM
Move Aligns Him With Conservative Voices Within His Party
Physicists Find Elusive Particle Seen as Key to Universe
Scientists in Geneva on Wednesday applauded the discovery of a subatomic particle that looks like the Higgs boson.


The Economist
In praise of charter schools
Britain's banking scandal spreads
Volkswagen overtakes the rest
A power struggle at the Vatican
When Lonesome George met Nora
A giant leap for science
Finding the Higgs boson


ヒッグス粒子 発見か
新素粒子検出 年内に結論
日米欧2チーム


EDIÇÃO LISBOA QUI 5 JUL 2012
Por dia, Deco recebe 87 casos por causa de sobreendividamento p14
HOJE: HERÓIS MARVEL
publico
Milhares de moradores de bairros sociais em risco de perderem RSI
A mudança está a passar despercebida, mas deve afectar milhares de beneficiários de RSI que vivem em habitação social agora, morar numa casa camarária é uma forma de rendimento Portugal, 12
Ministério de Portas contrata funcionário de CDS-PP
Lusófona diz que Relvas deu todos os dados para ter curso
CIÊNCIA
A "PARTÍCULA DE DEUS" EXISTE. MAS A HISTÓRIA NÃO ACABA AQUI
Destaque, 2/3


Spécial Festival d'Avignon
La 66e fête du théâtre démarre le 7 juillet
Le Monde
Le Monde des livres
Les coups de cœur de la rédaction
Science : la matière dévoilée
Le boson de Higgs, particule manquante pour expliquer l'Univers, vient d'être découvert
Les physiciens du CERN de Genève ont prouvé son existence à 99,9999 %
IMPÔTS CE QUI VA CHANGER
7,2 milliards de plus dès 2012
Réforme fiscale à l'automne
ALGÉRIE L'INDÉPENDANCE
Une fête sans panache
La souffrance, mais pas de haine
Ces livres qui explorent l'histoire


'God particle' discovery has scientists giddy. Page A2


The Gazette
MONTREAL | THURSDAY, JULY 5, 2012 | SINCE 1778 | BREAKINGNEWS.ATMONTREALGAZETTE.COM

EL PAIS
EL PERIÓDICO GLOBAL EN ESPAÑOL
A solas con la prueba del VIH
De Villota pierde el ojo derecho
Pistorius estará en los Juegos
Hallada la partícula clave para a comprensión del universo
La Audiencia Nacional imputa a toda la cúpula de Bankia


В ТЕАТРЫ БУДУТ ПУСКАТЬ ПО МОБИЛЬНЫМ ТЕЛЕФОНАМ
WWW.MK.RU
МК
№144 (25.980)
5 июля 2012
ПОСЛЕДНИЙ КИРПИЧ В СТЕНУ МИРОЗДАНИЯ
«КРЕМЛЕВСКИЕ» САМОЛЕТЫ ПРИШЛОСЬ МЕНЯТЬ НА ПЕРЕПРАВЕ
МЕТРО СПУСТЯТ НА ВОДУ


AD
ALGEMEEN DAGBLAD
donderdag 5 juli 2012
EINDELIJK GELIJK NA 48 JAAR
Zieke Kaj en zijn moeder toch samen in de VS
VAN PERSIE


Frankfurter Allgemeine
ZEITUNG FÜR DEUTSCHLAND
Fünf Tote bei Geiselnahme in Karlsruhe
Masse macht's
Große Mehrheit im


IMPORTANT MATTER
Scientists claim to have discovered 'God particle'
MOVIE PLOT
Iron Man film company looks to China for screen success
DANGEROUS MOVE
Freeing captured animals may lead to disasters
CHINA DAILY
THURSDAY, July 5, 2012
chinadaily.com.cn


THE TIMES OF INDIA
UNDER FIRE FROM OPPN, AKHILESH ROLLS BACK CAR BONANZA FOR MLAS
ADJUSTING DIESEL PRICE BETTER THAN TAXING CARS, SAYS MONTEK
BLADE RUNNER PISTORIUS SET FOR OLYMPIC HISTORY: TO RUN 400M & RELAY
Big bang moment: Scientists may have found 'God particle'
Adarsh scam: Finally, CBI charges sheets 13


THE HINDU
INDIA'S NATIONAL NEWSPAPER SINCE 1878
RARE CHOLA INSCRIPTIONS
MAY HAVE BEEN POISONED
SUBBARAO ON MFIS
RAHANE RETURNS
Elusive particle found, looks like Higgs boson
CERN physicists hail evidence of game-changing discovery of subatomic particle


CORRIERE DELLA SERA
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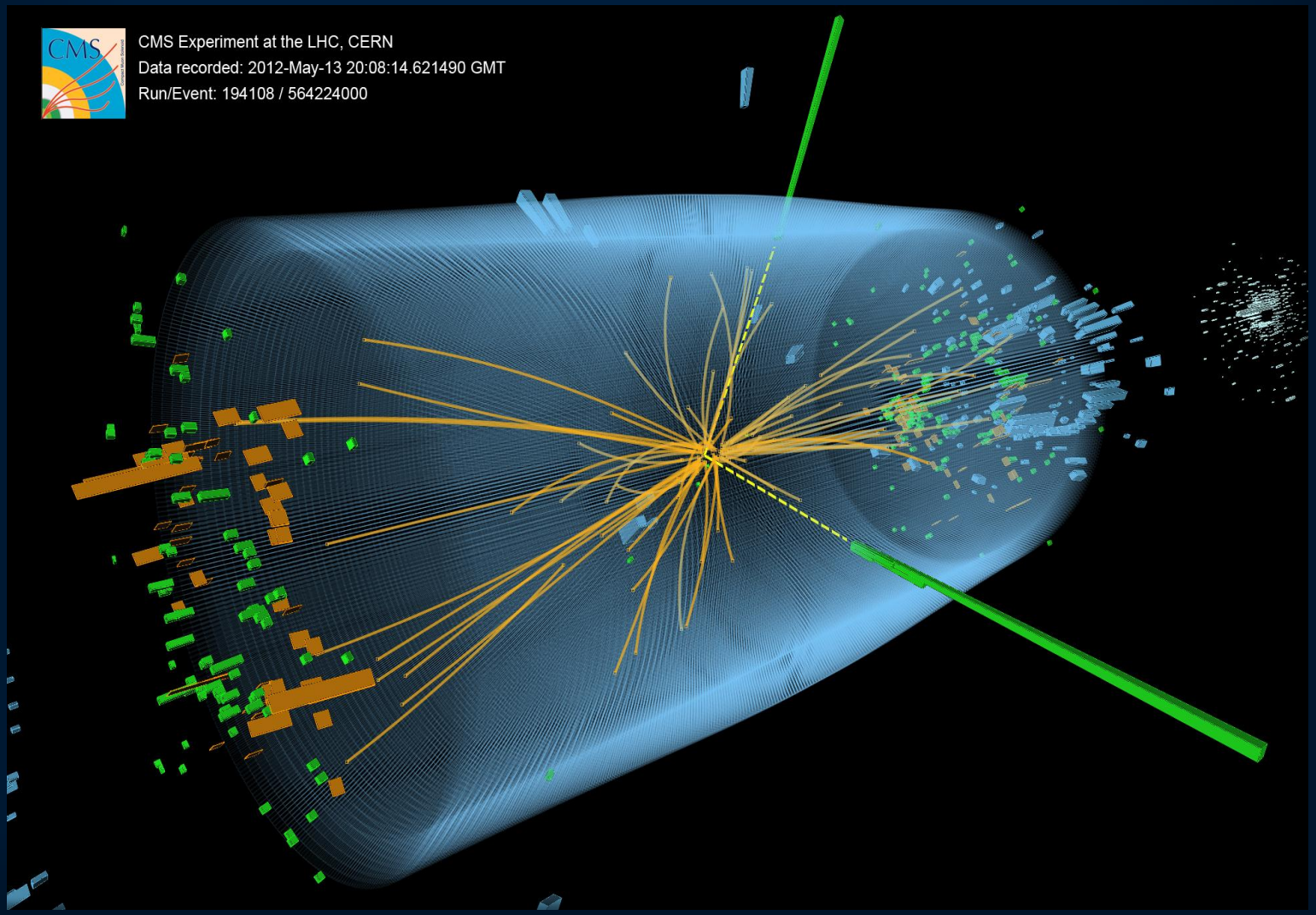
Geopolitica
Contaminazioni
Con il Corriere
Rinviato a oggi il voto sui nuovi consiglieri
Nomine Rai bloccate Scontro Fini-Schifani
Scienza
La particella che può svelare i segreti dell'universo
UN'AZIENDA IN OSTAGGIO


gazeta
WYBORCZA.PL
Ukraińcy biją się o język. Rosyjski
Cząstkę Higgsa fizycy najpierw wymyślili, potem szukali 40 lat
BOSKA MASA
Po tym odkryciu świat już nigdy nie będzie taki sam.


আনন্দবাজার পত্রিকা
বিজ্ঞানের 'ঈশ্বর' দর্শন
সত্যেন্দ্রনাথকে বিনম্র প্রণাম
'পেয়েছি, যা খুঁজছিলাম'

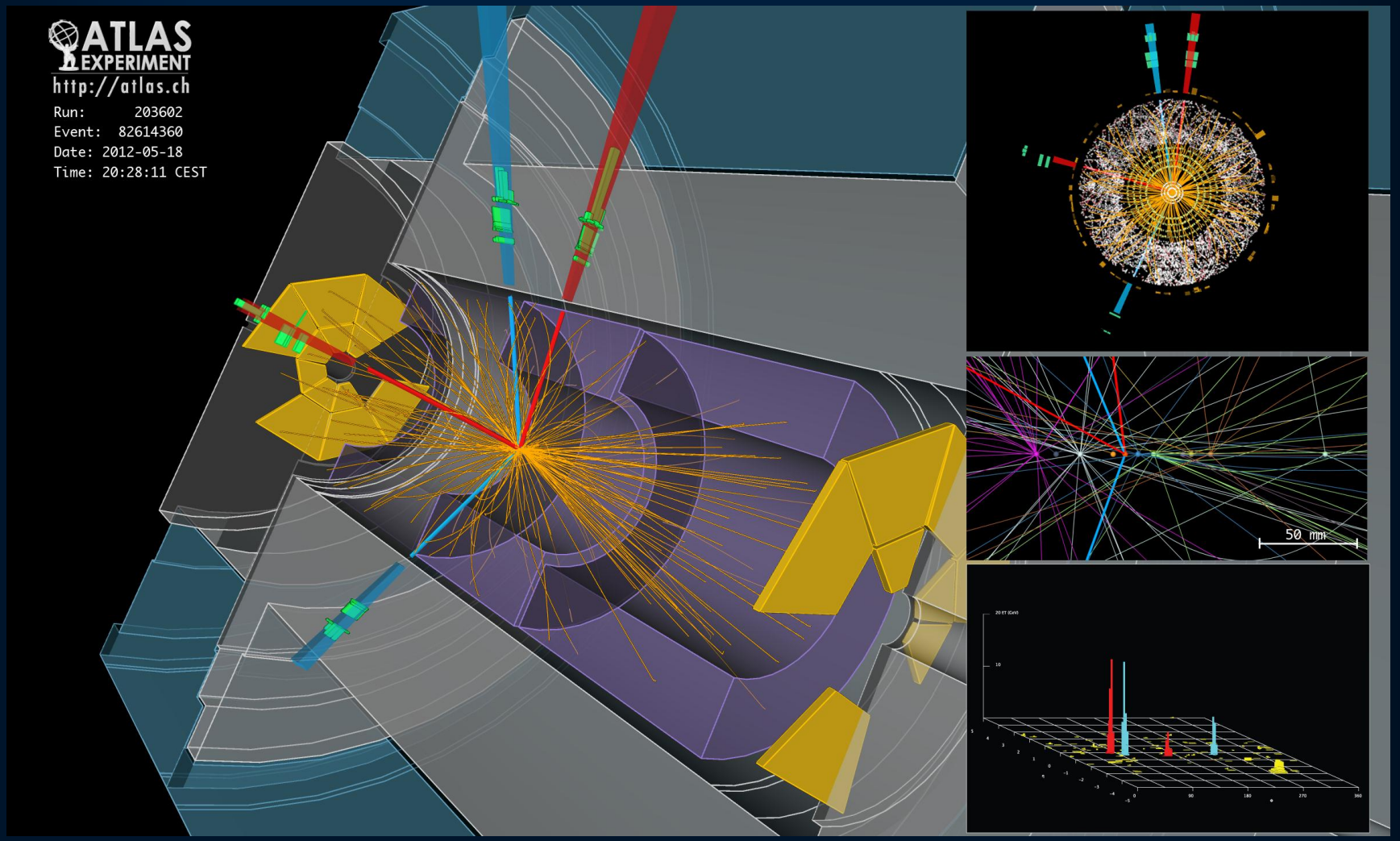
4 July 2012: CERN press conference

“CERN experiments observe particle consistent with long-sought Higgs boson”

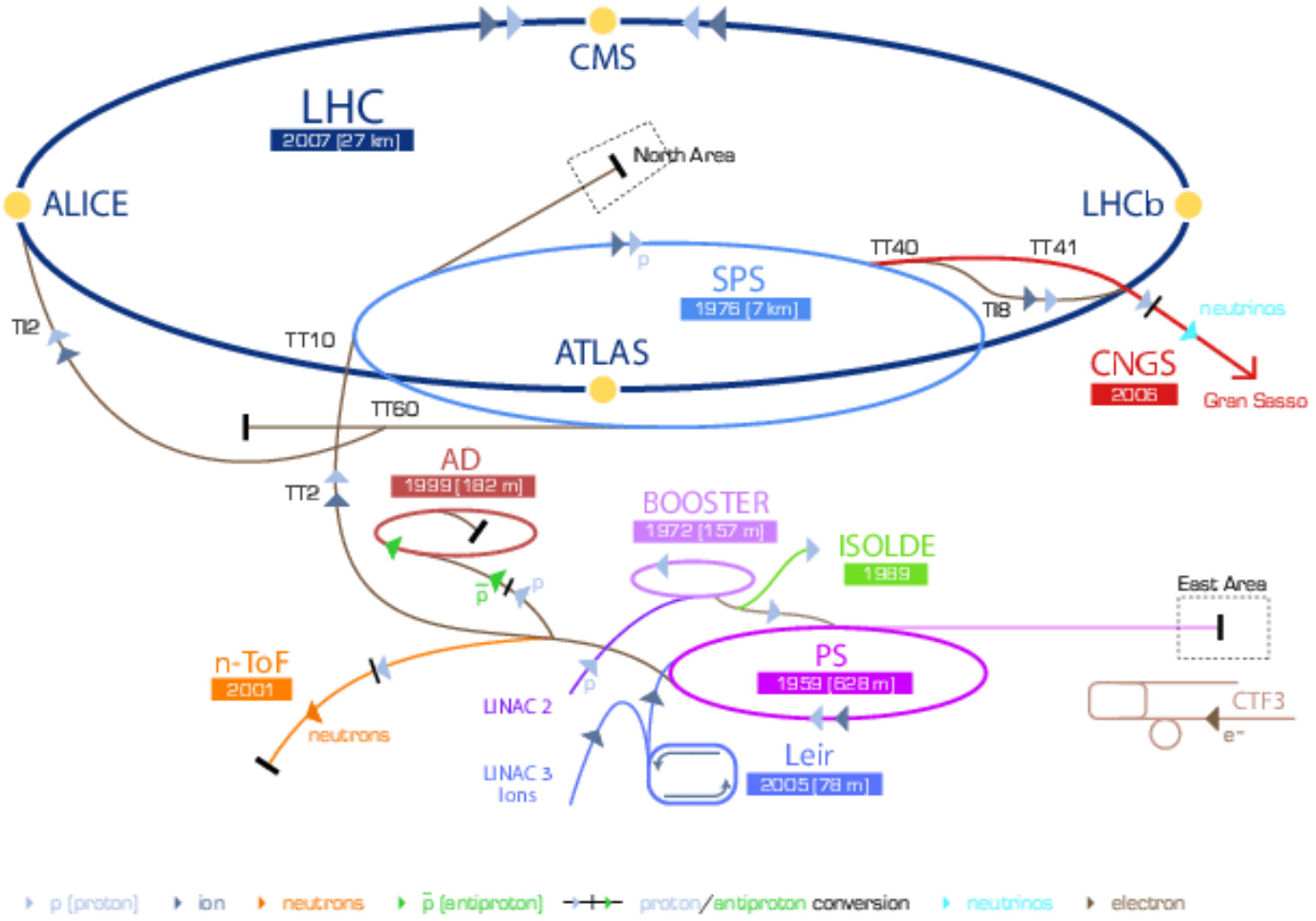


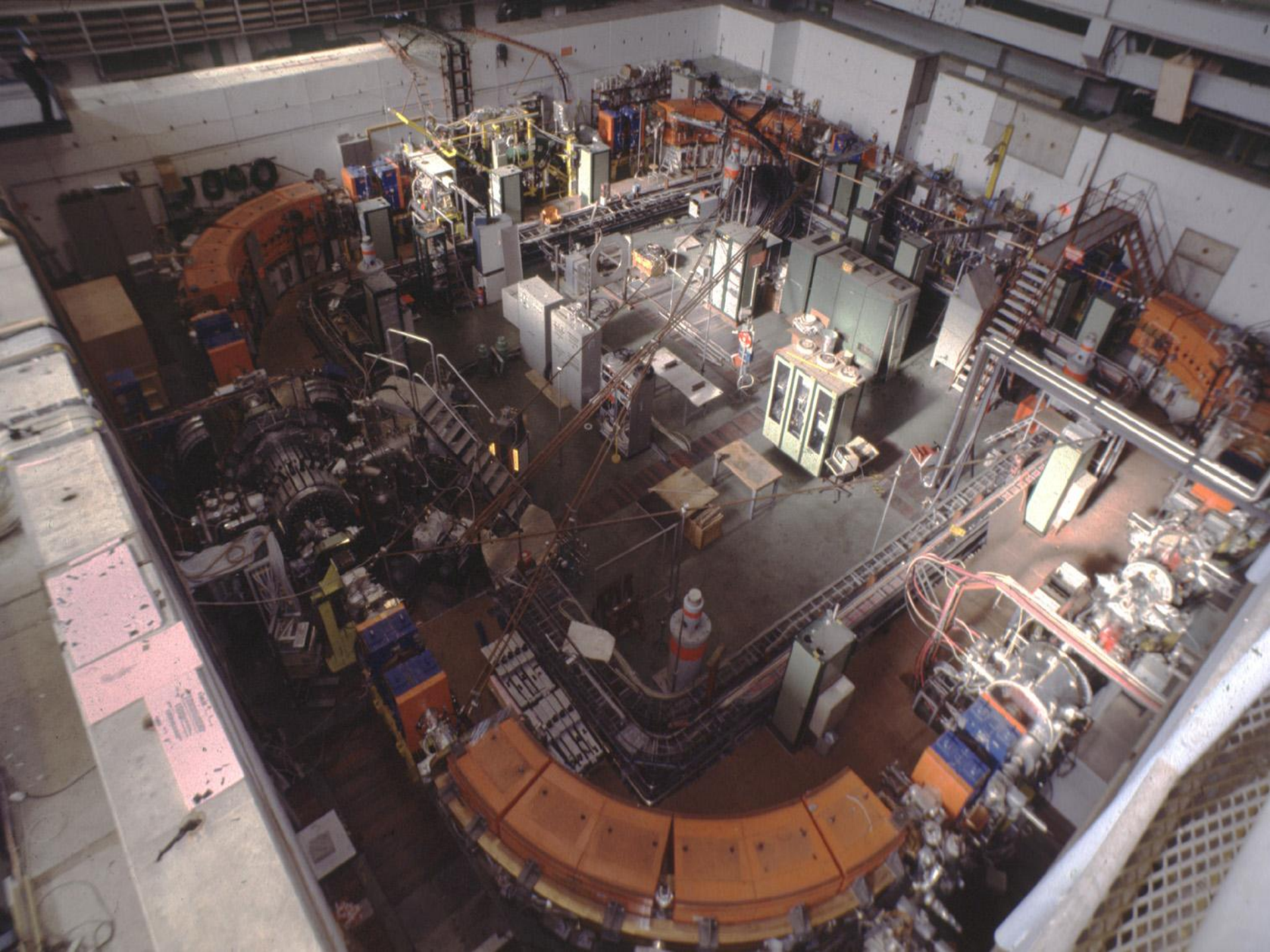
4 July 2012: CERN press conference

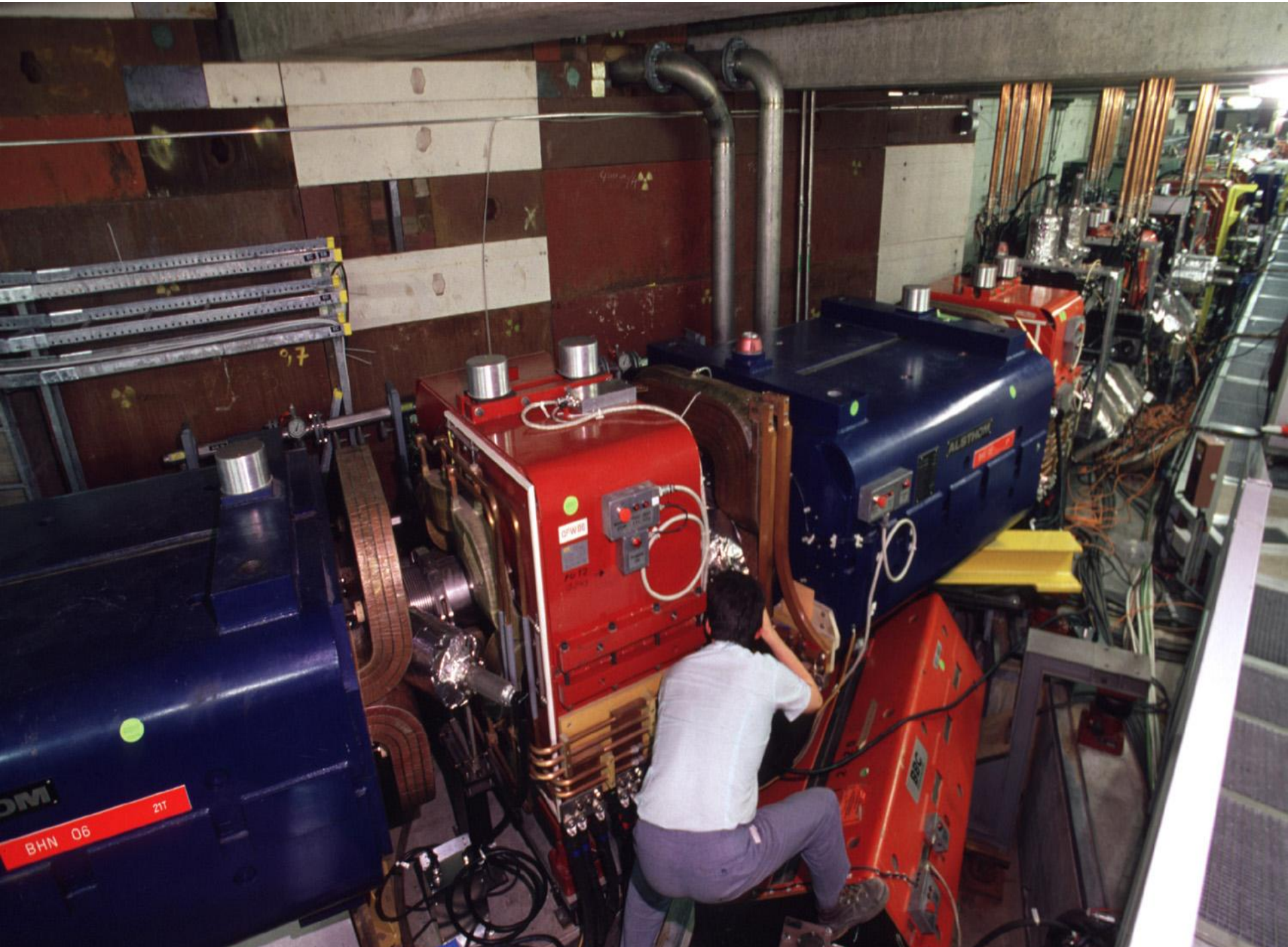
“CERN experiments observe particle consistent with long-sought Higgs boson”



CERN – world biggest accelerator complex





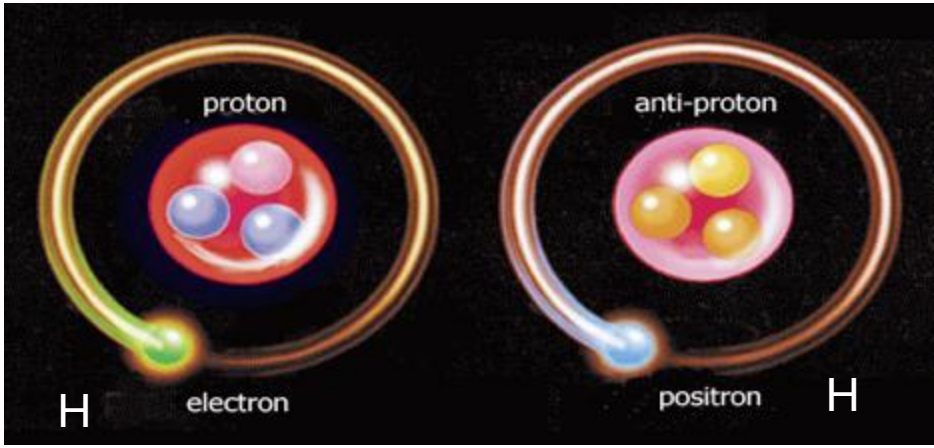

BHN 06
217
ALSTHOM

Antimatter Physics

Matter-Antimatter comparison

Very fundamental in our theory of physics

$m=\bar{m}$ $g=\bar{g}$



ASACUSA
ATRAP
ALPHA

Trapping $\bar{H}$ in a magnetic bottle

AEGIS

Look at $\bar{H}$ free fall

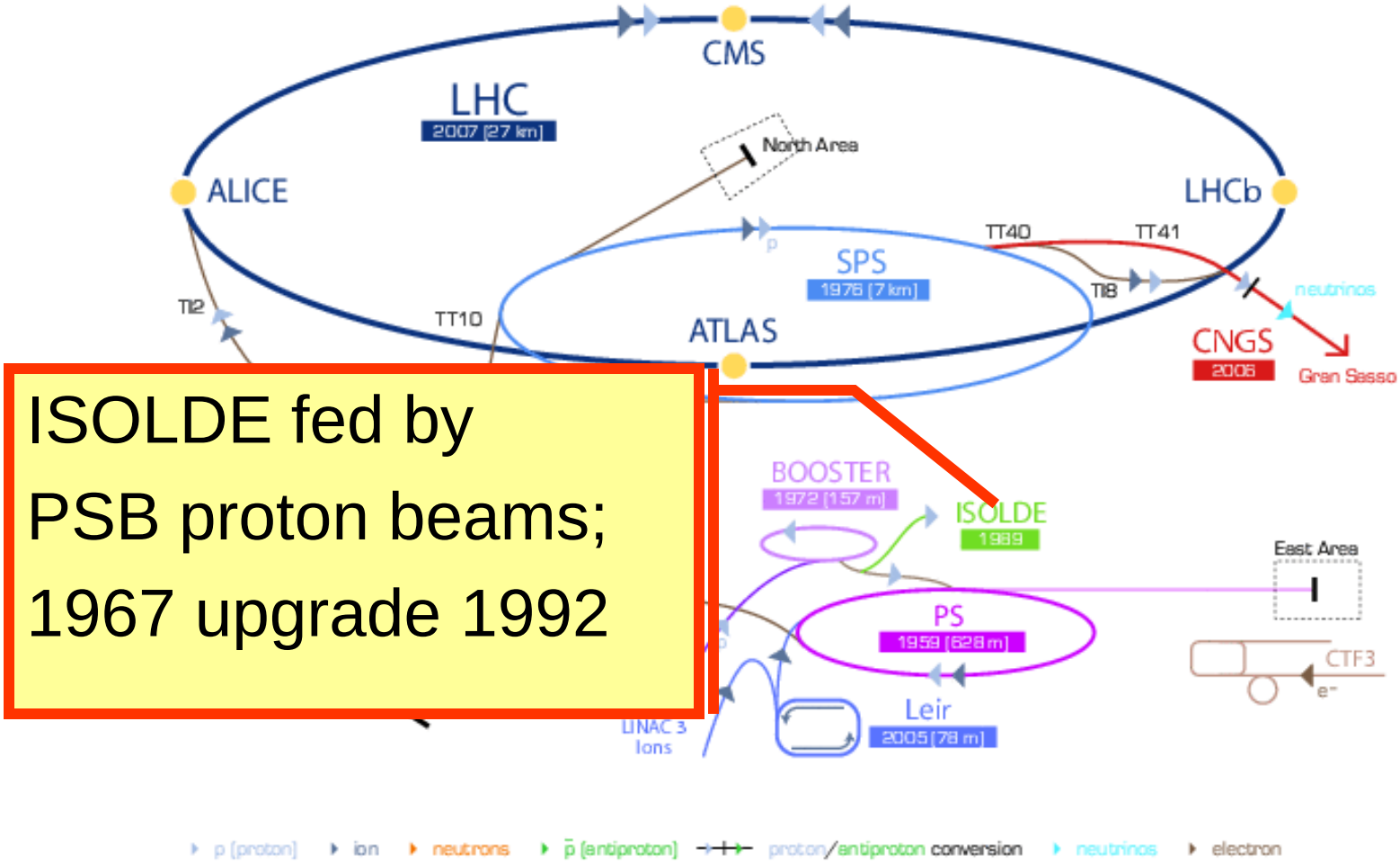
Galileo's experiment for antimatter !

ACE

Biological effect of $\bar{p}$

Possible use for cancer therapy

CERN accelerator complex,
working not only for LHC

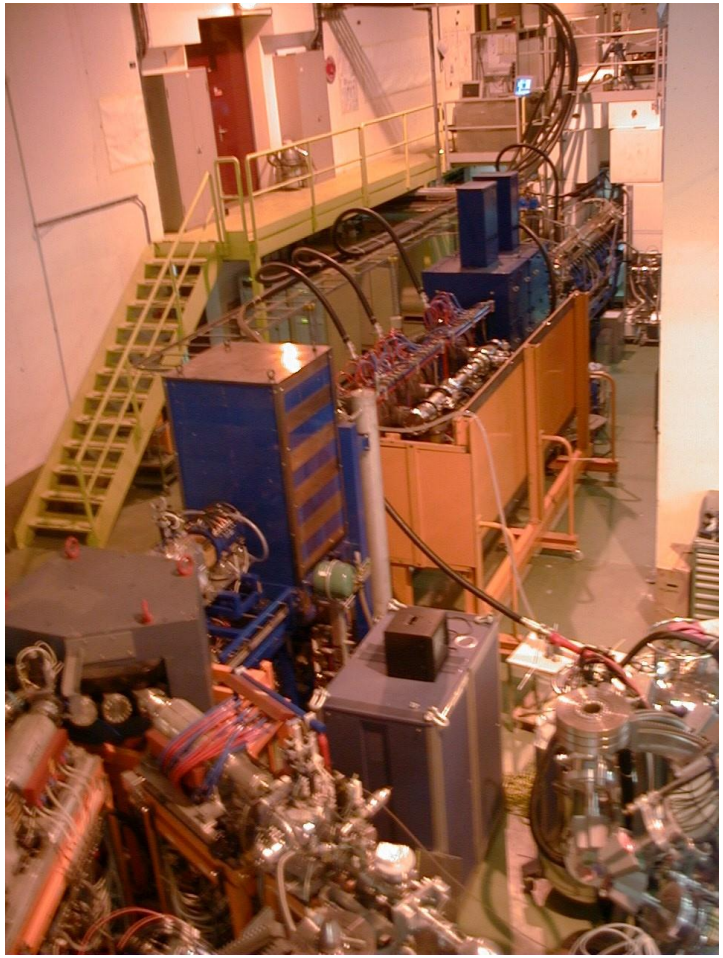


ISOLDE fed by
PSB proton beams;
1967 upgrade 1992

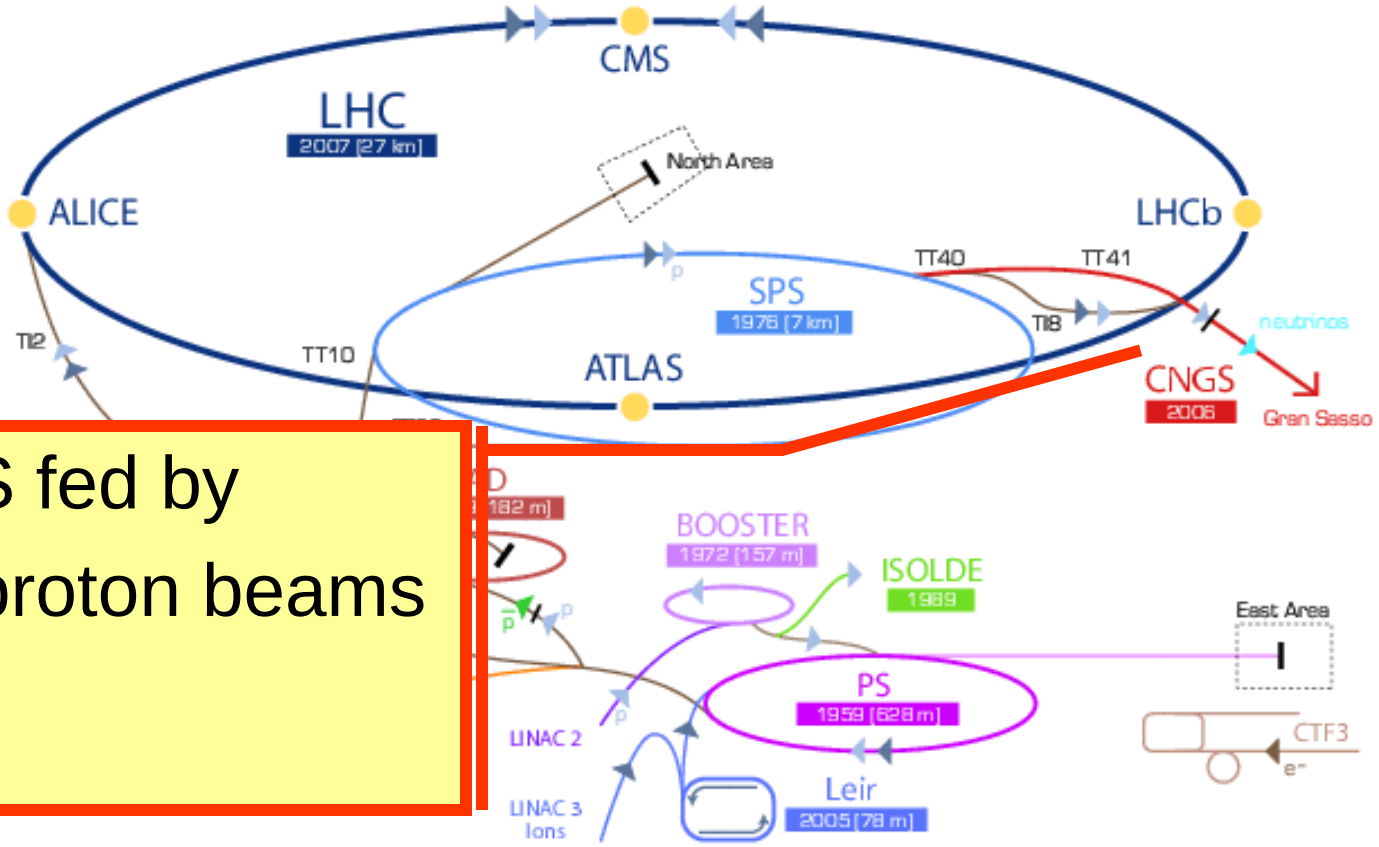
ISOLDE - Isotope Separator On Line, and Radioactive beam EXperiment (REX)

An alchemical factory for nuclear physics

Low-energy beams of radioactive isotopes - atomic nuclei. The facility, located at the Proton-Synchrotron Booster (PSB), is like a small alchemical factory, changing one element to another. It produces a total of more than 1000 different isotopes for a wide range of research.



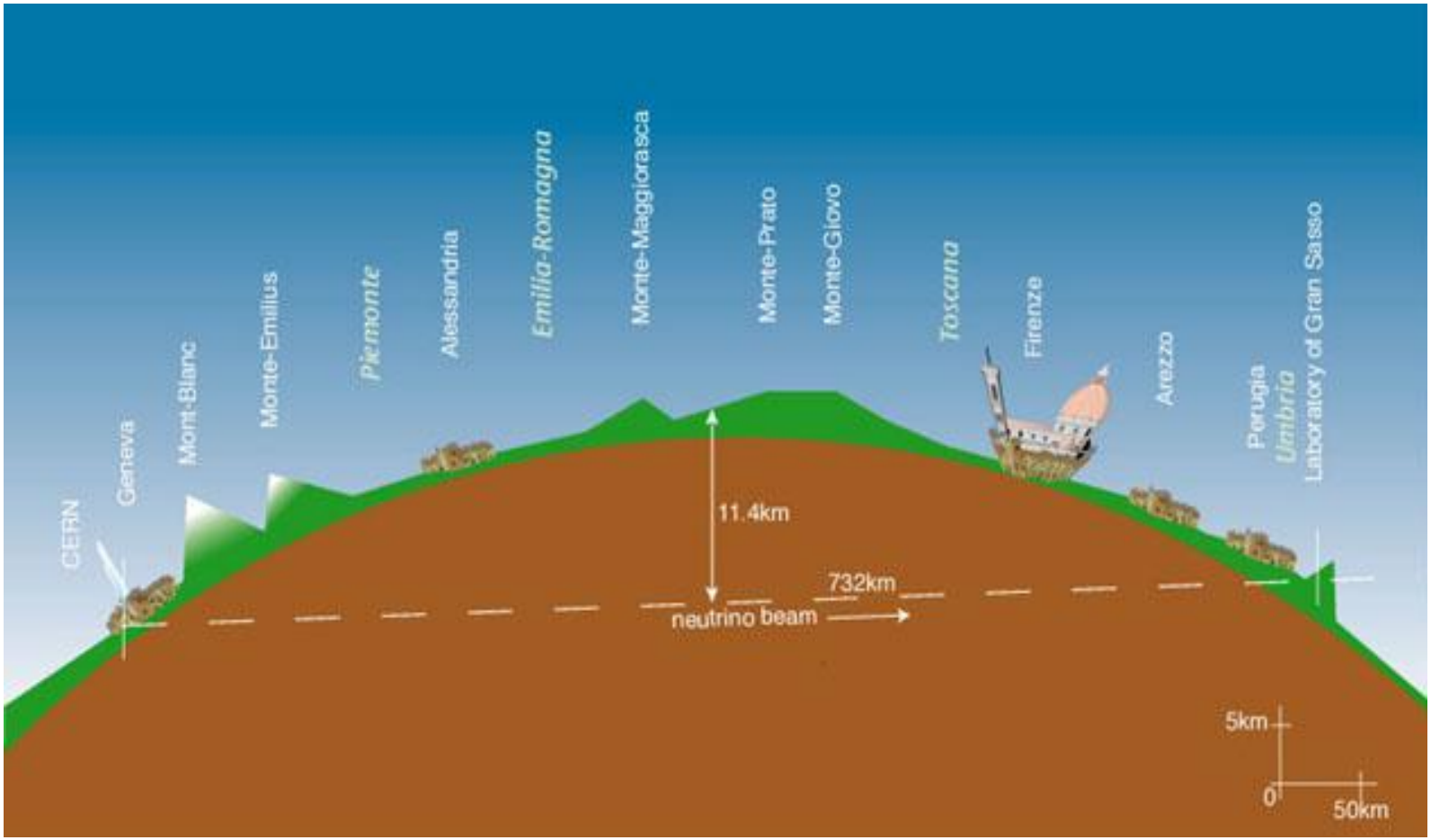
CERN accelerator complex,
working not only for LHC !



CNGS fed by
SPS proton beams

CNGS – CERN Neutrino to Gran Sasso experiment - investigation of the nature of neutrinos

CERN sends muon neutrinos to the Gran Sasso National Laboratory (LNGS), 732 km away in Italy. There, two experiments, OPERA and ICARUS, wait to find out if any of the muon neutrinos have transformed into tau neutrinos. To create the neutrino beam, a proton beam from the Super Proton Synchrotron (SPS) is used.



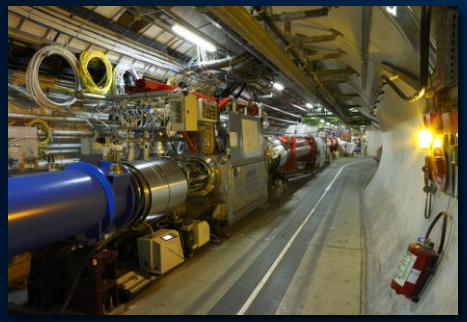
An experiment on climate

Study effect of cosmic rays on clouds formation
(cosmic rays “simulated “ by T11 beam, clouds created in a large climatic chamber

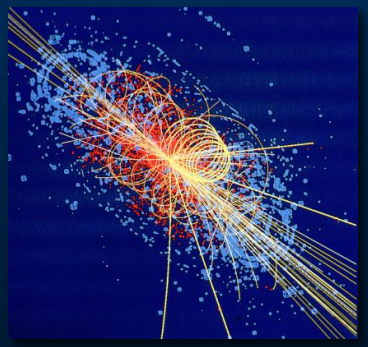
CERN: Particle Physics and Innovation

- Interfacing between fundamental science and key technological developments

- CERN Technologies and Innovation



Accelerating particle beams

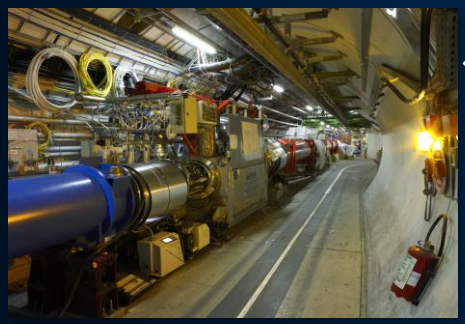


Detecting particles

Large-scale computing (Grid)

Medical Application as an Example of Particle Physics Spin-off

Combining Physics, ICT, Biology and Medicine to fight cancer

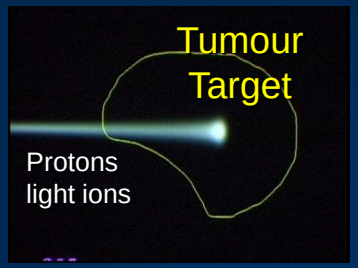


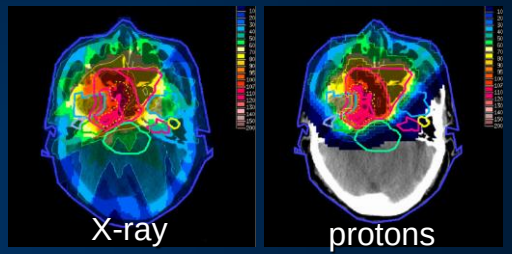
Accelerating particle beams

~30’000 accelerators worldwide

~17’000 used for medicine

Hadron Therapy

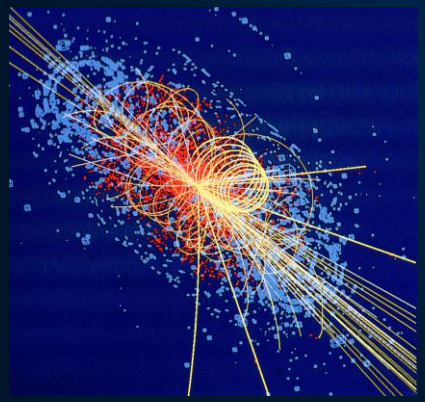




Leadership in Ion Beam Therapy now in Europe and Japan

>70’000 patients treated worldwide (30 facilities)

>21’000 patients treated in Europe (9 facilities)

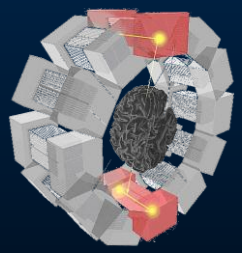


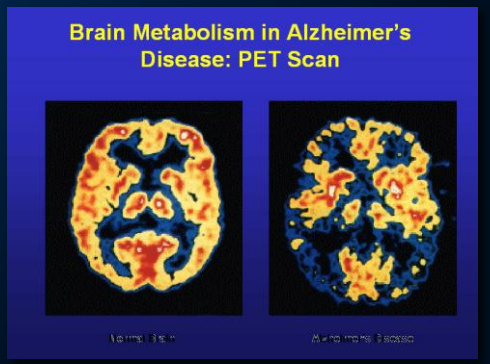
Detecting particles

Imaging

Clinical trial in Portugal for new breast imaging system (ClearPEM)

PET Scanner

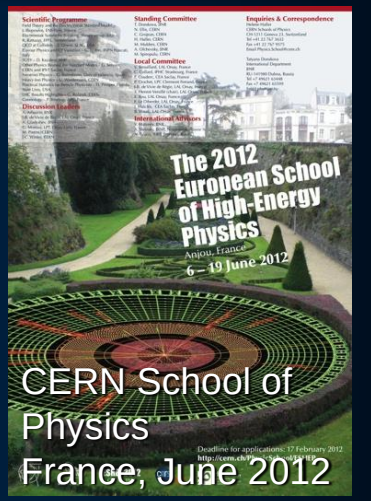




CERN Education Activities

Scientists at CERN
Academic Training Programme

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



Physics Students
Summer Students
Programme

CERN Teacher Schools
International and National
Programmes

CERN Teacher Programme

CERN Teacher Programme Participants 1998 - 2011

MEMBER STATES

Austria	58
Belgium	25
Bulgaria	199
Czech Republic	128
Denmark	72
Finland	401
France	162
Germany	418
Greece	298
Hungary	265
Italy	152
Netherlands	61
Norway	80
Poland	514
Portugal	255
Slovakia	190
Spain	236
Sweden	100
Switzerland	52
United Kingdom	866

4532

CANDIDATE FOR ACCESSION

Romania	10

ASSOCIATE MEMBER IN THE PRE-STAGE TO MEMBERSHIP

Israel	2
Serbia	10

OBSERVER STATES

India	2
Japan	3
Russia	132
Turkey	3
USA	56

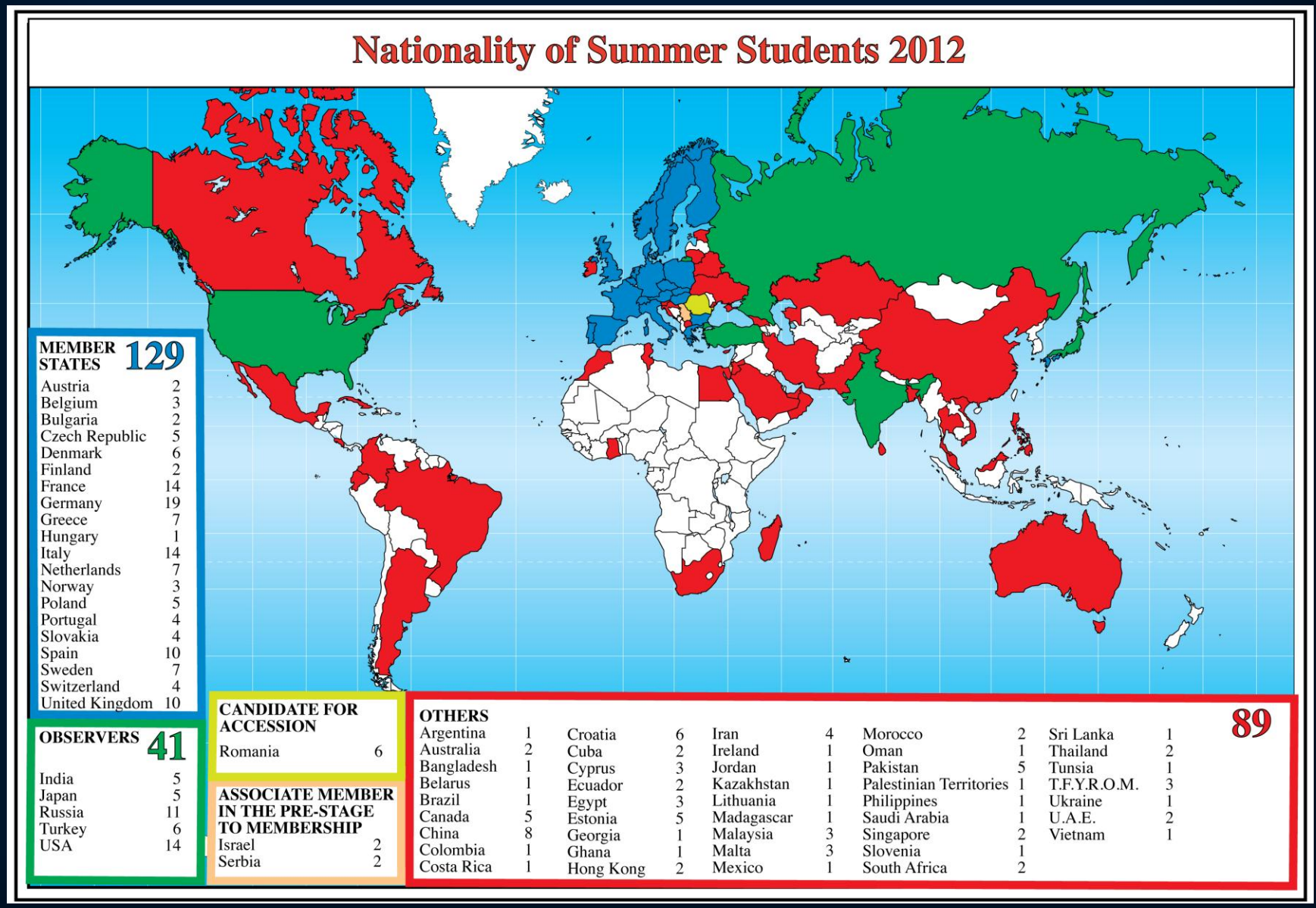
196

OTHERS

Angola	4	China	1	Kenya	2	Qatar	1	Thailand	4
Australia	3	Croatia	1	Latvia	1	Rwanda	15	T.F.Y.R.O.M.	11
Azerbaijan	1	Cyprus	4	Lebanon	1	Sao Tome	2	Timor-Leste	1
Brazil	53	Ecuador	1	Madagascar	1	Saudi Arabia	1	Ukraine	30
Cameroon	1	Estonia	18	Malta	36	Singapore	2	U.A.E.	1
Canada	1	Georgia	16	Mexico	5	Slovenia	21		
Cape Verde	2	Ghana	4	Mongolia	1	South Africa	6		
Chile	3	Guinea Bissau	1	Montenegro	13	South Korea	22		
		Ireland	3	Morocco	2	Swaziland	1		
		Kazakhstan	3	Mozambique	13				

343

Summer Students 2012



Summer Students 2012

დიდი მაღლობა ყურადღებისათვის

Accelerating Science and Innovation