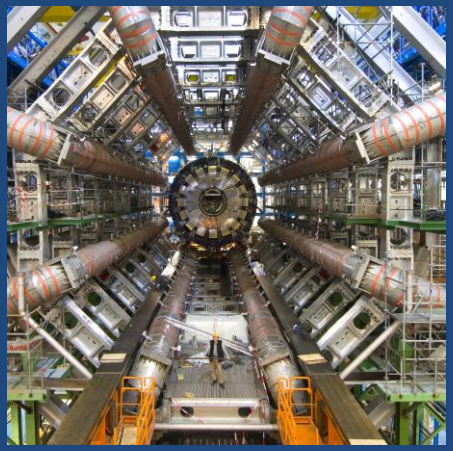
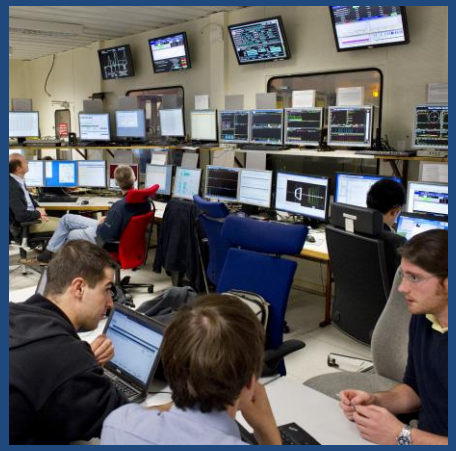



# საქართველოს ფიზიკის მასწავლებლების 2014 წლის პროგრამა
# პირველი გაცნობა ცერნ-თან

ირაკლი მინაშვილი

1945წ დამთავრდა მეორე მსოფლიო ომი, მეორე დიდი ომი ევროპაში ბოლო 30 წლის განმავლობაში

მეცნიერთა უმრავლესობამ დატოვა ევროპა, უმეტესად გადავიდნენ ამერიკისა და საბჭოეთში.

# ვინ ვართ ჩვენ?

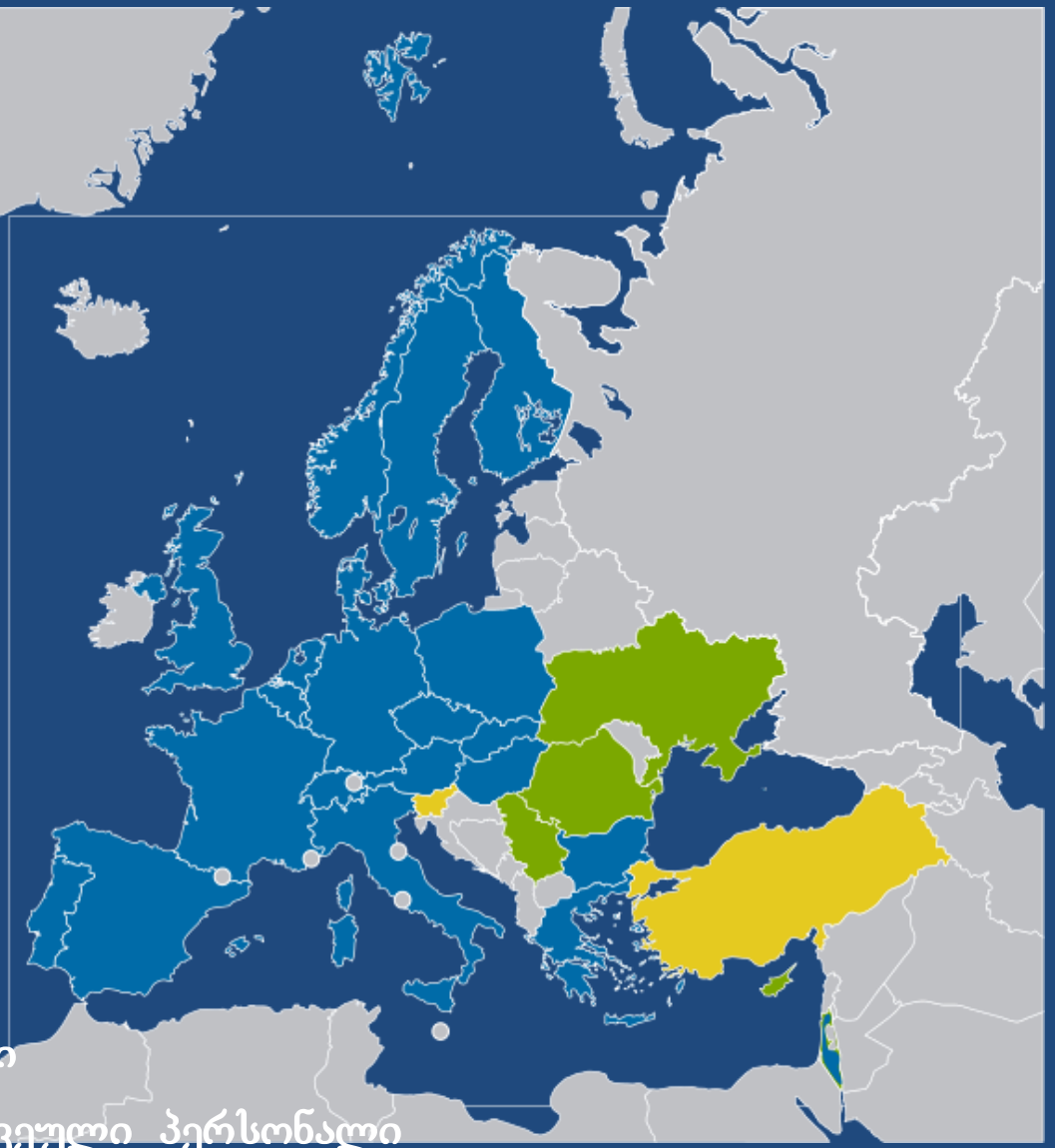
- **CERN: Conseil Européen pour la Recherche Nucléaire**
- ცერნი – ბირთვული კვლევების ევროპული ორგანიზაცია
- საერთაშორისო ორგანიზაციის სტატუსით (როგორიცაა იუნესკო, გაერო, მსო, ..)
- ჩამოყალიბებდა 1954წ 12 ევროპულ ქვეყნებს შორის შეთანხმების საფუძველზე. 60 წლის იუბილარია დღეს!!!
- ამჟამად 21 ქვეყანაა გაწევრიანებული ცერნ-ში

# COLLABORATION
# EDUCATION
# FUNDAMENTAL RESEARCH
# NEW TECHNOLOGIES

# CERN member states

| | |
|---|---|
| Austria | 2,2% |
| Belgium | 2,9% |
| Bulgaria | 0.3% |
| Czech Rep | 1.0% |
| Denmark | 1.8% |
| Finland | 1.4% |
| France | 15.5% |
| Germany | 20.3% |
| Greece | 1.6% |
| Hungary | 0.6% |
| Israel | 0.3% |

| | |
|---|---|
| Italy | 11,2% |
| Netherland | 4,7% |
| Norway | 2.5% |
| Poland | 2.9% |
| Portugal | 1.3% |
| Slovak Rep | 0.5% |
| Spain | 8.1% |
| Sweden | 2.8% |
| Switzerland | 5.2% |
| United Kingdom | 13.6% |



**2300** პერსონალი

**1050** სხვა მოწვეული პერსონალი

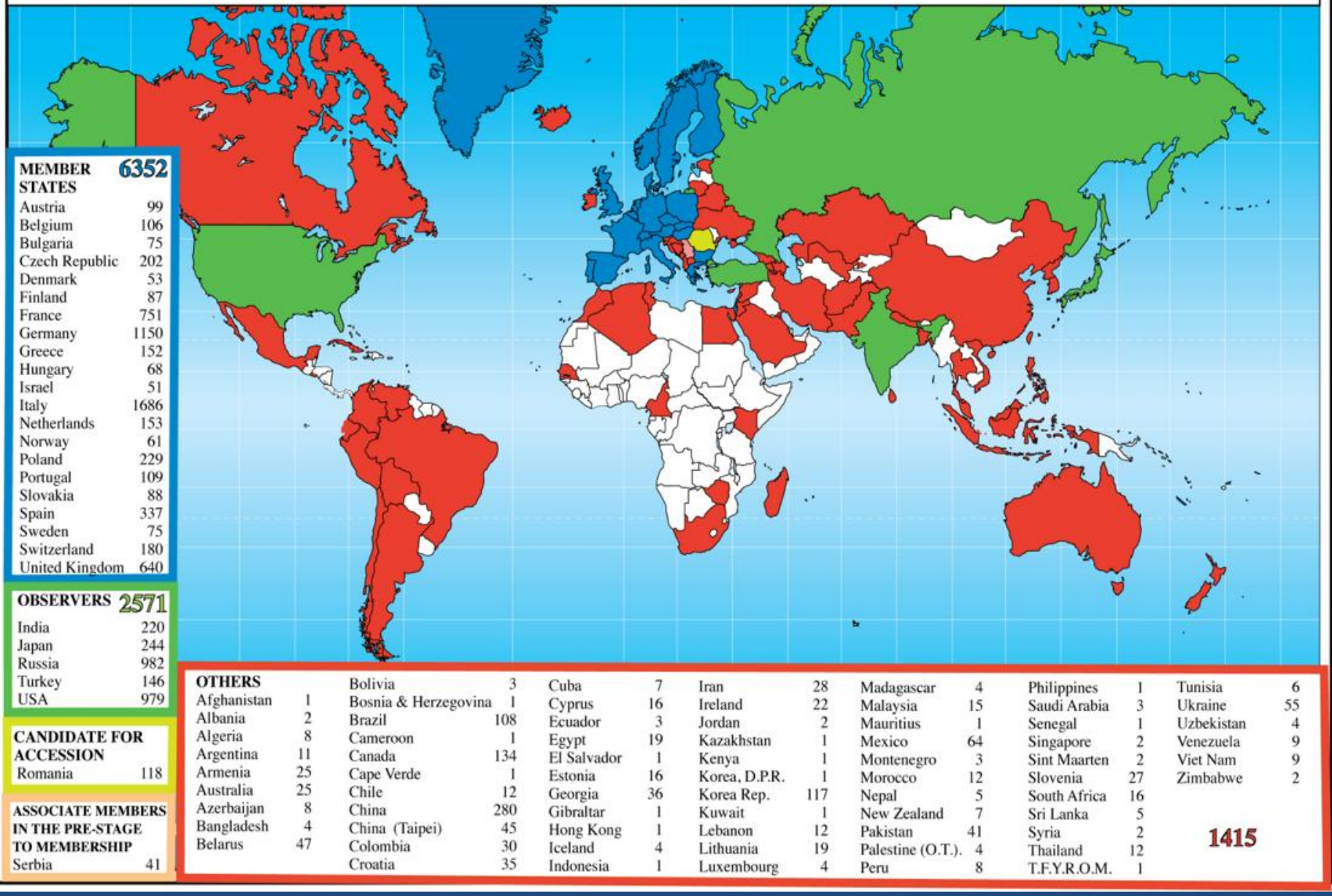
**11000** მომხმარებელი

**ბიუჯეტი (2013) ~1000 MCHF**

წევრები

კანდიდატები

# Distribution of All CERN Users by Nationality (14.01.2014)



| MEMBER STATES | 6352 |
|---|---|
| Austria | 99 |
| Belgium | 106 |
| Bulgaria | 75 |
| Czech Republic | 202 |
| Denmark | 53 |
| Finland | 87 |
| France | 751 |
| Germany | 1150 |
| Greece | 152 |
| Hungary | 68 |
| Israel | 51 |
| Italy | 1686 |
| Netherlands | 153 |
| Norway | 61 |
| Poland | 229 |
| Portugal | 109 |
| Slovakia | 88 |
| Spain | 337 |
| Sweden | 75 |
| Switzerland | 180 |
| United Kingdom | 640 |

| OBSERVERS | 2571 |
|---|---|
| India | 220 |
| Japan | 244 |
| Russia | 982 |
| Turkey | 146 |
| USA | 979 |

| CANDIDATE FOR ACCESSION | |
|---|---|
| Romania | 118 |

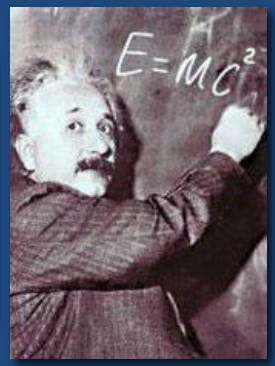
| ASSOCIATE MEMBERS IN THE PRE-STAGE TO MEMBERSHIP | |
|---|---|
| Serbia | 41 |

| OTHERS | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Afghanistan | 1 | Bolivia | 3 | Cuba | 7 | Iran | 28 | Madagascar | 4 | Philippines | 1 | Tunisia | 6 |
| Albania | 2 | Bosnia & Herzegovina | 1 | Cyprus | 16 | Ireland | 22 | Malaysia | 15 | Saudi Arabia | 3 | Ukraine | 55 |
| Algeria | 8 | Brazil | 108 | Ecuador | 3 | Jordan | 2 | Mauritius | 1 | Senegal | 1 | Uzbekistan | 4 |
| Argentina | 11 | Cameroon | 1 | Egypt | 19 | Kazakhstan | 1 | Mexico | 64 | Singapore | 2 | Venezuela | 9 |
| Armenia | 25 | Canada | 134 | El Salvador | 1 | Kenya | 1 | Montenegro | 3 | Sint Maarten | 2 | Viet Nam | 9 |
| Australia | 25 | Cape Verde | 1 | Estonia | 16 | Korea, D.P.R. | 1 | Morocco | 12 | Slovenia | 27 | Zimbabwe | 2 |
| Azerbaijan | 8 | Chile | 12 | Georgia | 36 | Korea Rep. | 117 | Nepal | 5 | South Africa | 16 | | |
| Bangladesh | 4 | China | 280 | Gibraltar | 1 | Kuwait | 1 | New Zealand | 7 | Sri Lanka | 5 | | |
| Belarus | 47 | China (Taipei) | 45 | Hong Kong | 1 | Lebanon | 12 | Pakistan | 41 | Syria | 2 | 1415 | |
| | | Colombia | 30 | Iceland | 4 | Lithuania | 19 | Palestine (O.T.). | 4 | Thailand | 12 | | |
| | | Croatia | 35 | Indonesia | 1 | Luxembourg | 4 | Peru | 8 | T.F.Y.R.O.M. | 1 | | |

# ცერნ-ის მისია

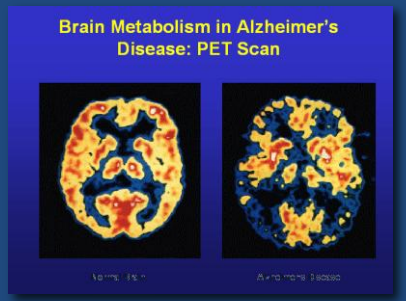
Innovation
Education
CERN
uniting people
Research

# ცერნ-ის მისია




**ჩახედვა წარსულში** – ცოდნის საზღვრების გაფართოება

დიდი აფეთქების საიდუმლოები – როგორი იყო მატერია სამყაროს შექმნის პირველ მომენტში




**ახალი ტექნოლოგიების განვითარება** - ამაჩქარებლებისა და დეტექტორებისთვის

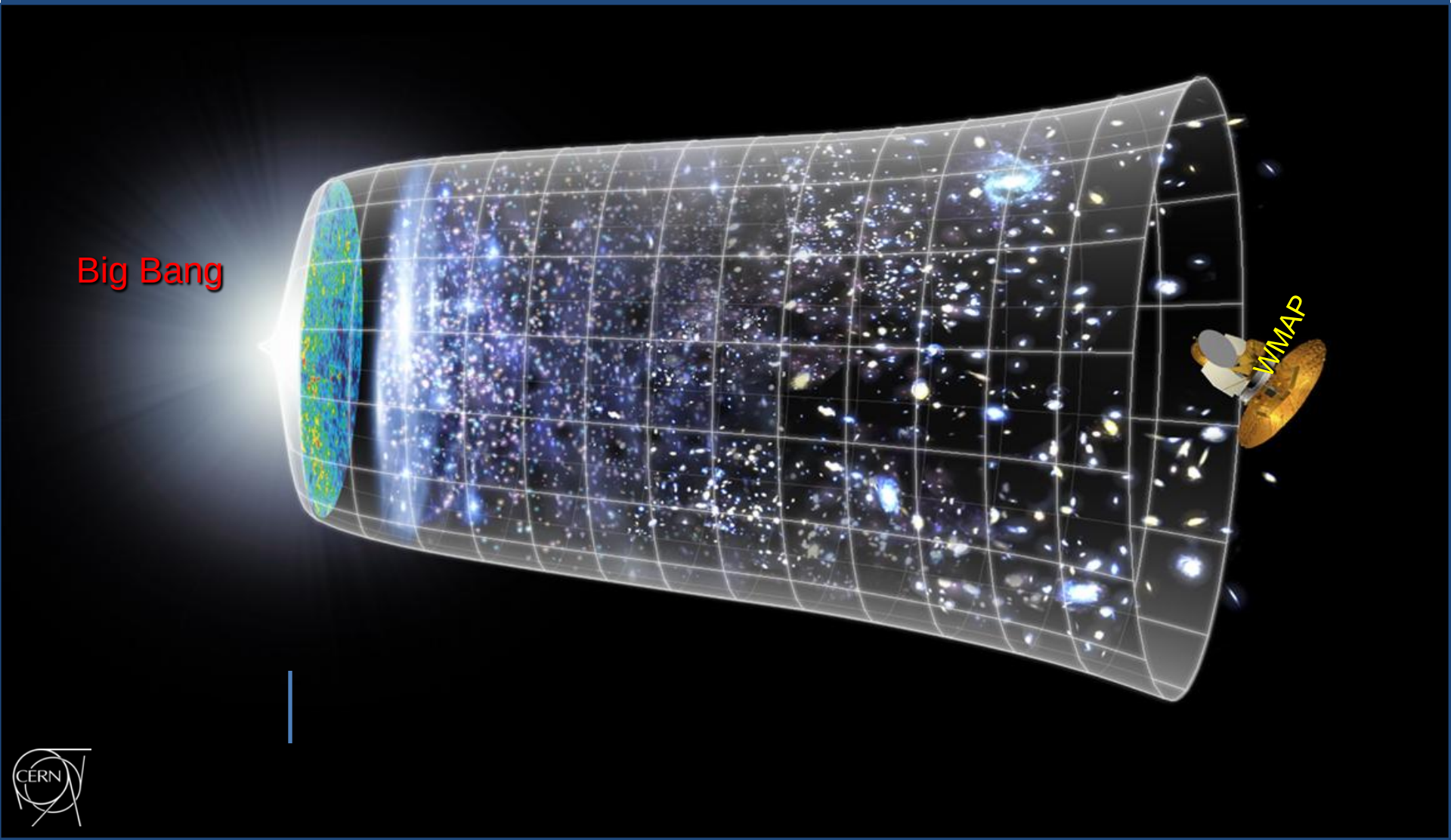
ტექნოლოგია ინფორმატიკაში - **Web** და **GRID**

მედიცინა – დიაგნოსტიკა და თერაპია

**თრეინინგი** – მომავალ მეცნიერთა და ინჟინერთათვის

სხვადასხვა კულტურისა და ქვეყნების ხალხთა **გაერთიანება**

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

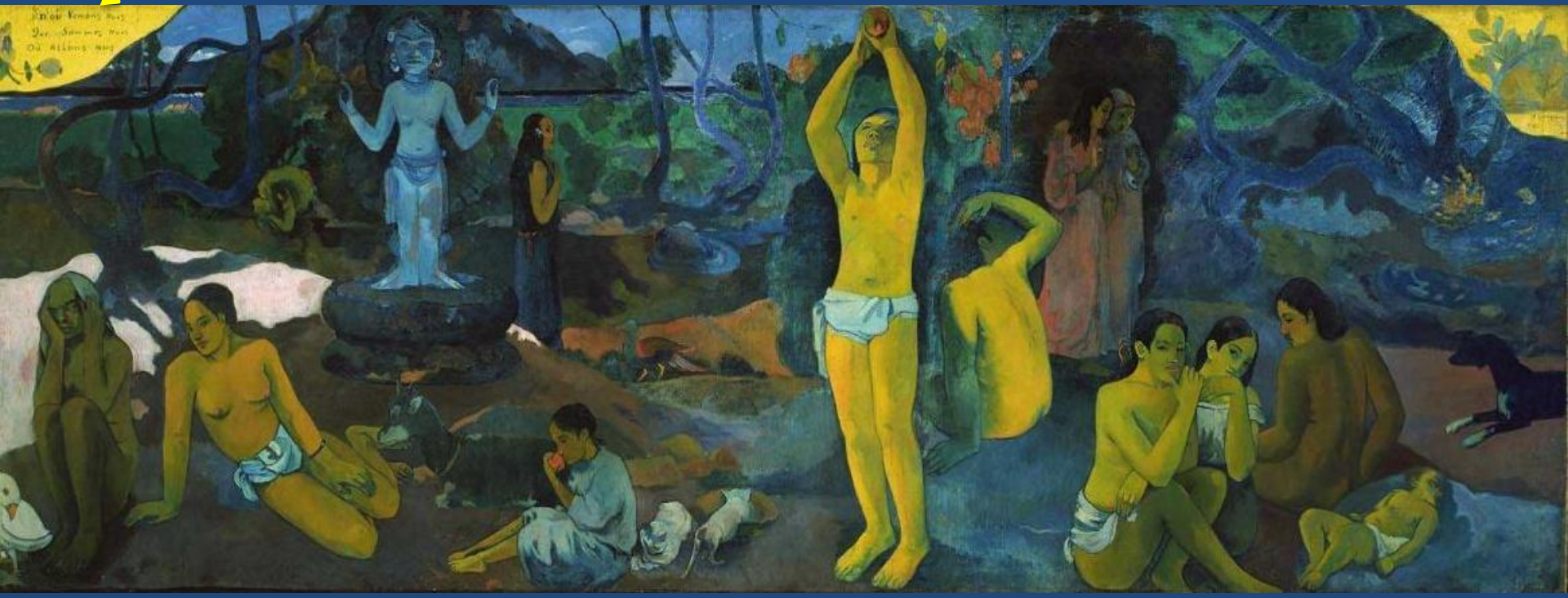


- საიდან ვართ
- ვინ ვართ
- საით მივდივართ?

## პოლ გოგენი

**Gauguin Paul**

Where Do We come from? What Are We? Where Are We Going?



ნაწილაკების ფიზიკის მიზანი, **CERN & the LHC:**
რისგანაა სამყარო შედგენილი?

Big Bang

Proton

Atom

$10^{-32}$ $10^{-28}$ $10^{-24}$ $10^{-20}$ $10^{-16}$ $10^{-12}$ $10^{-8}$

Radius of Earth

Earth to Sun

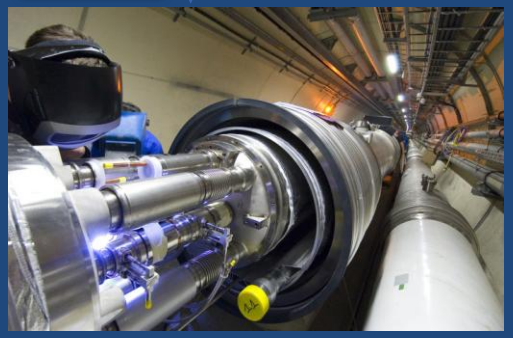
$10^{8}$ $10^{12}$ $10^{16}$ $10^{20}$ $10^{24}$ $10^{28}$

Radius of Galaxies

Universe

cm

CERN



LHC

Super-Microscope

ALMA

დიდი აფეთქების შემდეგ პირველი მომენტების ფიზიკური კანონების შესწავლა ურო და უფრო აღრმავებს სიმბიოზ ნაწილაკების ფიზიკას, კოსმოლოგიასა და ასტროფიზიკას შორის

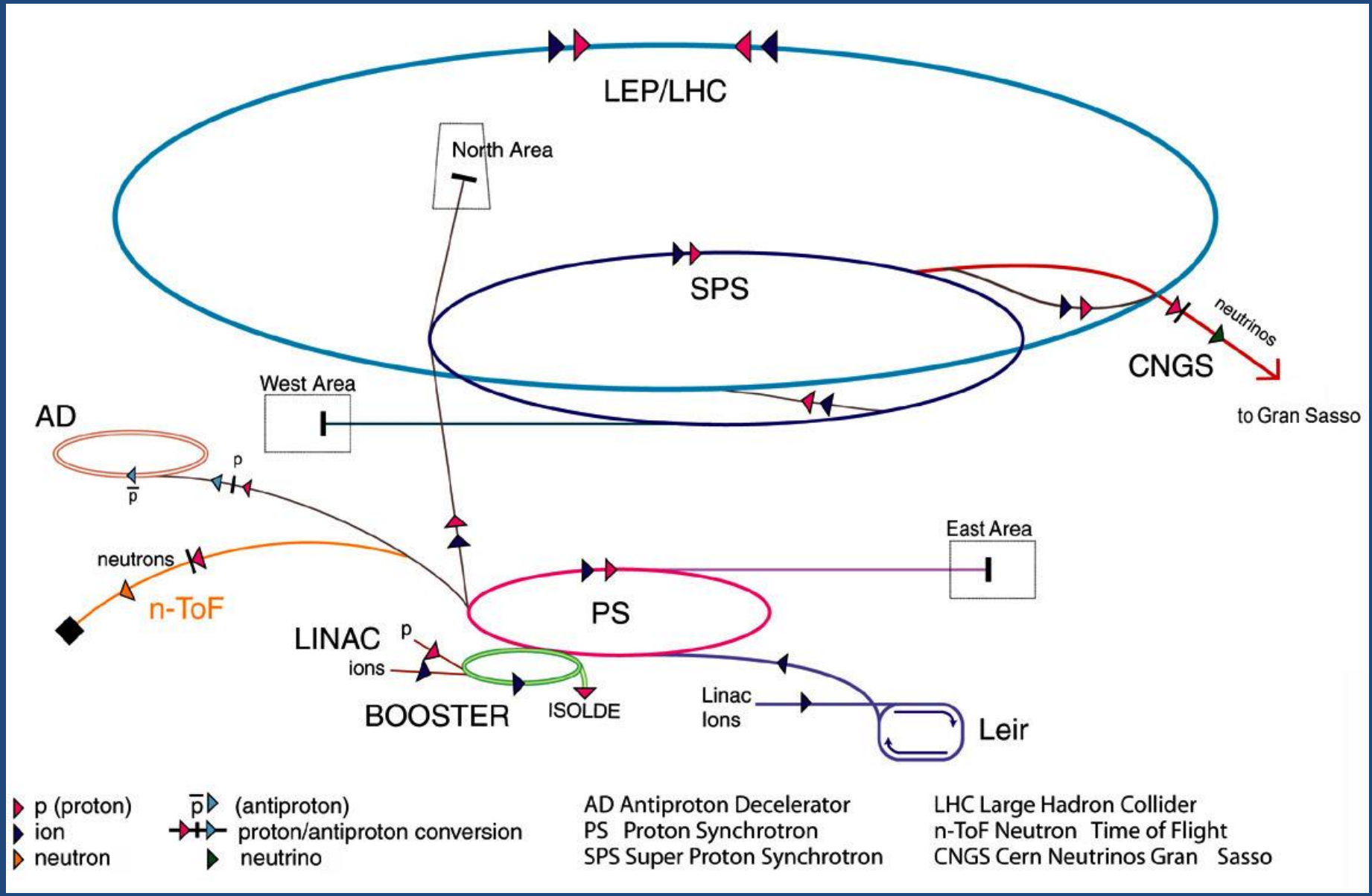
# როგორ ვაკეთებთ ამას?

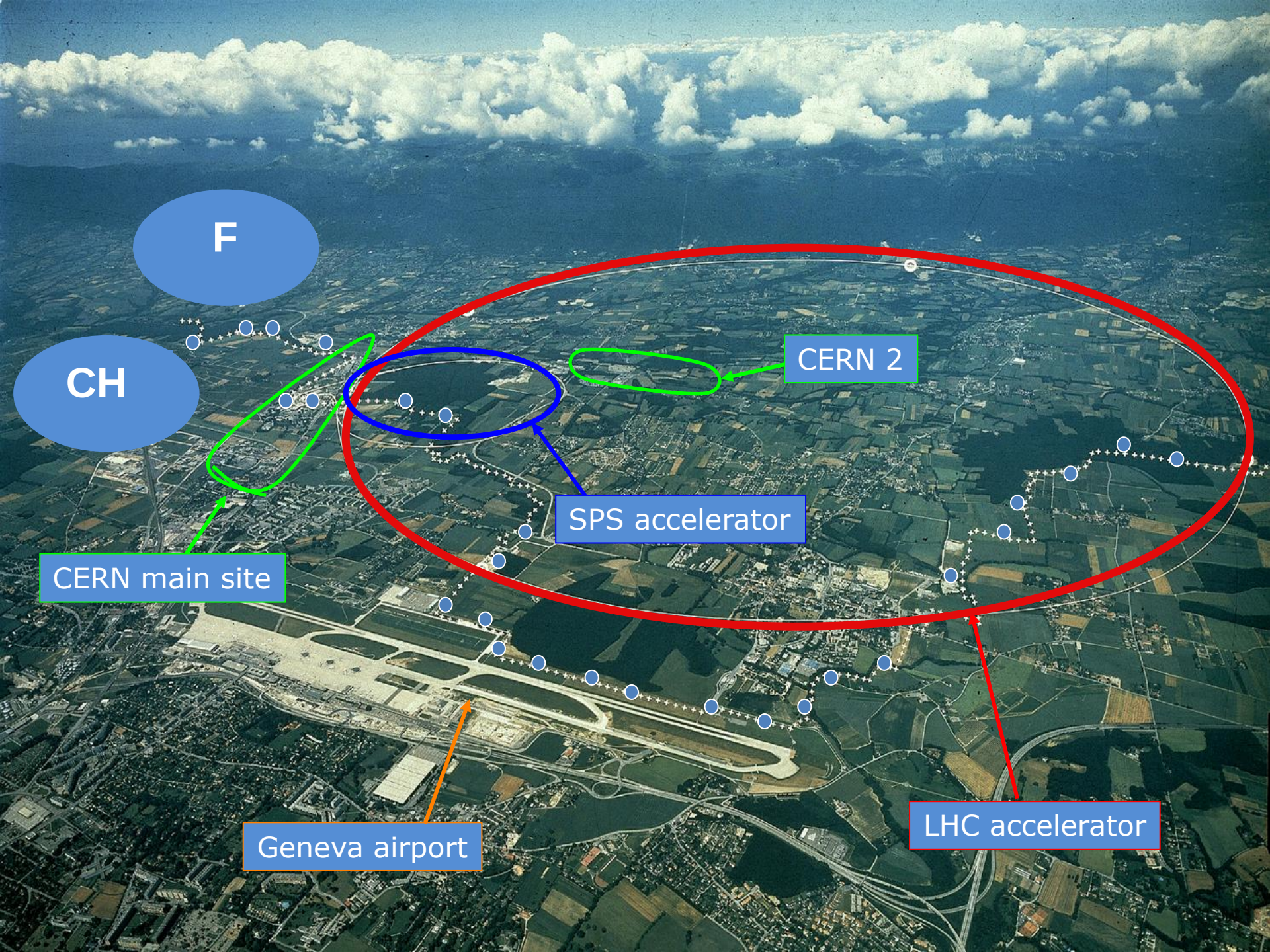
**ამაჩქარებლები:** ანიჭებენ ნაწილაკებს დიდ ენერგიას;
ენერგია გარდაიქმნება მატერიაში $E=mc^2$

**დეტექტორები:** ნაწილაკების იდენტიფიკაცია და დეტექტირება

**კომპიუტერები:** მონაცემთა ანალიზი და საწყისი სურათის აღდგენა

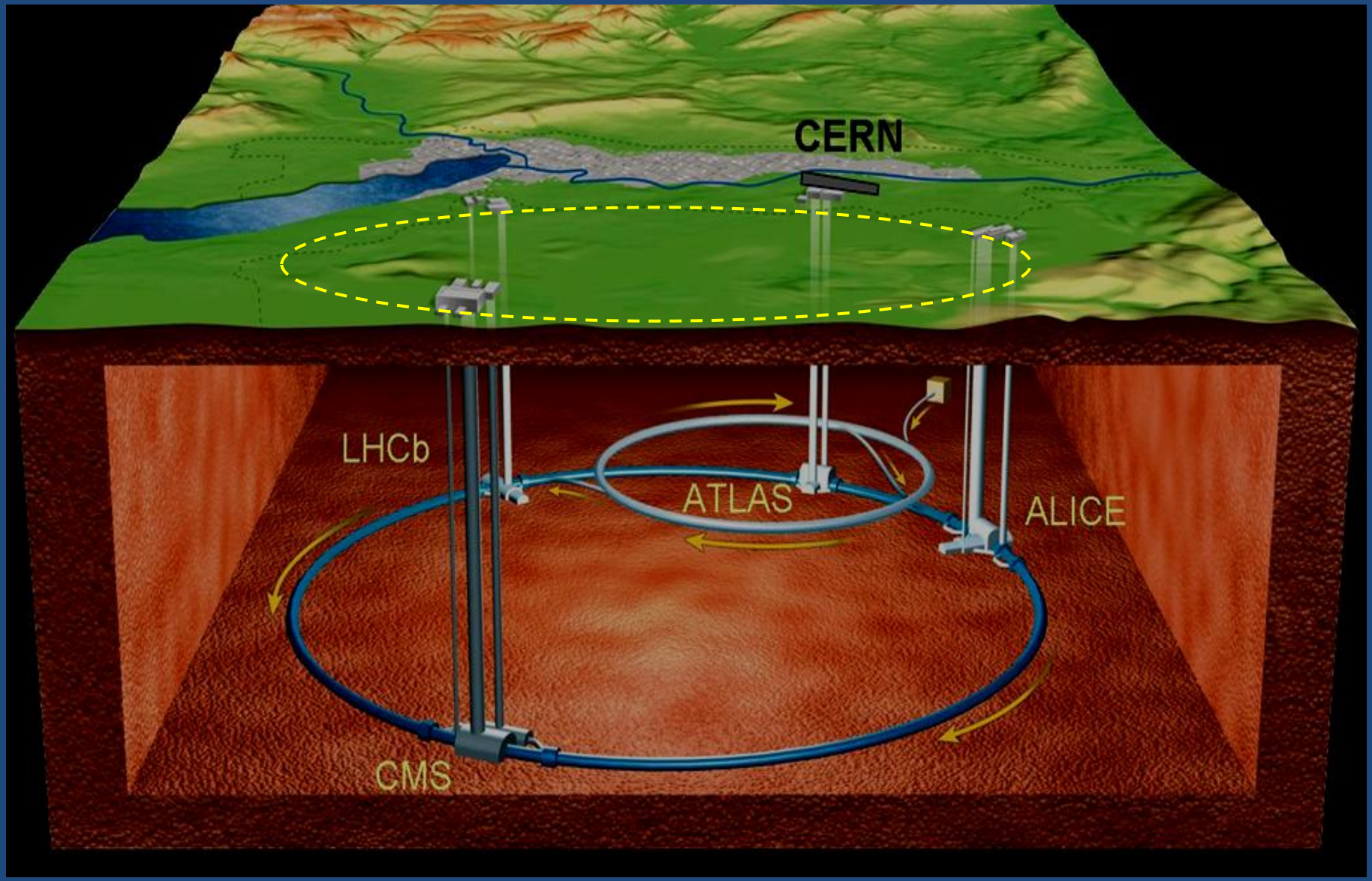
# CERN – world biggest accelerator complex




F
CH
CERN 2
SPS accelerator
CERN main site
Geneva airport
LHC accelerator

# LHC – Large Hadron Collider

## დიდი ადრონული კოლაიდერი



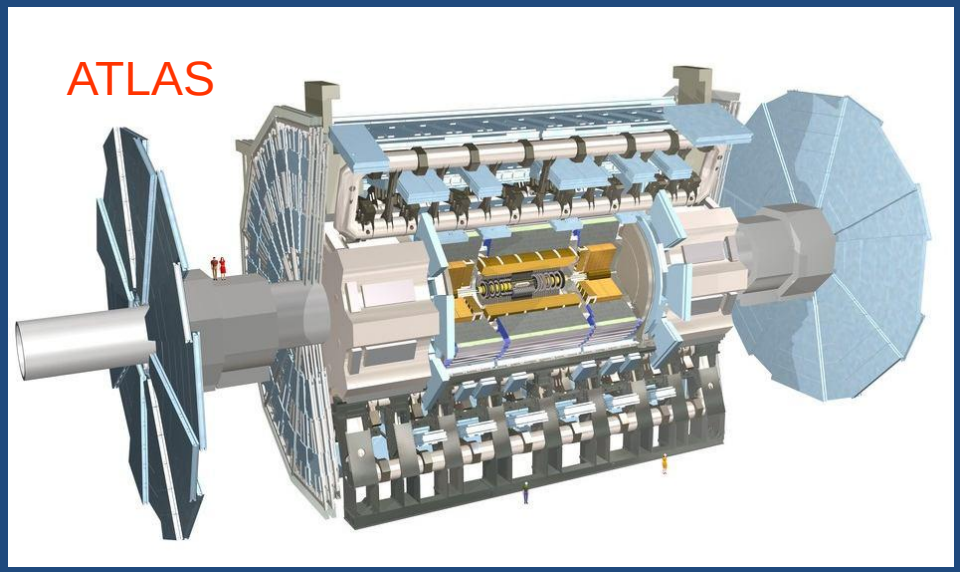
დიდი ადრონული კოლაიდერი (LHC)
პროტონ-პროტონული კოლაიდერი
7 TeV + 7 TeV
1,000,000,000 დაჯახება/წამში
ძირითადი მიზნები:
• მასის წარმოშობა
• ბნელი მატერიის ბუნება
• თავდაპირველი პლაზმა
• მატერია/ანტიმატერია

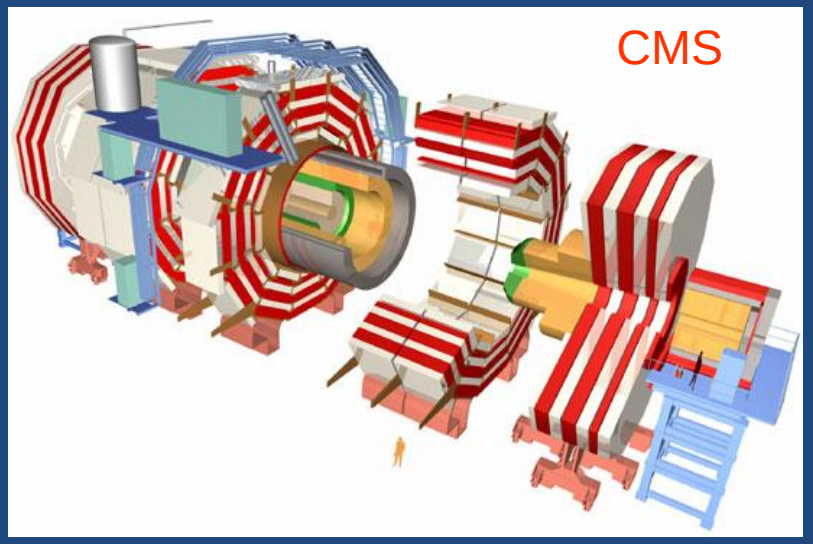
# ყველაზე მეტად გაუხშოებული სისტემა სამყაროში

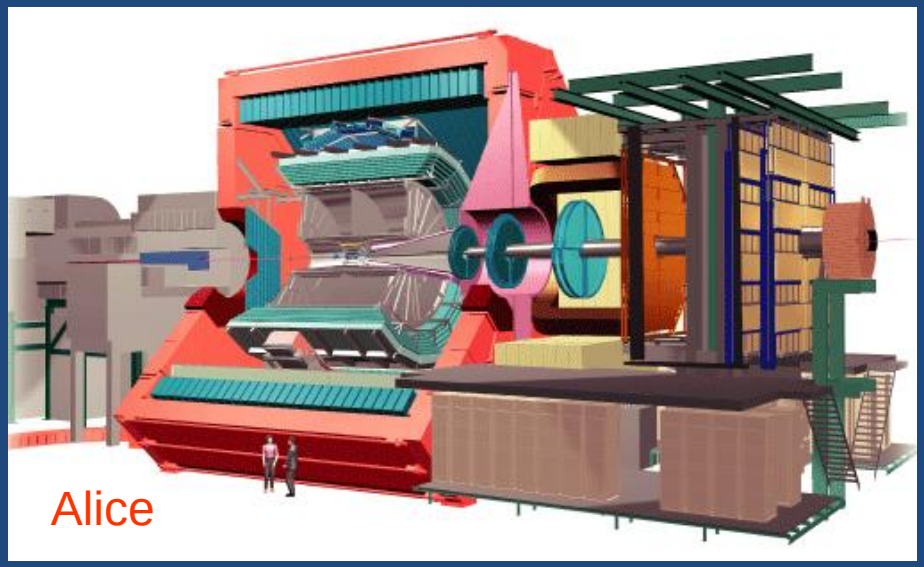
## პლანეტაშორის სივცეში მსგავსი ვაკუუმი:

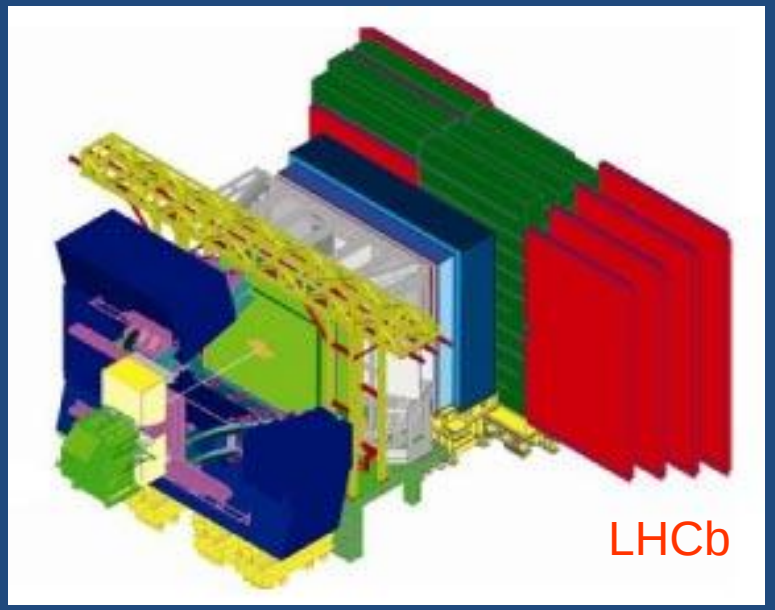
ნაკადის მილებში წნევა ათჯერ უფრო დაბალია ვიდრე მთვარეზე

# LHC-ის ოთხი ძირითადი დეტექტორი

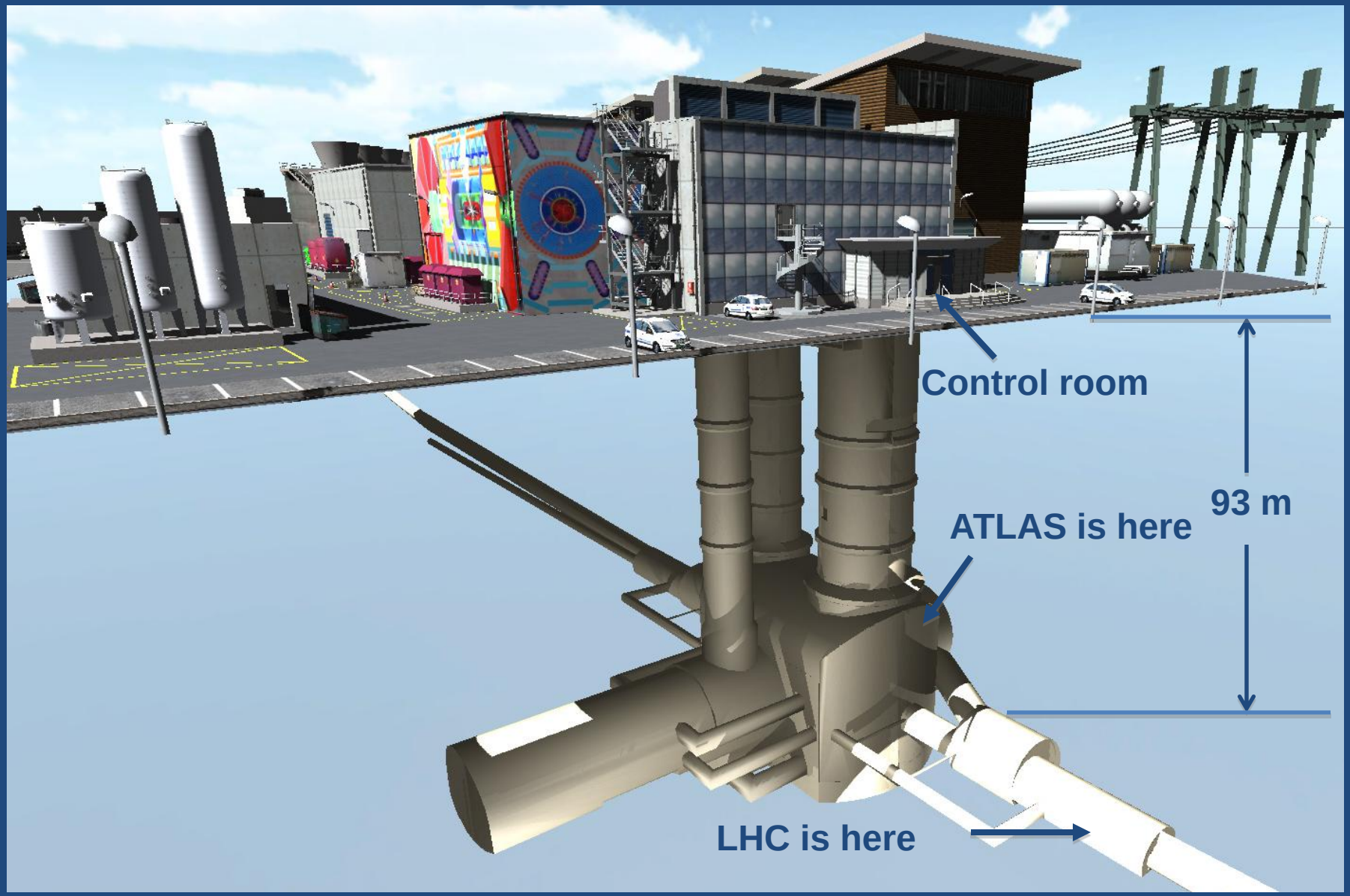


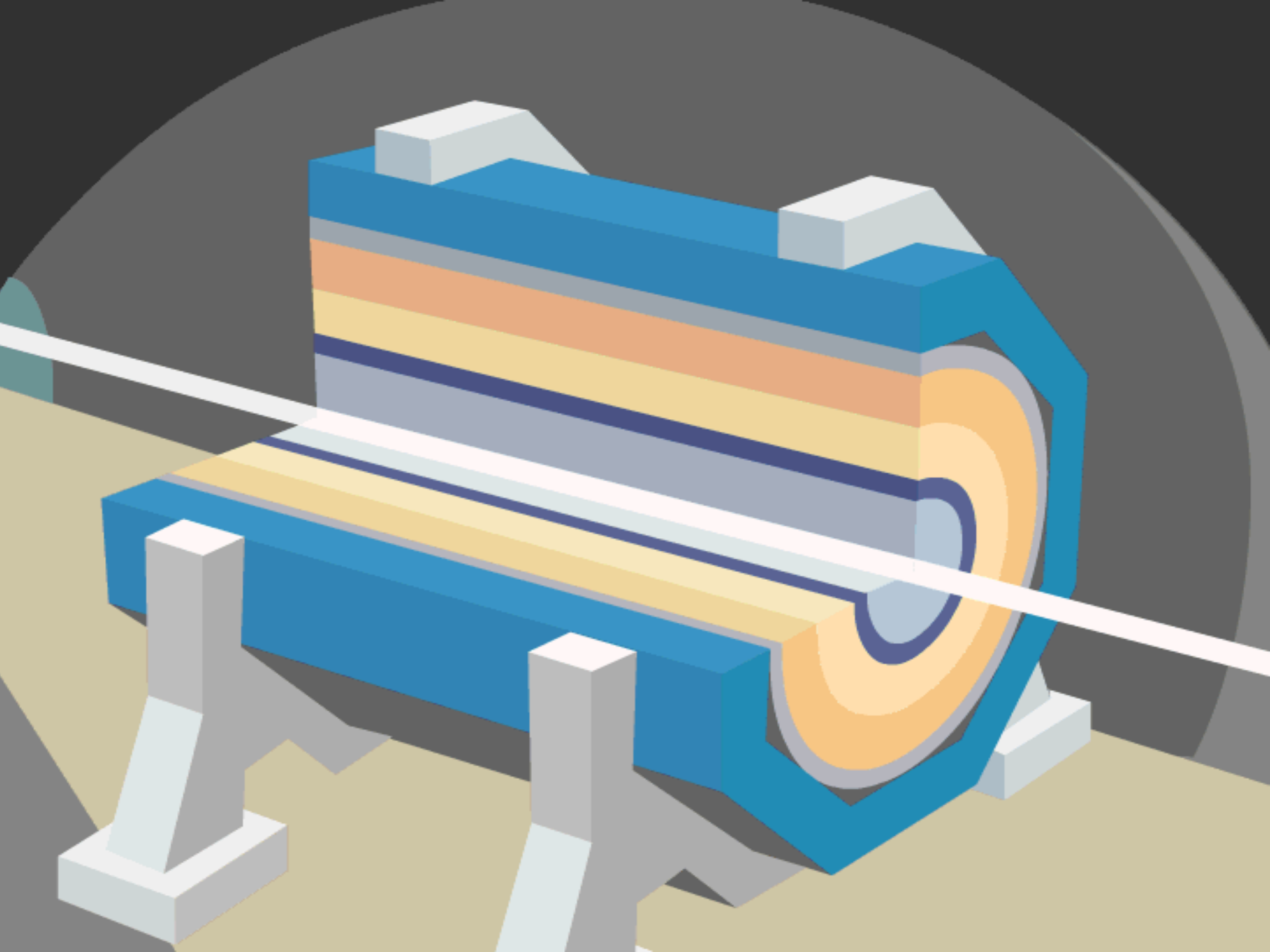



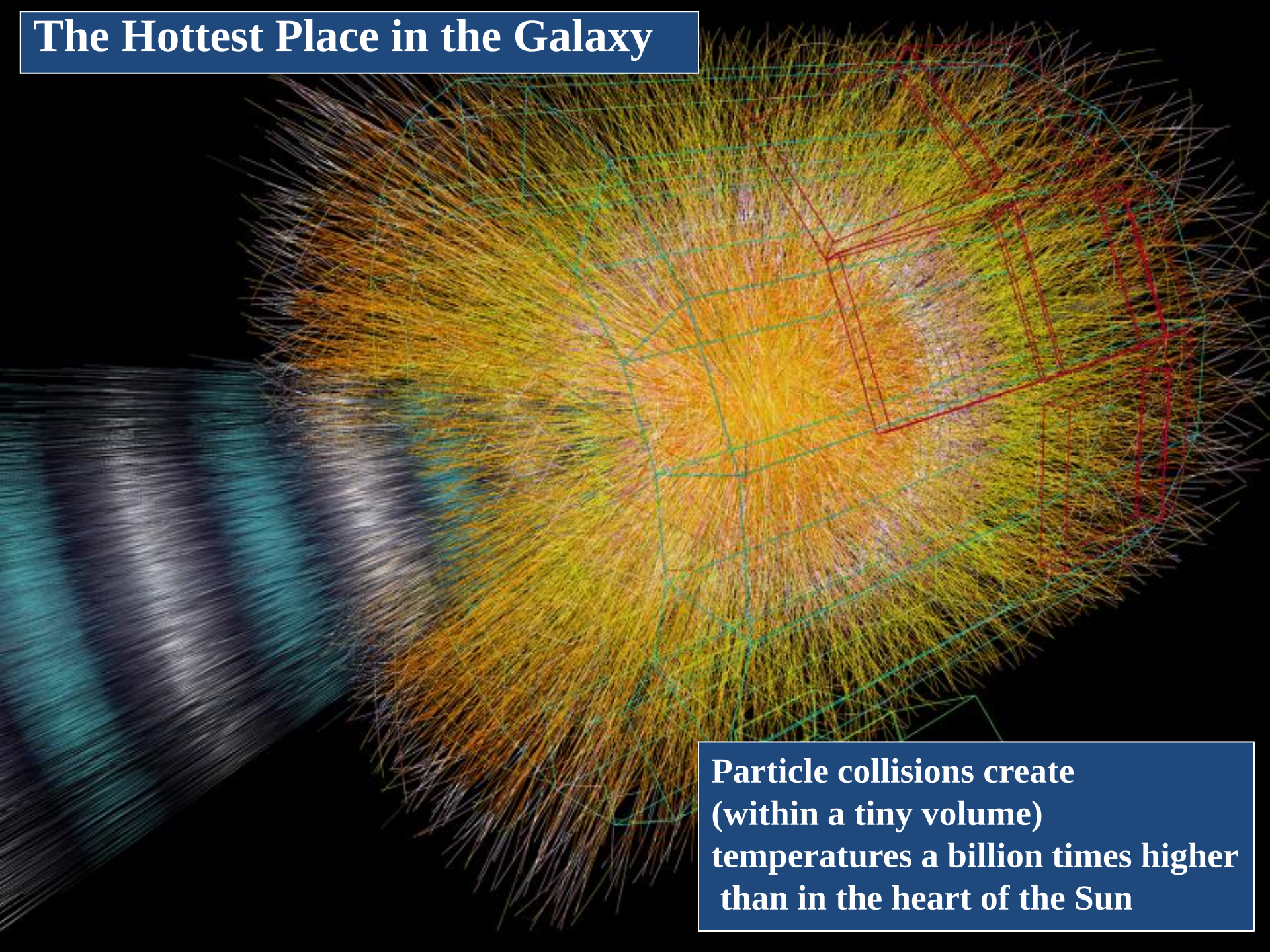
# *Site of the ATLAS experiment*



# The CMS Detector before closing

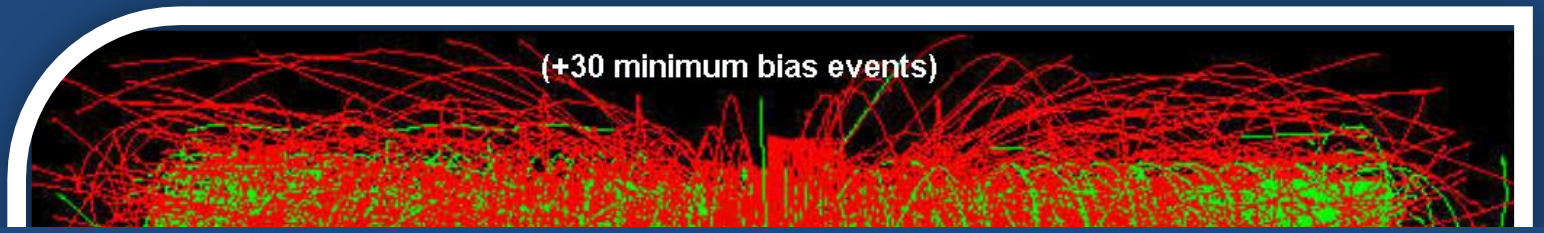


# The Hottest Place in the Galaxy



**Particle collisions create (within a tiny volume) temperatures a billion times higher than in the heart of the Sun**

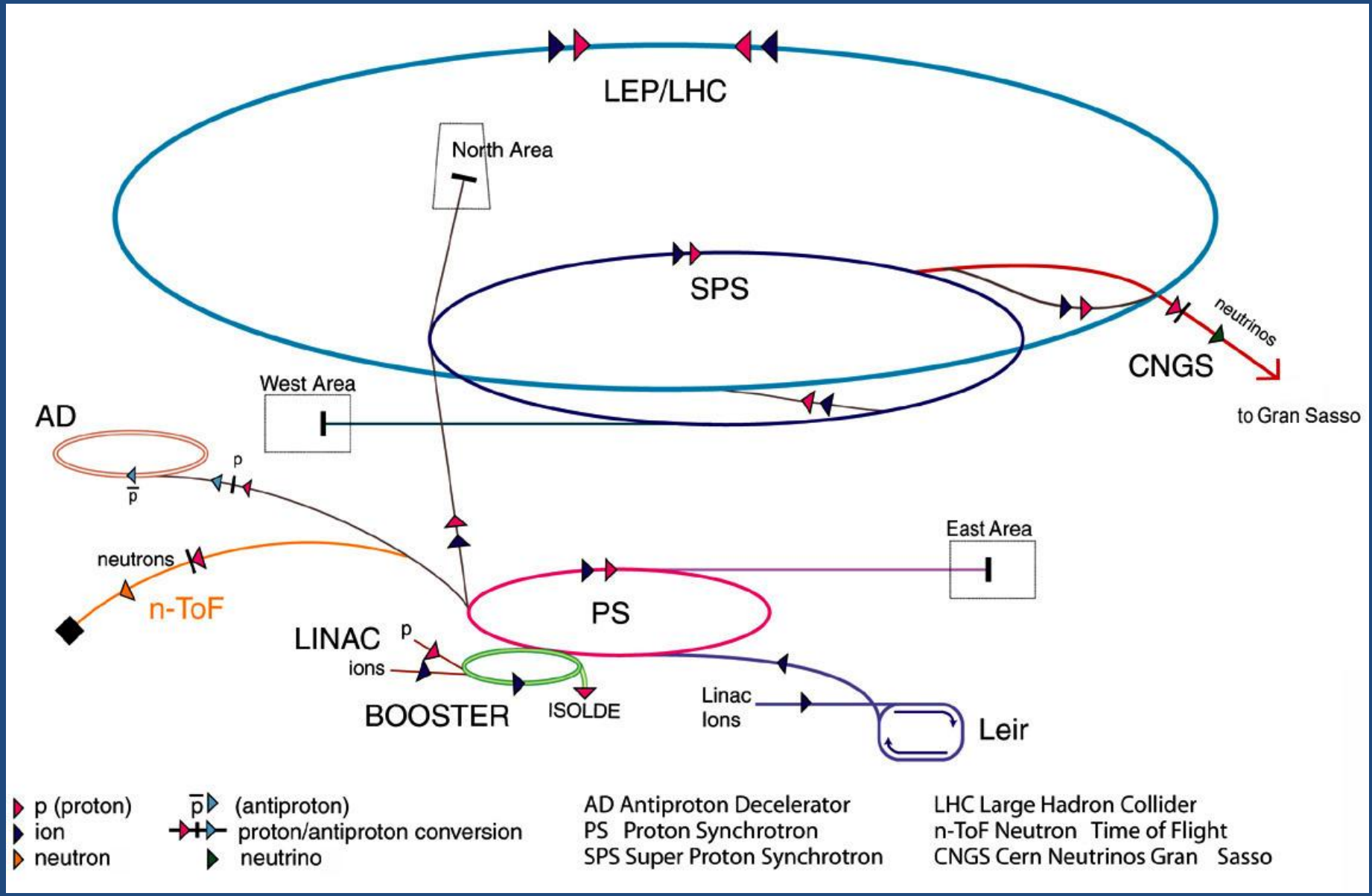
# Searching for new particles requires selection and analysis of enormous quantity of data from LHC detectors



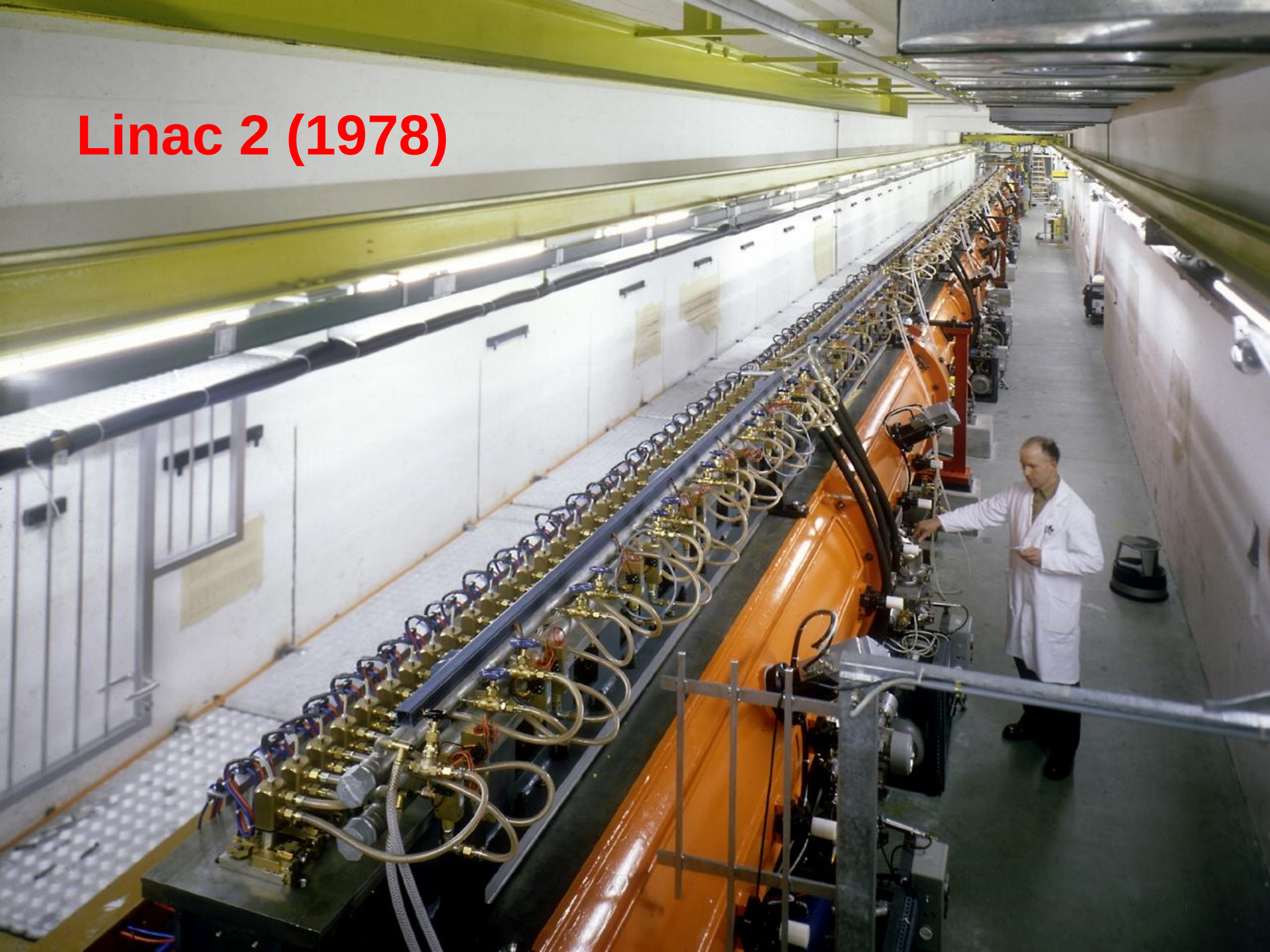

- LHC experiments produce 10-15 million Gigabytes of data each year (about 20 million CDs!)
- LHC data analysis requires a computing power equivalent to ~100,000 of today's fastest PC processors.

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

# CERN – world biggest accelerator complex



# Linac 2 (1978)



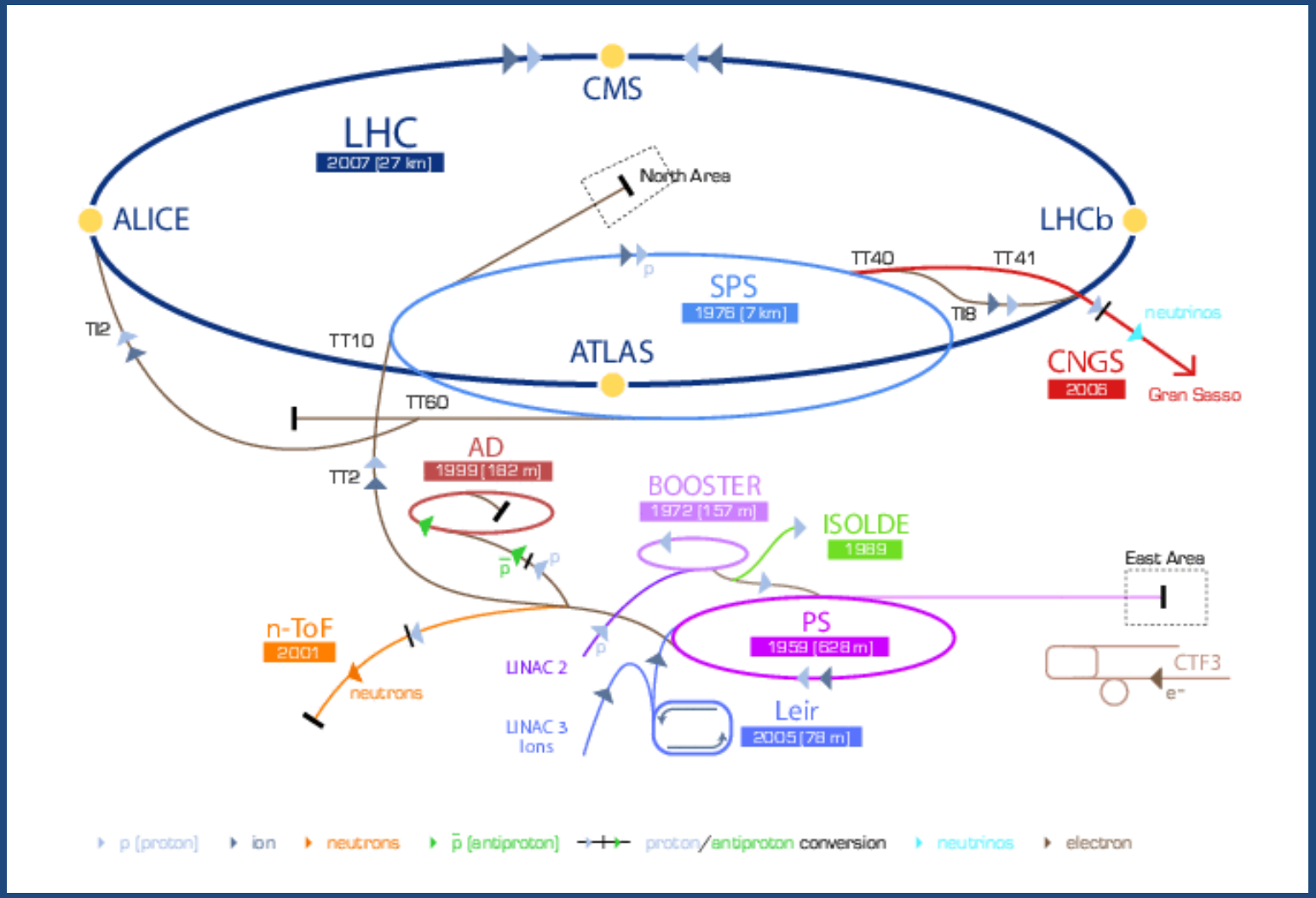
Proton Synchrotron Booster 1972
PA 312 3T

PS - 50
years
of service!!

Super Proton Synchrotron 1976
MB 231

Large Hudron Collider 2008

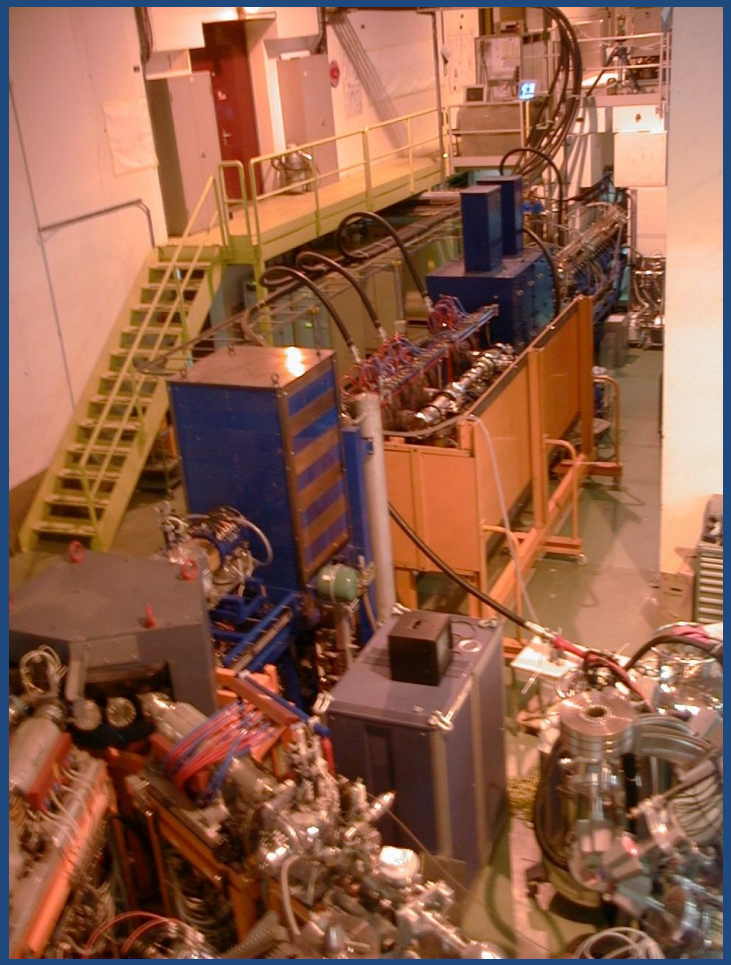
# CERN accelerator complex, working not only for LHC !



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

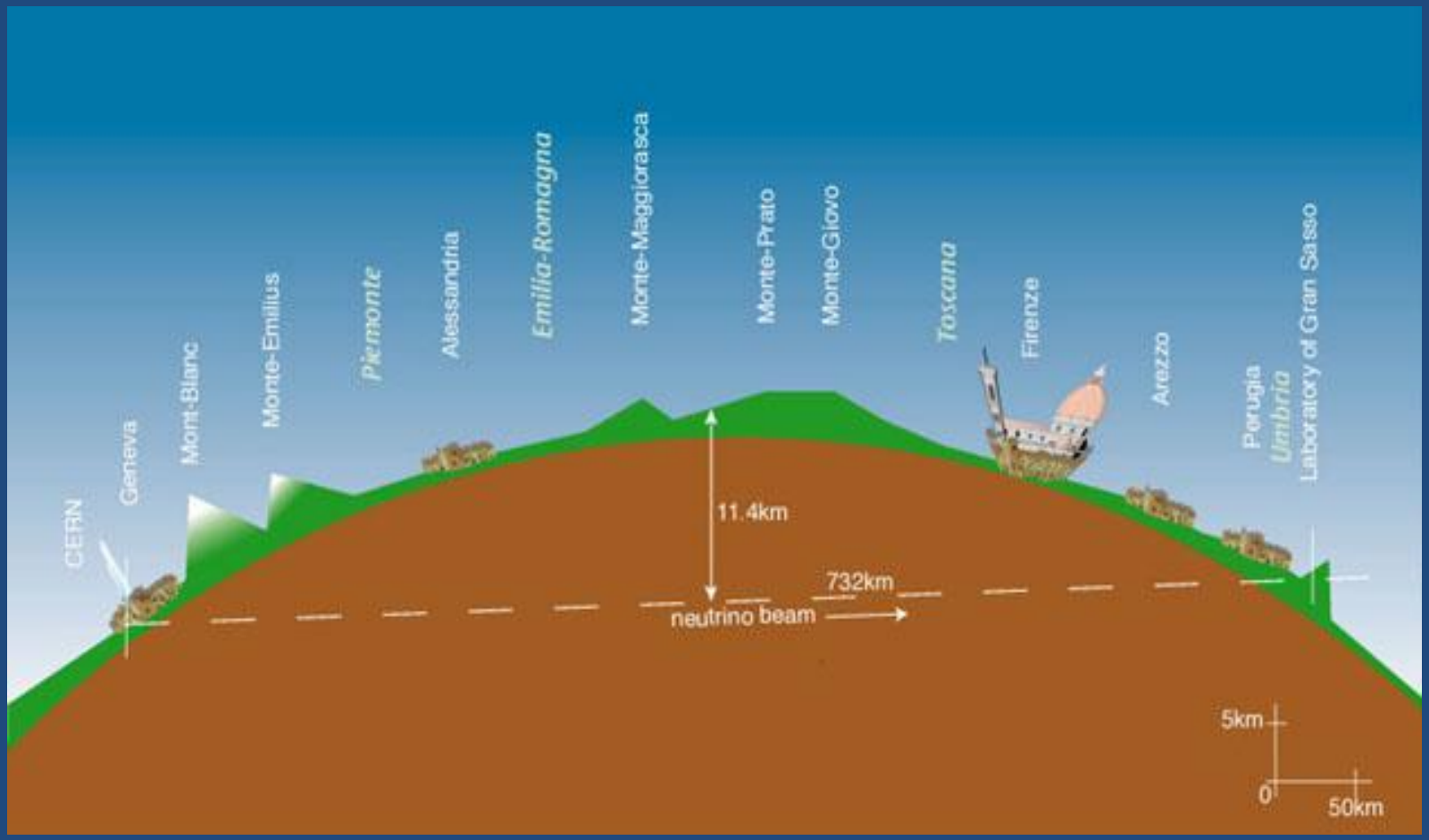
## An alchemical factory for nuclear physics

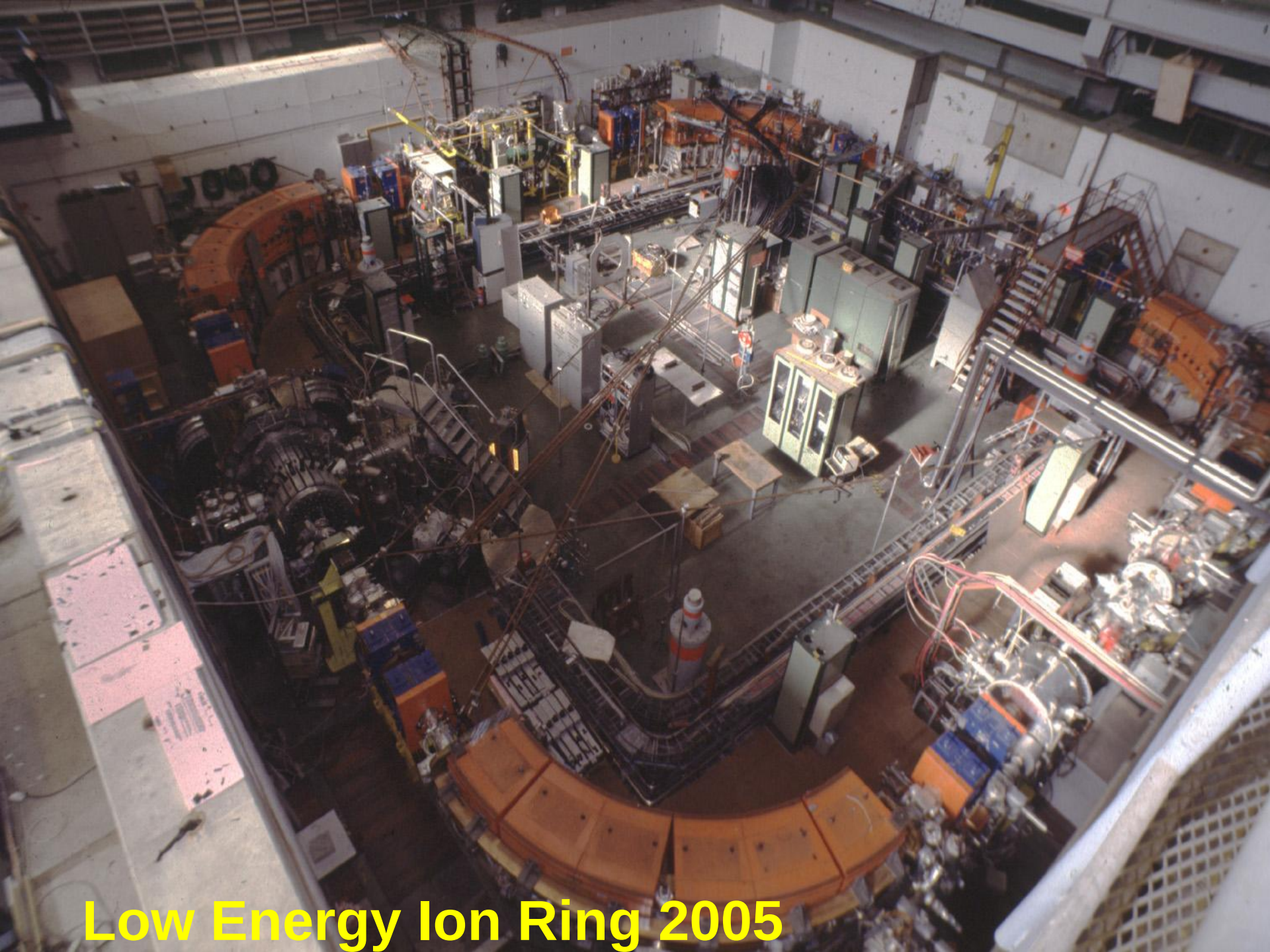
Low-energy beams of radioactive isotopes - atomic nuclei. The facility, located at the Proton-Synchrotron Booster (PSB), is like a small alchemical factory, changing one element to another. It produces a total of more than 1000 different isotopes for a wide range of research.



# 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.**




Low Energy Ion Ring 2005

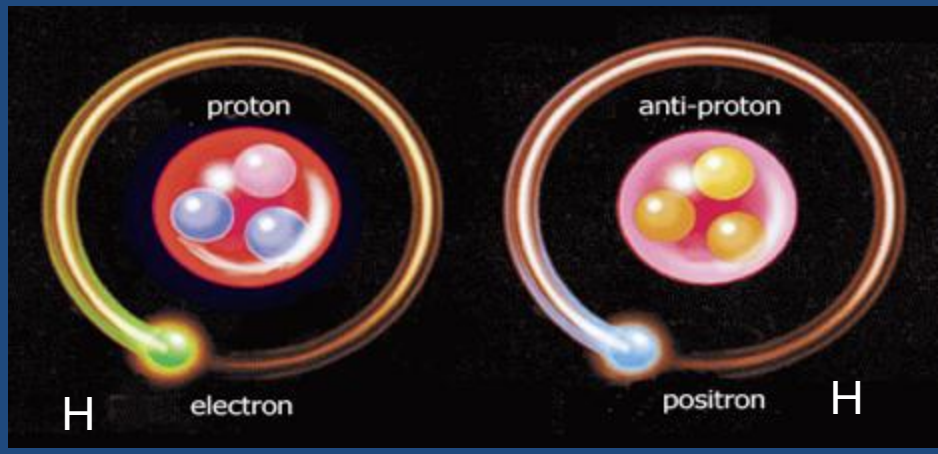
Antiproton Deccelerator 1999
BHN 06
21T

# 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

# An experiment on climate

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

# Nobel prize 1984: CERN

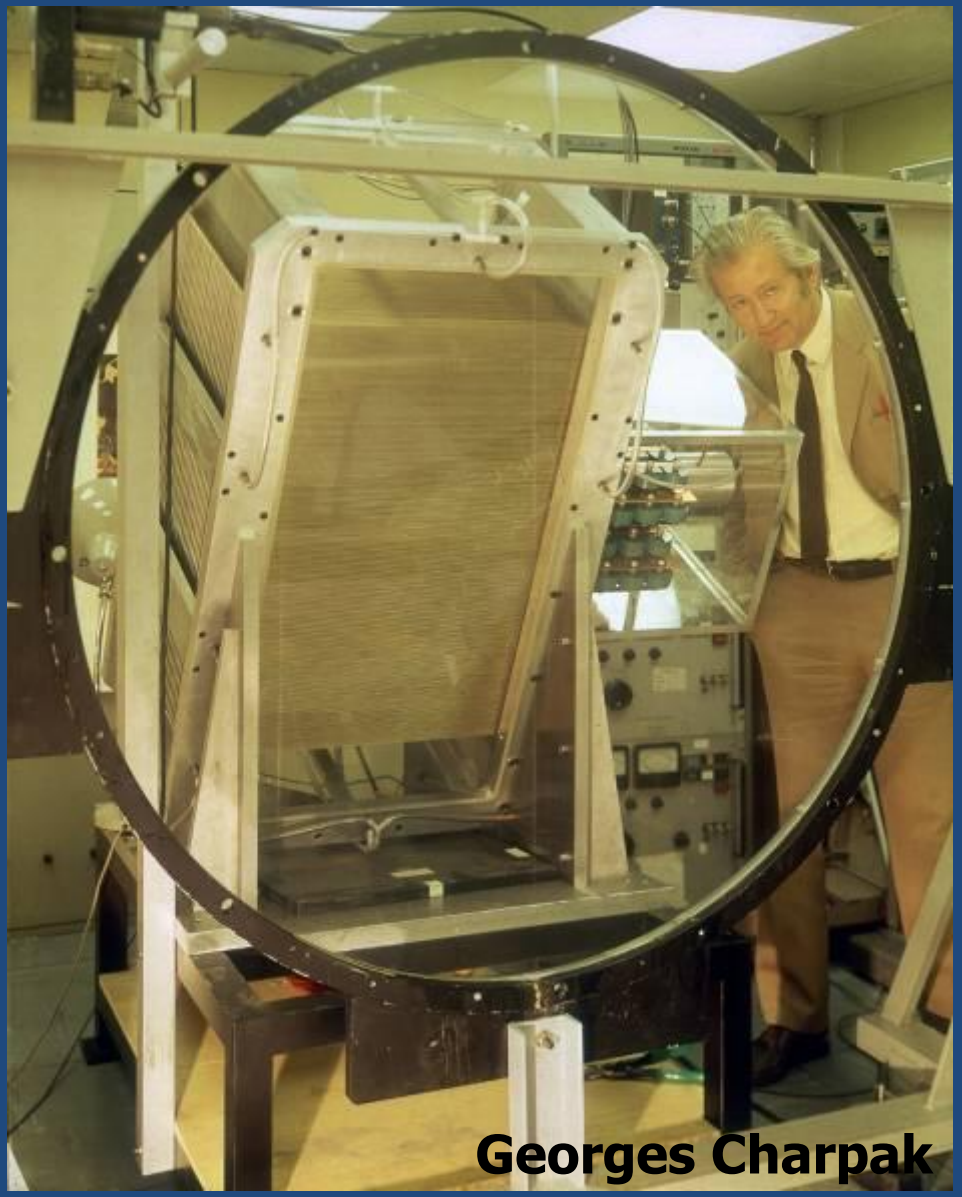
*"for their decisive contributions to the large project, which led to the discovery of the field particles W and Z, communicators of weak interaction"*

# Nobel prize 1992: CERN

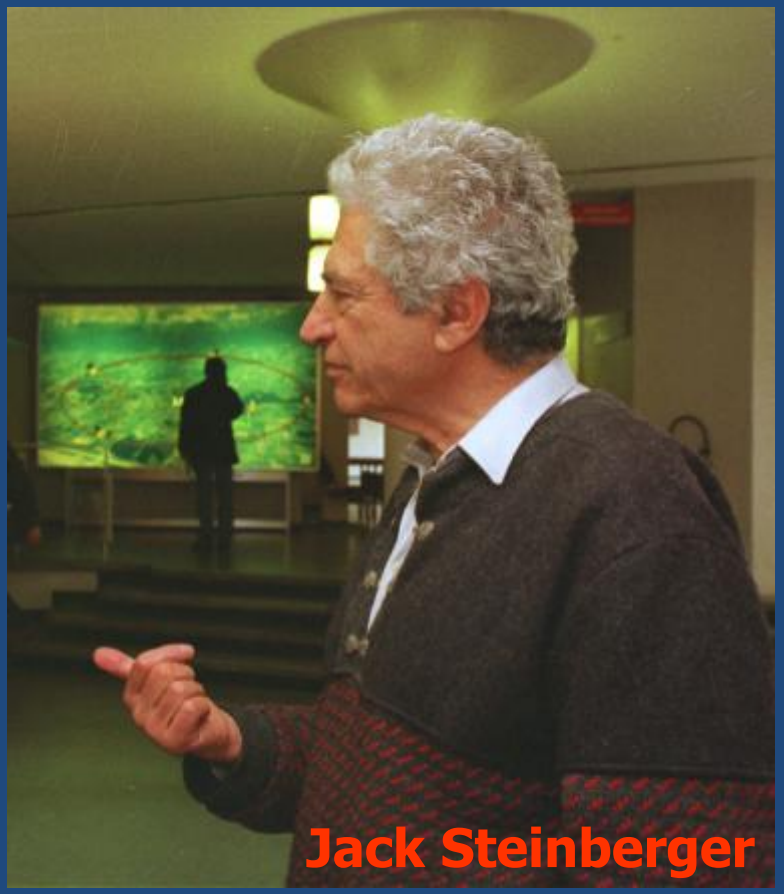
We (physicists) cannot just go to a shop and buy our detectors.

So we invent them !

*"for his invention and development of particle detectors, in particular the multiwire proportional chamber"*



# Nobel prize 1988




*"for the neutrino beam method and the demonstration of the doublet structure of the leptons through the discovery of the muon neutrino"*

# CERN Technologies - Innovation

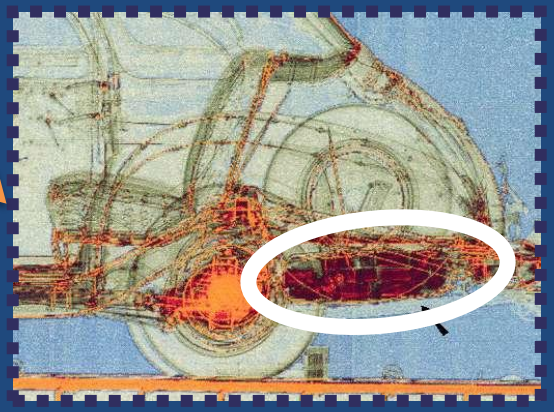
Accelerating particle beams

**Charged hadron beam that loses energy in matter**

**Medical imaging**

Detecting particles

**Grid computing for big data management and analysis**



**Drugs hidden inside the gas tank**

# World Wide Web, GRID, Computing…

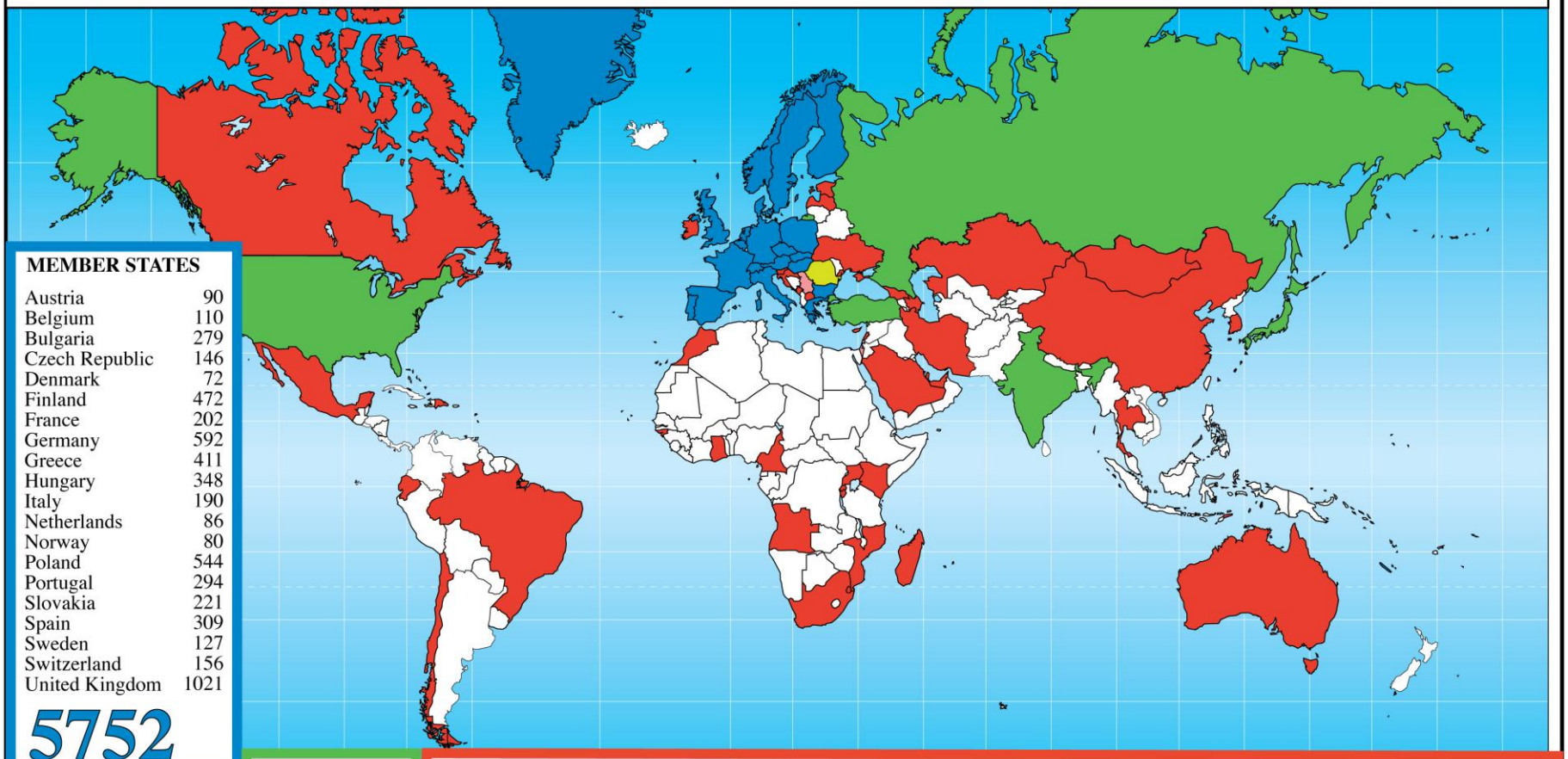
From the past…

Tim Berners-Lee
father of WWW

… into the future

www.cern.ch

# Teacher Programme Participants 1998 - 2013



**MEMBER STATES**

| | |
|---|---|
| Austria | 90 |
| Belgium | 110 |
| Bulgaria | 279 |
| Czech Republic | 146 |
| Denmark | 72 |
| Finland | 472 |
| France | 202 |
| Germany | 592 |
| Greece | 411 |
| Hungary | 348 |
| Italy | 190 |
| Netherlands | 86 |
| Norway | 80 |
| Poland | 544 |
| Portugal | 294 |
| Slovakia | 221 |
| Spain | 309 |
| Sweden | 127 |
| Switzerland | 156 |
| United Kingdom | 1021 |

**5752**

**CANDIDATE FOR ACCESSION**

| | |
|---|---|
| Romania | 12 |

**ASSOCIATE MEMBER IN THE PRE-STAGE TO MEMBERSHIP**

| | |
|---|---|
| Israel | 7 |
| Serbia | 14 |

**OBSERVER STATES**

| | |
|---|---|
| India | 2 |
| Japan | 5 |
| Russia | 163 |
| Turkey | 3 |
| USA | 65 |

**238**

**OTHERS**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Angola | 4 | China | 1 | Ireland | 5 | Morocco | 2 | Swaziland | 1 |
| Australia | 5 | Croatia | 1 | Kazakhstan | 3 | Mozambique | 17 | Thailand | 7 |
| Azerbaijan | 1 | Cyprus | 8 | Kenya | 4 | Qatar | 1 | T.F.Y.R.O.M. | 11 |
| Brazil | 83 | Dominican Rep. | 2 | Latvia | 1 | Rwanda | 17 | Timor-Leste | 4 |
| Burundi | 1 | Ecuador | 2 | Lebanon | 1 | Sao Tome | 3 | Uganda | 3 |
| Cameroon | 3 | Estonia | 37 | Madagascar | 2 | Saudi Arabia | 1 | Ukraine | 57 |
| Canada | 3 | Georgia | 55 | Malta | 36 | Singapore | 2 | U.A.E. | 1 |
| Cape Verde | 3 | Ghana | 6 | Mexico | 6 | Slovenia | 21 | | |
| Chile | 3 | Guinea Bissau | 1 | Mongolia | 1 | South Africa | 6 | | |
| | | Iran | 1 | Montenegro | 13 | South Korea | 44 | | |

**490**

# Georgian Teachers Programms at CERN

1st programm – 2011 November

2nd programm - 2012 May

3rd programm – 2012 November

4th programm - 2013 November

5th programm – 2014 October

# CERN Visit Programme

## Multinational and multilingual

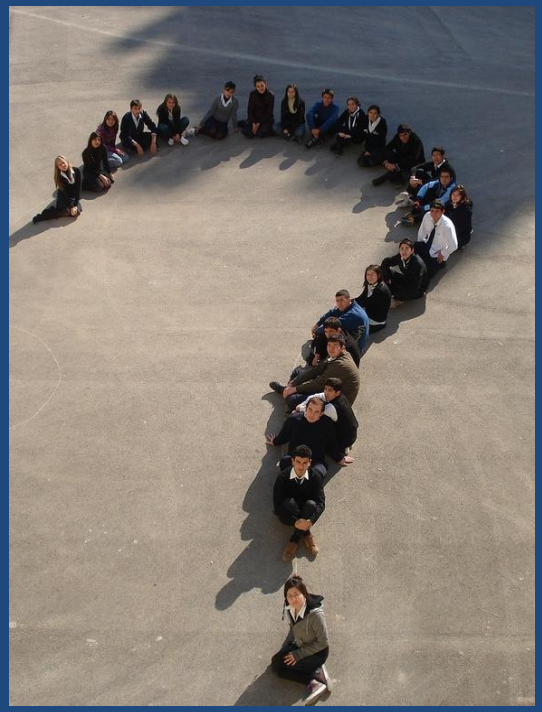
- **Visits**
  **more than 80 000 visitors per year**
  **50 % from schools and universities**

- **Video conferences with**
  **Schools and Universities**

- **Conferences**

- **Science fairs**

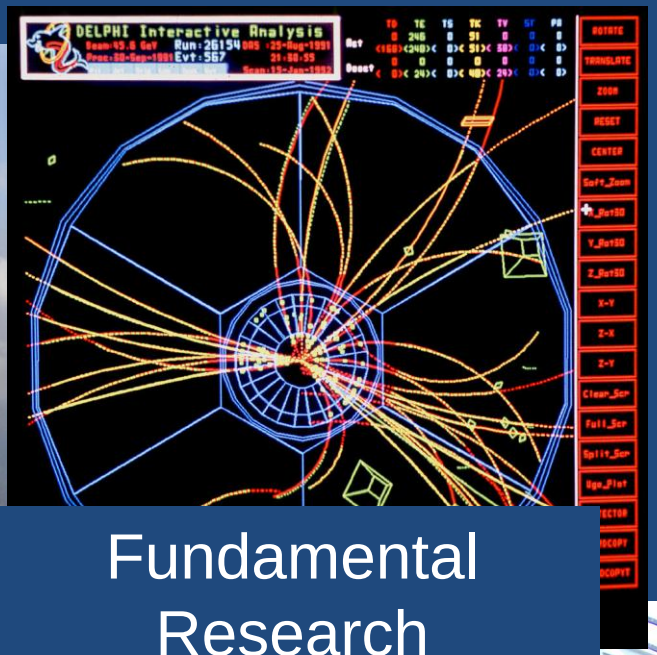
# Personnel



# Workforce

- Physicists
  - Experimental and Theoretical
  - Applied Physicists and Engineers
- Technicians
- Craftsmen
- Administrative personnel
- Fellows
- Doctoral Students
- Technical Students
- Associates
- Summer Students
- Employees of CERN
- Users

International Collaboration

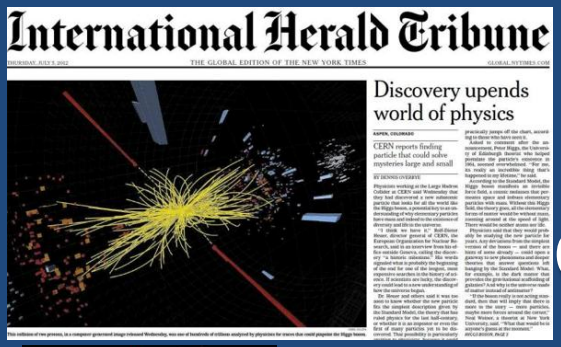


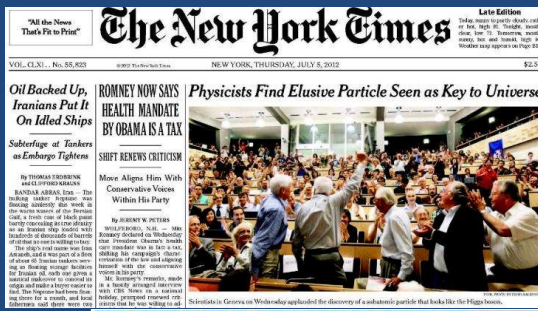

Fundamental Research

Technology Transfer

Education Training the scientists of tomorrow

# 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
Physicists Find Elusive Particle Seen as Key to Universe

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

Milhares de moradores de bairros sociais em risco de perderem RSI

Le Monde
Science : la matière dévoilée
IMPÔTS CE QUI VA CHANGER
7,2 milliards de plus dès 2012
Réforme fiscale à l'automne
ALGÉRIE L'INDÉPENDANCE
Une fête sans panache

'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
5 июля 2012
ПОСЛЕДНИЙ КИРПИЧ В СТЕНУ МИРОЗДАНИЯ
«КРЕМЛЕВСКИЕ» САМОЛЕТЫ ПРИШЛОСЬ МЕНЯТЬ НА ПЕРЕПРАВЕ
МЕТРО СПУСТЯТ НА ВОДУ

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

Frankfurter Allgemeine
ZEITUNG FÜR DEUTSCHLAND
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

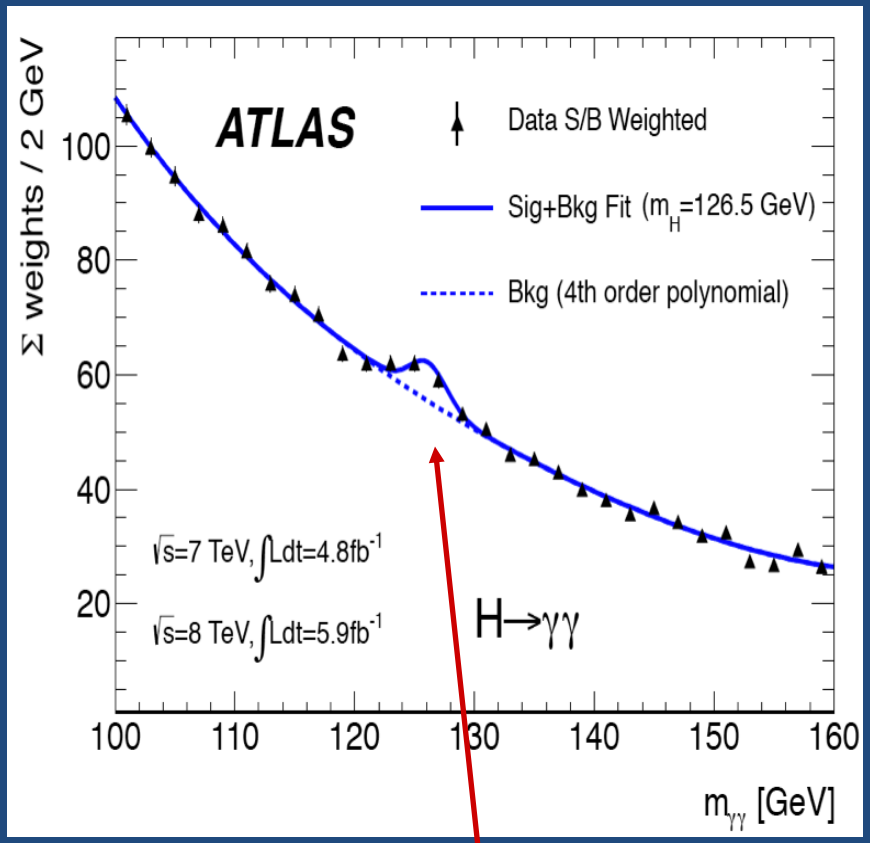
THE HINDU
INDIA'S NATIONAL NEWSPAPER SINCE 1878
RARE CHOLA INSCRIPTIONS
MAY HAVE BEEN POISONED
SUBBARAO ON MFIS
RAHANE RETURNS
Elusive particle found, looks like Higgs boson
CERN physicists hail evidence of game-changing discovery of subatomic particle

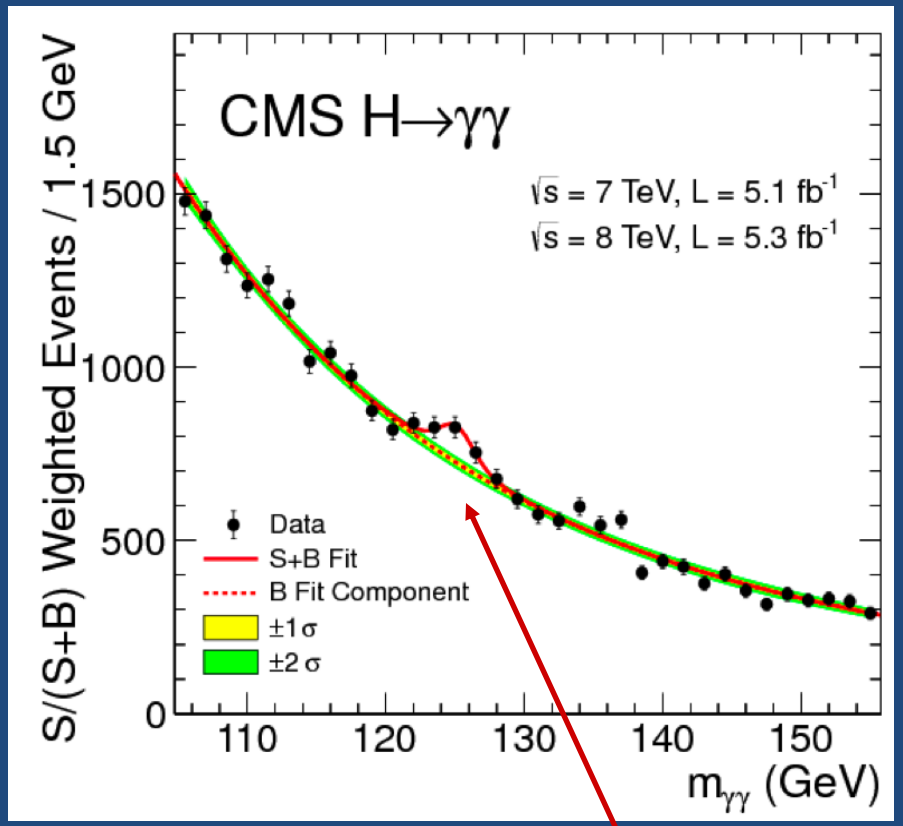
CORRIERE DELLA SERA
Fondato nel 1876
Rinviato a oggi il voto sui nuovi consiglieri
Nomine Rai bloccate Scontro Fini-Schifani
La particella che può svelare i segreti dell'universo
UN'AZIENDA IN OSTAGGIO

gazeta
WYBORCZA.PL
Ukraińcy biją się o język. Rosyjski
Cząstkę Higgsa fizycy najpierw wymyślili, potem szukali 40 lat
BOSKA MASA

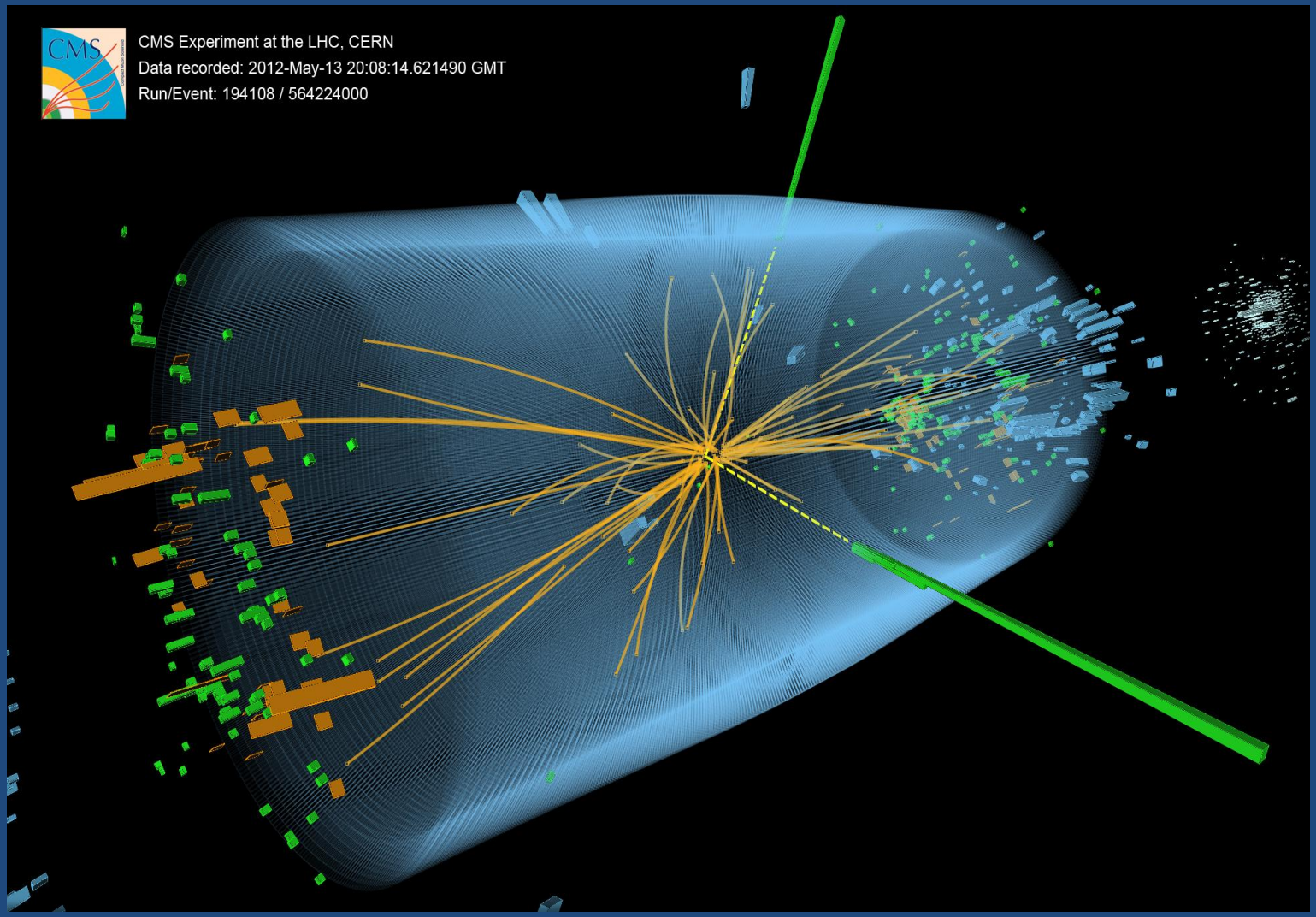
আনন্দবাজার পত্রিকা
বিজ্ঞানের 'ঈশ্বর' দর্শন
সত্যেন্দ্রনাথকে বিনম্র প্রণাম
'পেয়েছি, যা খুঁজছিলাম'

# Higgs decay to γγ, ATLAS and CMS, summer 2012 data



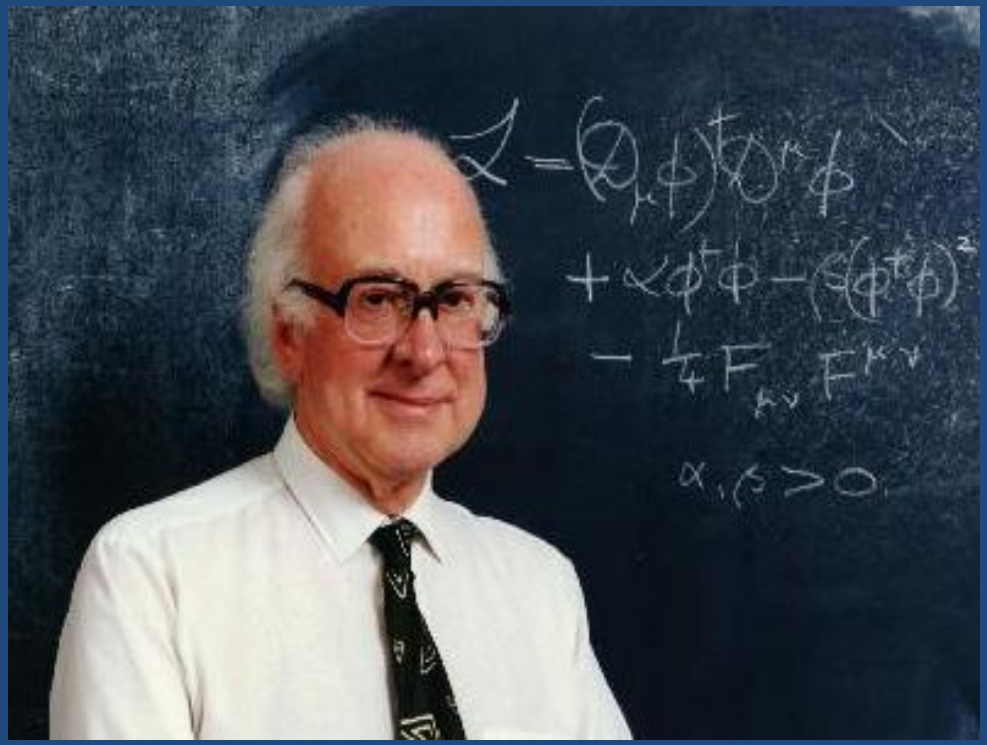



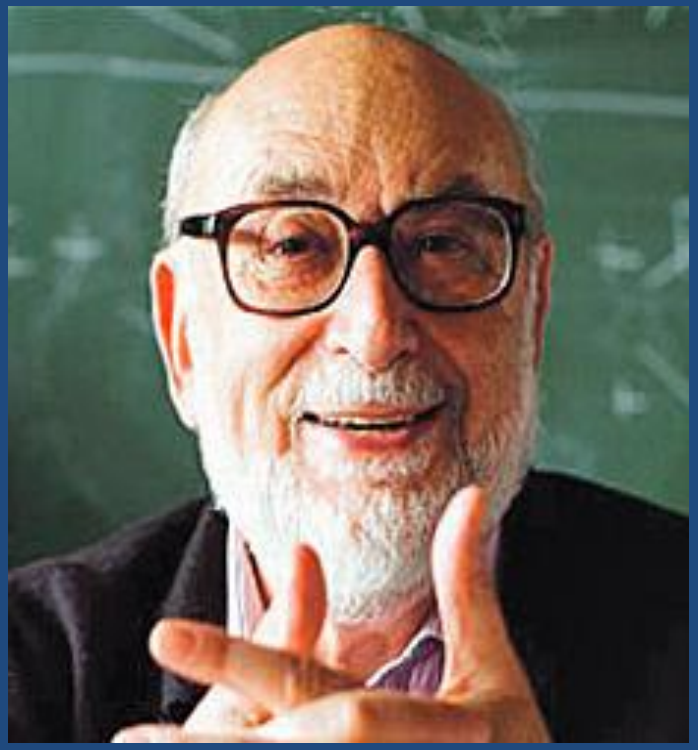
# 4 July 2012: CERN press conference
# “CERN experiments observe particle consistent with long-sought Higgs boson”



# Nobel prize in Physics 2013

## Peter Higgs and Francois Englert





*"for the theoretical discovery of a mechanism that contributes to our understanding of the origin of mass of subatomic particles, and which recently was confirmed through the discovery of the predicted fundamental particle, by the ATLAS and CMS experiments at CERN's Large Hadron Collider"*

გმადლობთ ყურადღებისთვის