



*Benvenuti
al CERN*



**European Organization
for Nuclear Research**

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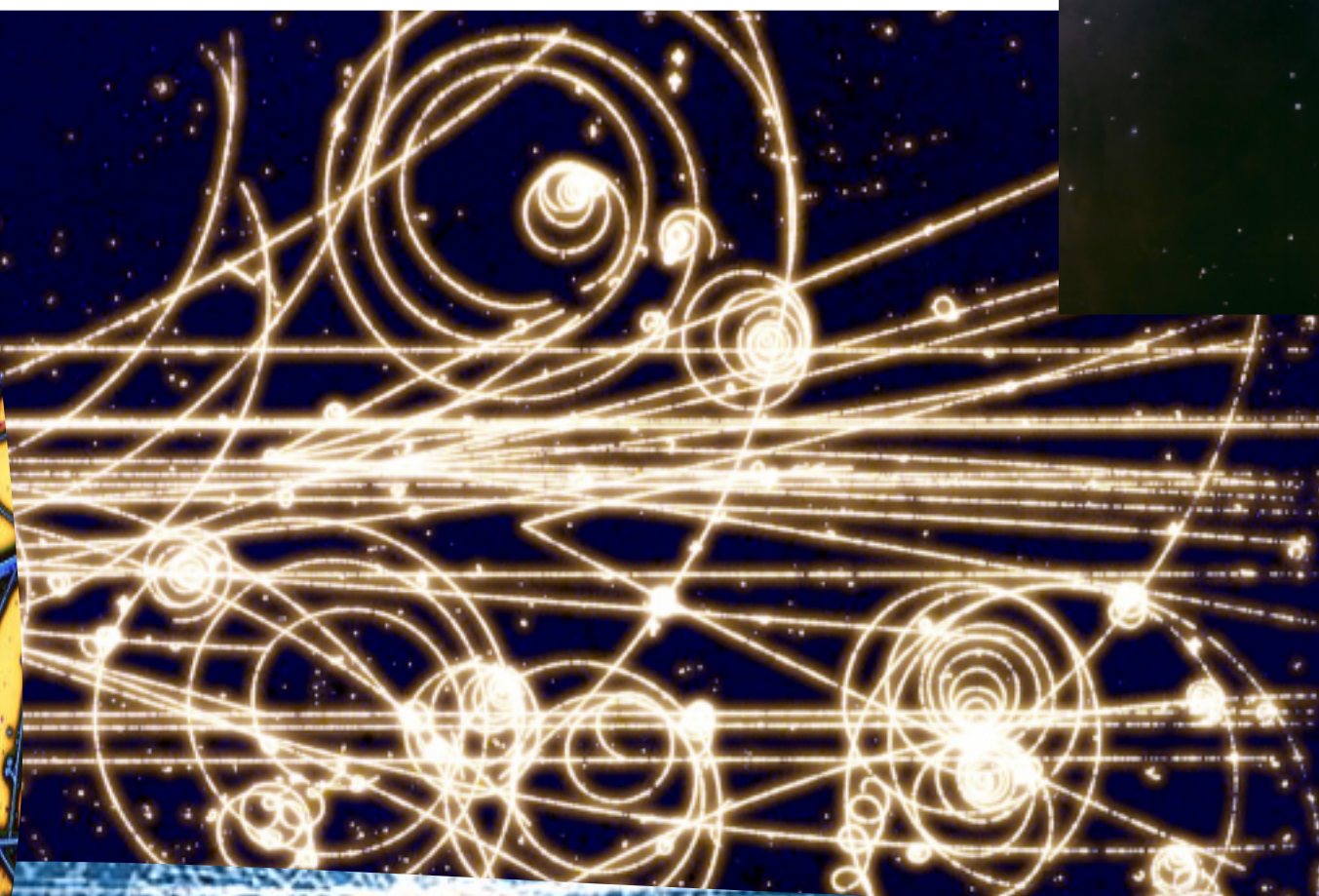


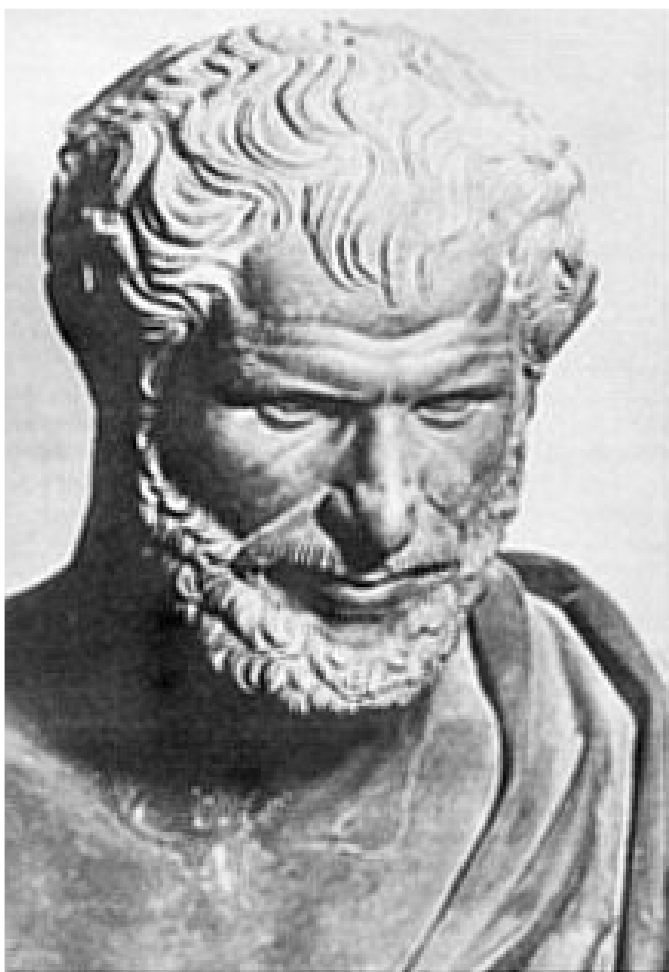
Due antiche domande

Da dove veniamo?



*Di che cosa
siamo fatti?*



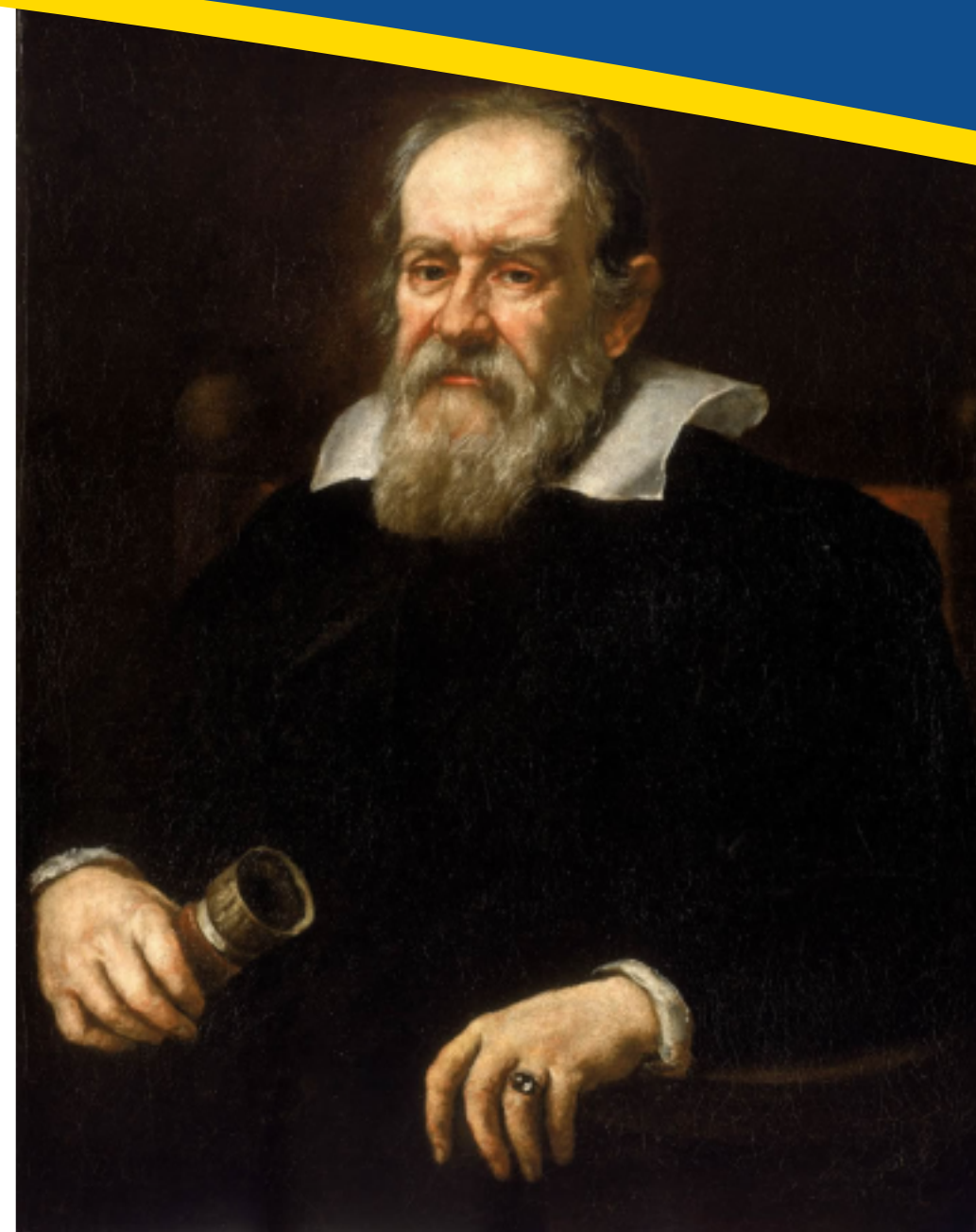


φιλοσοφία - ἄτομος

Δημόκριτος
460-370 a.C.

Quare in seminibus quoque idem fateare necessest,
esse aliam praeter plagas et pondera causam
motibus, unde haec est nobis innata potestas,
de nilo quoniam fieri nil posse videmus.

Titus Lucretius Carus, 98-55 a.C.
De Rerum Natura, (II, 284-287)



Fisica: Metodo Scientifico Sperimentale

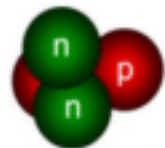
Galileo Galilei
1564-1642 a.C.



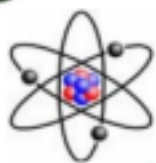
*40 ordini di
grandezza!*



Fisica delle Particelle



Fisica quantistica



Fisica Nucleare

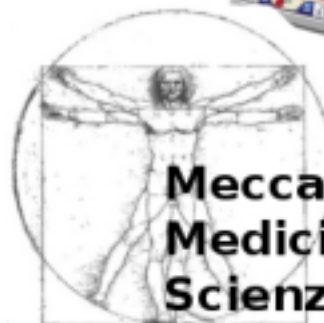
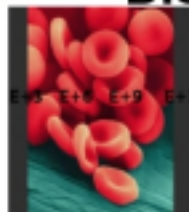


**Chimica
e Fisica Molecolare**

Genetica



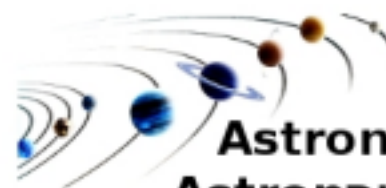
**Biologia
Biofisica**



**Meccanica
Medicina
Scienze Naturali**

$$\sum_{n=0}^{+\infty} \frac{1}{\binom{2n}{n}}$$

**Matematica
Informatica**



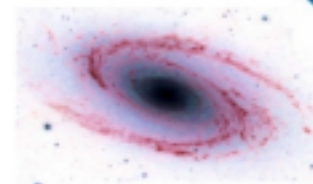
**Astronomia
Astronautica**



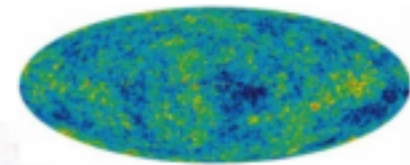
**Geologia
Ecologia
Geofisica**



**Geografia
Meteorologia**



Astrofisica



Cosmologia

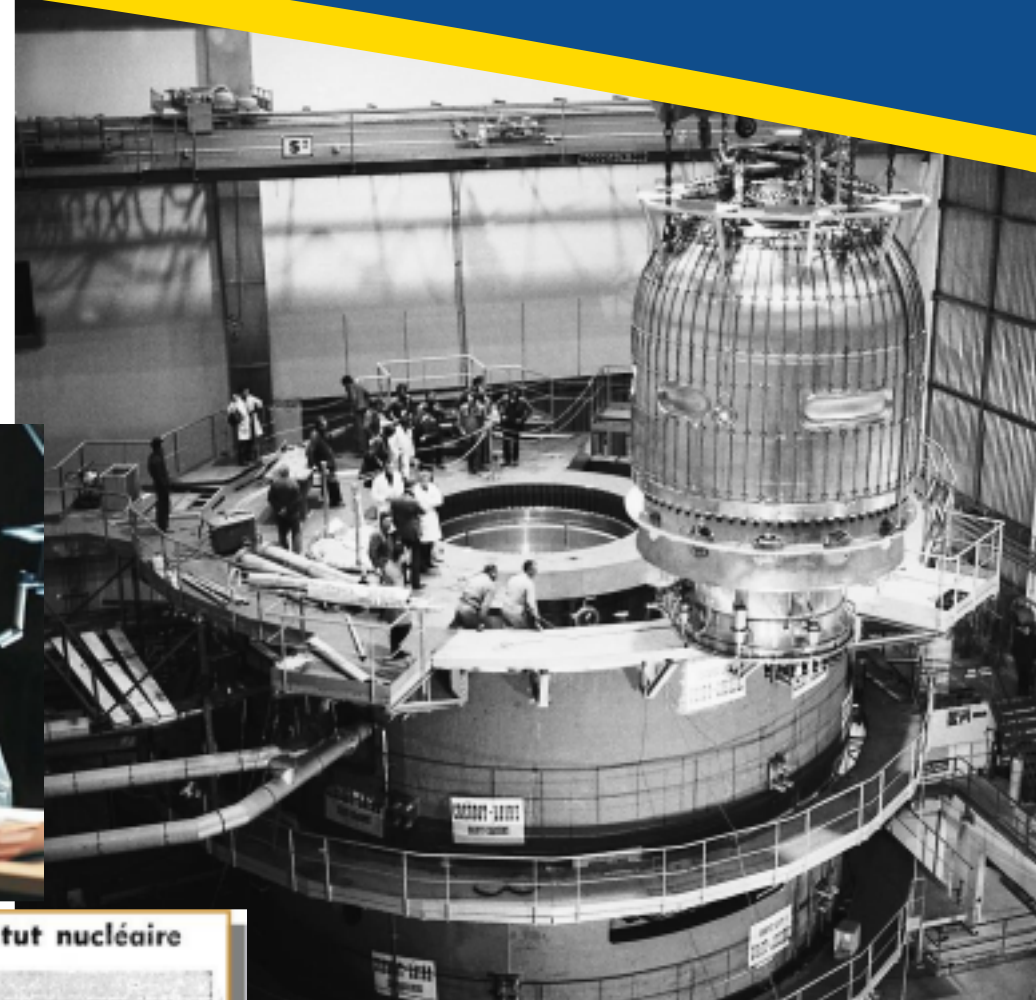
*500 anni
di ricerca
scientifica*

E-15	E-12	E-9	E-6	E-3	1m	E+3	E+6	E+9	E+12	E+15	E+18	E+21	E+24
fm	pm	nm	μm	mm	m	Km	Mm	Gm	Tm	Pm	Em	Zm	Ym



1954 *nasce il CERN*

1954 Foundation
1959 PS Startup
1968 Charpak detector
1971 First proton-proton collision
1973 Neutral currents revealed
1976 SPS Commissioned
1983 W and Z Discovery
1984 Nobel Prize, C Rubbia
1986 Heavy ion collision
1989 Giant LEP
1990 World Wide Web
1995 AntiMatter
2002 GRID
2004 50 Years!
2008 LHC Startup
2009 LHC Energy Record





Il CERN oggi



2500 Staff
750 Fellows e Associates
10000 Totale + Users

982 MCHF (610ME) Budget/year

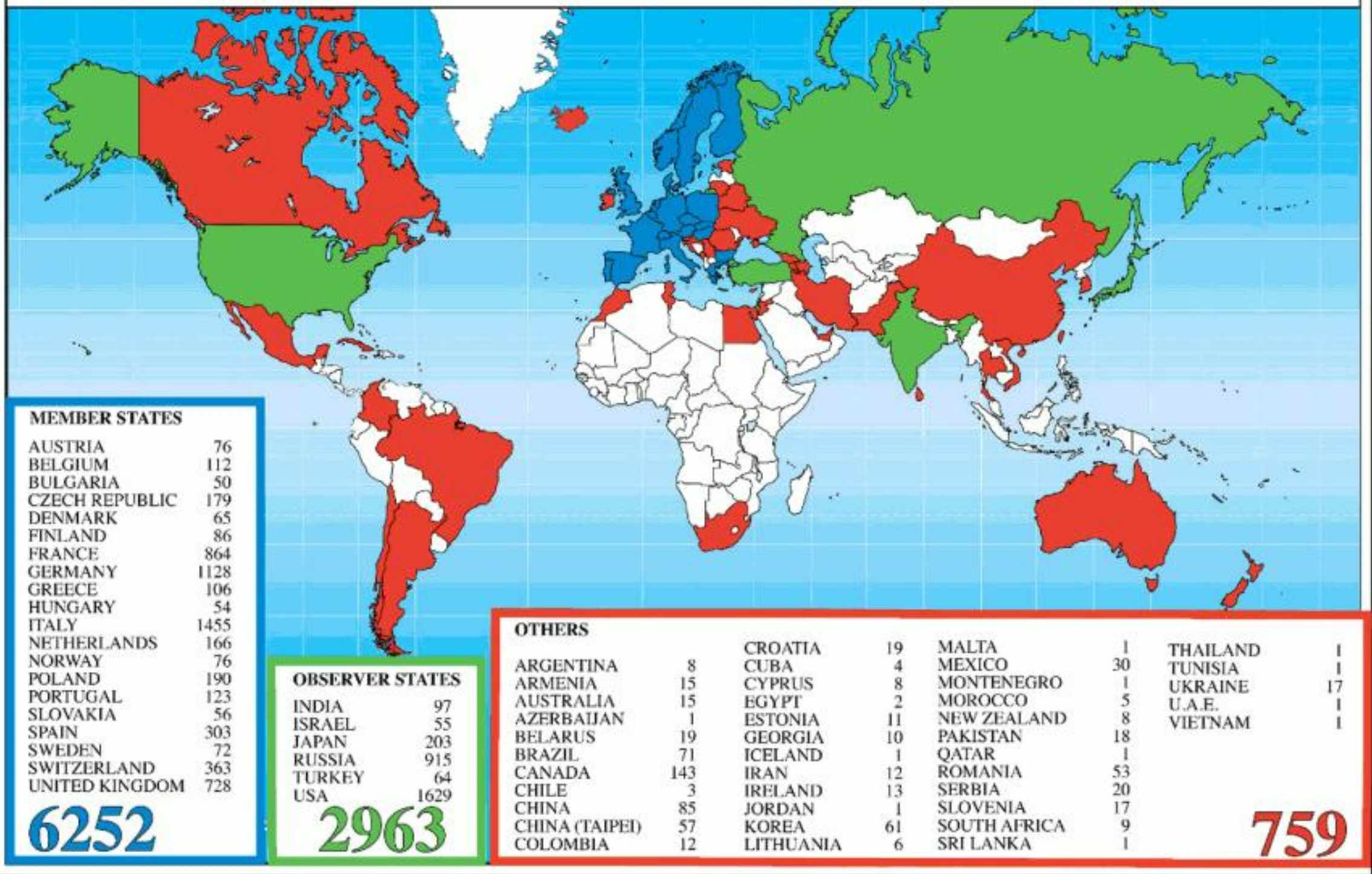
34Km Laboratori sotterranei!





Gli scienziati del CERN

Distribution of All CERN Users by Nation of Institute on 27 October 2009





La nostra missione

Research

Seeking and finding answers to questions about the Universe

Technology

Advancing the frontiers of technology

Collaborating

Bringing nations together through science

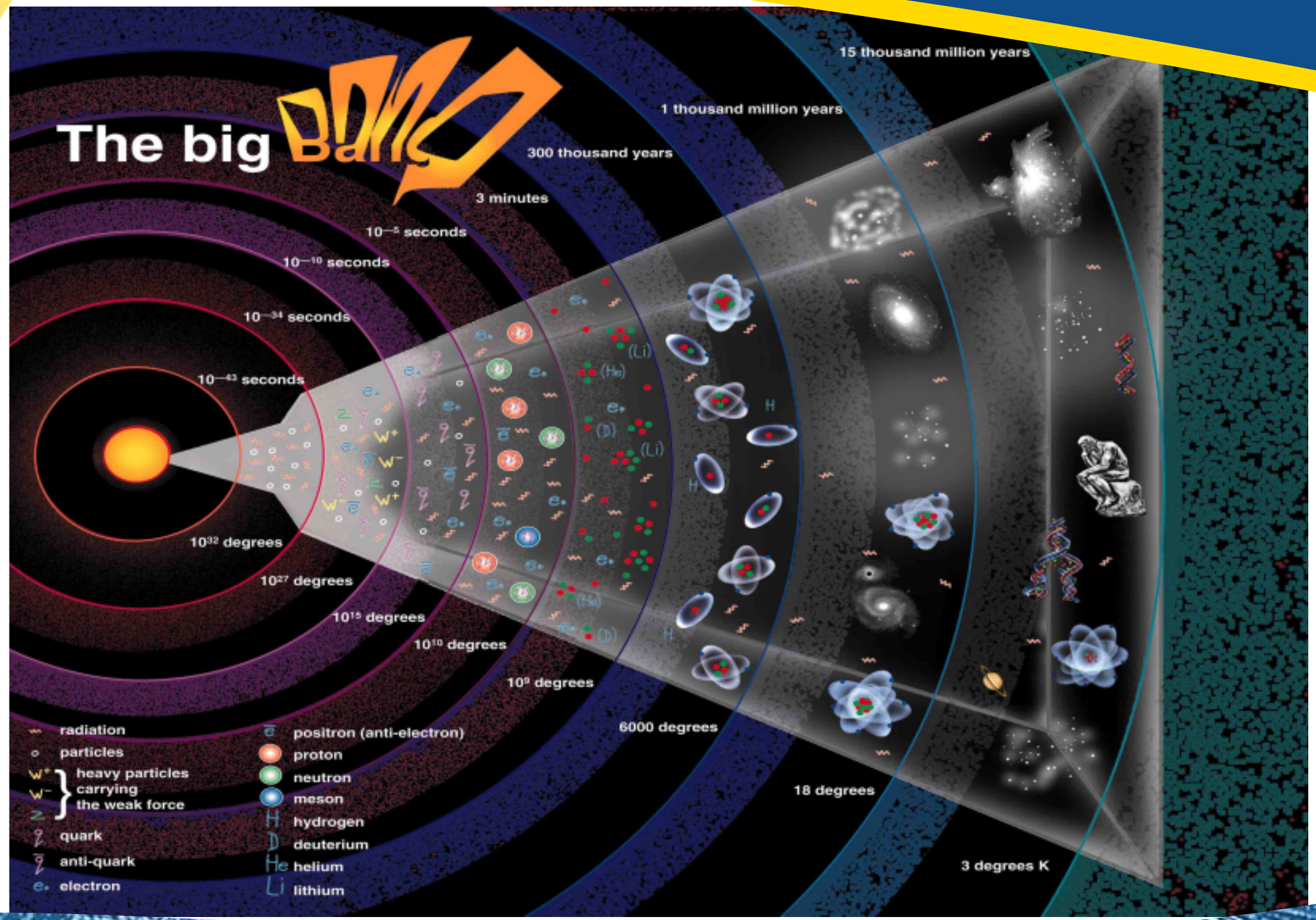
Education

Training the scientists of tomorrow



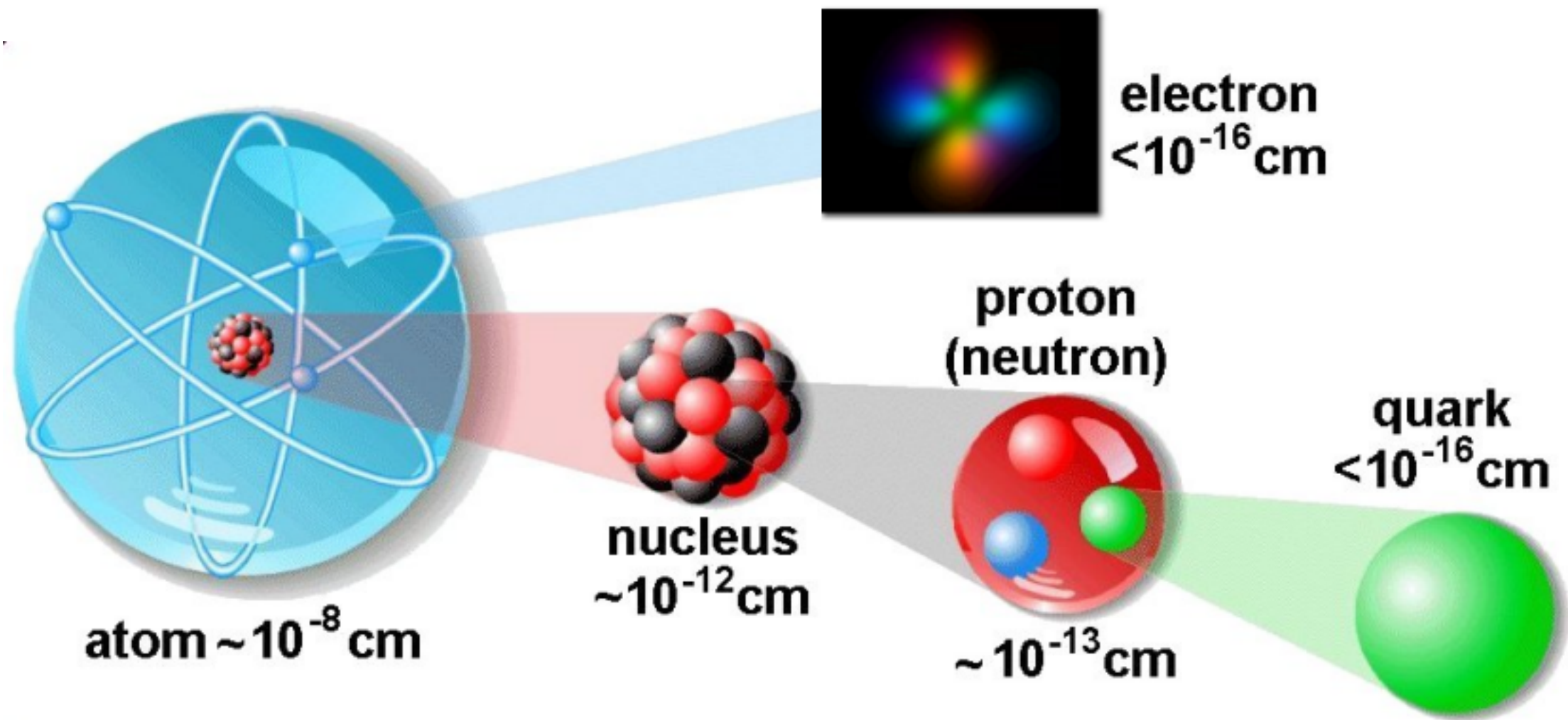


Vita dell'universo





Struttura della materia





Il Modello Standard

Three Generations of Matter (Fermions)

	I	II	III	
mass→	2.4 MeV	1.27 GeV	171.2 GeV	0
charge→	□	□	□	0
spin→	1/2	1/2	1/2	1
 Quarks	u up	c charm	t top	γ photon
	4.8 MeV -□ 1/2	104 MeV -□ 1/2	4.2 GeV -□ 1/2	g gluon
 Lepton	<2.2 eV 0 1/2 ν_e electron neutrino	<0.17 MeV 0 1/2 ν_μ muon neutrino	<15.5 MeV 0 1/2 ν_τ tau neutrino	91.2 GeV 0 1 Z⁰ weak force
	0.511 MeV -1 1/2 e electron	105.7 MeV -1 1/2 μ muon	1.777 GeV -1 1/2 τ tau	80.4 GeV ±1 1 W[±] weak force
				Bosons

Electro Magnetic

Strong

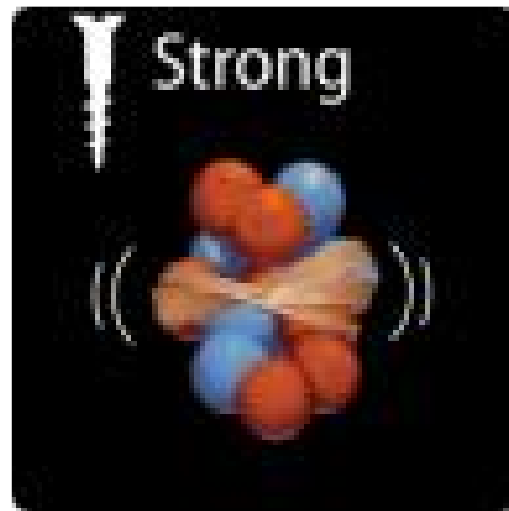
Weak



Quattro forze fondamentali



Fotone



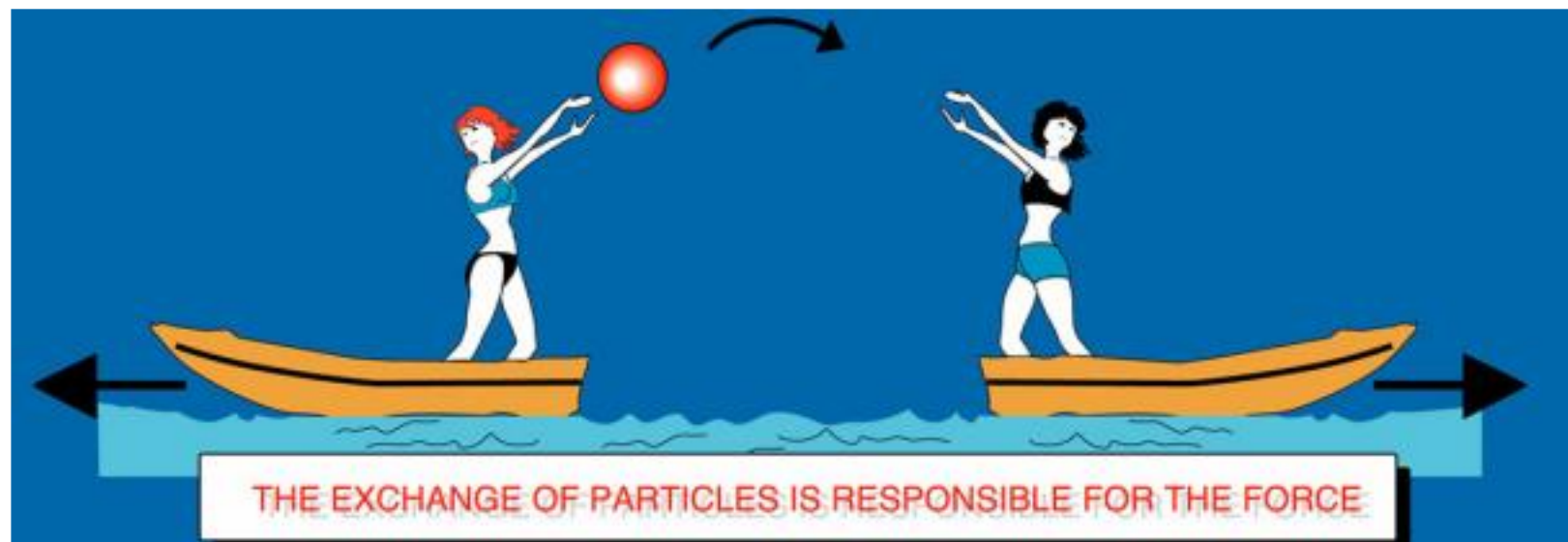
Gluone



W, Z



???





Il Modello Standard

Three Generations of Matter (Fermions)

	I	II	III	
mass→	2.4 MeV	1.27 GeV	171.2 GeV	0
charge→	□	□	□	0
spin→	1/2	1/2	1/2	1
 Quarks	u up	c charm	t top	γ photon
	4.8 MeV	104 MeV	4.2 GeV	0
	-□	-□	-□	0
	1/2	1/2	1/2	1
 Lepton	d down	s strange	b bottom	g gluon
	<2.2 eV	<0.17 MeV	<15.5 MeV	91.2 GeV
	0	0	0	0
	1/2	1/2	1/2	1
	ν_e electron neutrino	ν_μ muon neutrino	ν_τ tau neutrino	Z⁰ weak force
	0.511 MeV	105.7 MeV	1.777 GeV	80.4 GeV
	-1	-1	-1	± 1
	1/2	1/2	1/2	1
	e electron	μ muon	τ tau	W[±] weak force

Electro Magnetic

Strong

Weak

Bosons



Il Modello Standard

Three Generations of Matter (Fermions)

	I	II	III	
mass→	2.4 MeV	1.27 GeV	171.2 GeV	0
charge→	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	0
spin→	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1
 Quarks	u up	c charm	t top	γ photon
	d down	s strange	b bottom	g gluon
 Lepton	<2.2 eV ν_e electron neutrino	<0.17 MeV ν_μ muon neutrino	<15.5 MeV ν_τ tau neutrino	91.2 GeV Z^0 weak force
	0.511 MeV -1 $\frac{1}{2}$ e electron	105.7 MeV -1 $\frac{1}{2}$ μ muon	1.777 GeV -1 $\frac{1}{2}$ τ tau	80.4 GeV ± 1 $\frac{1}{2}$ $W^\pm$ weak force

Electro Magnetic

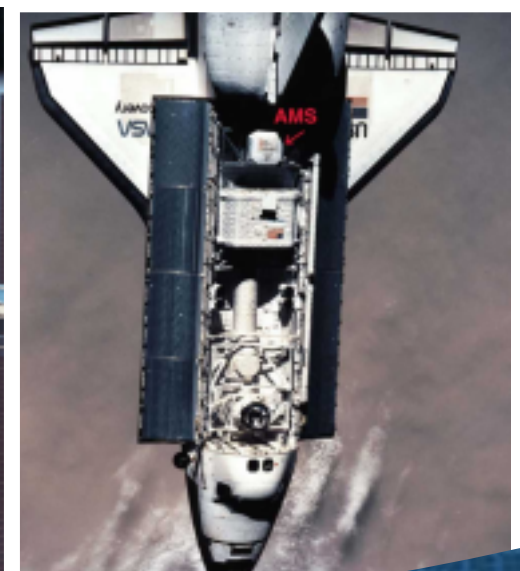
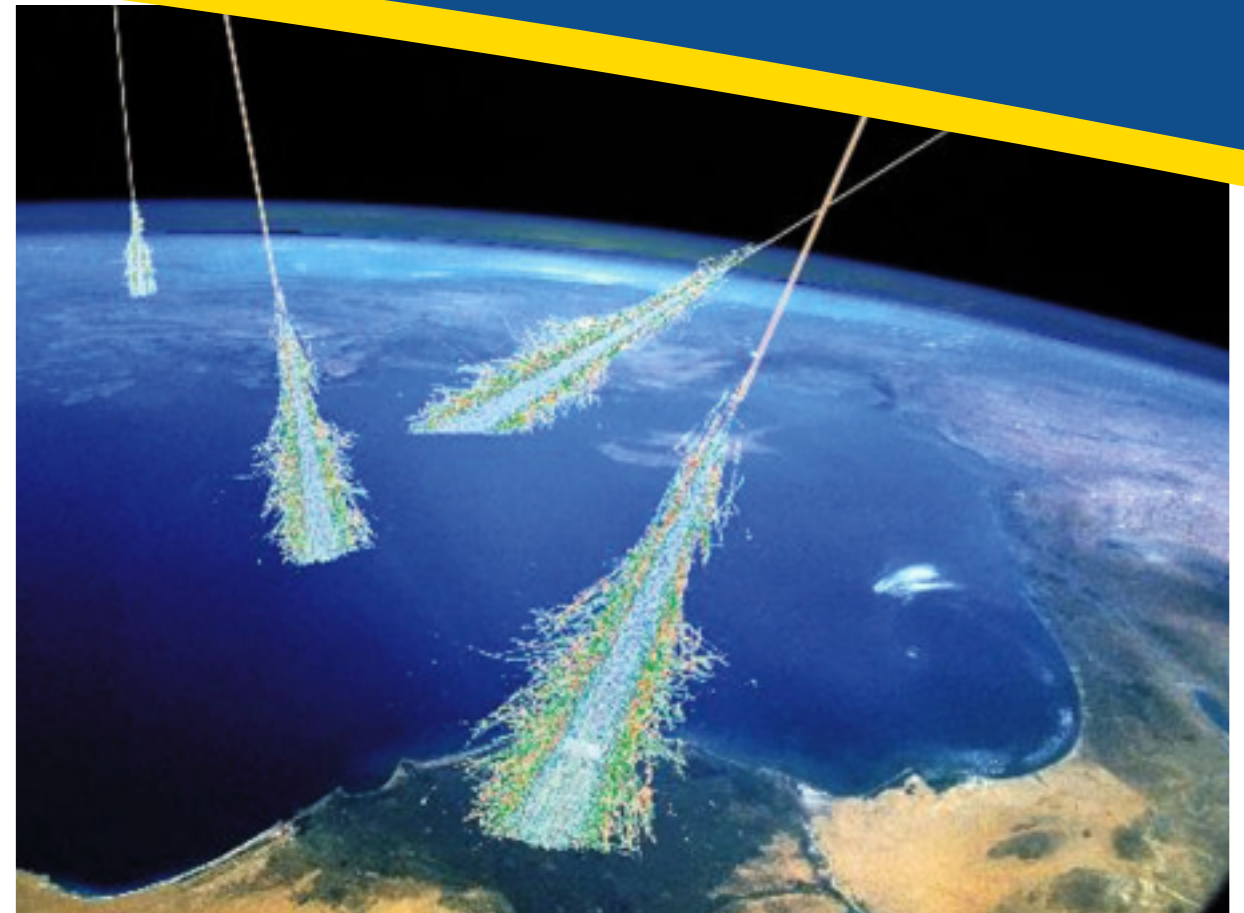
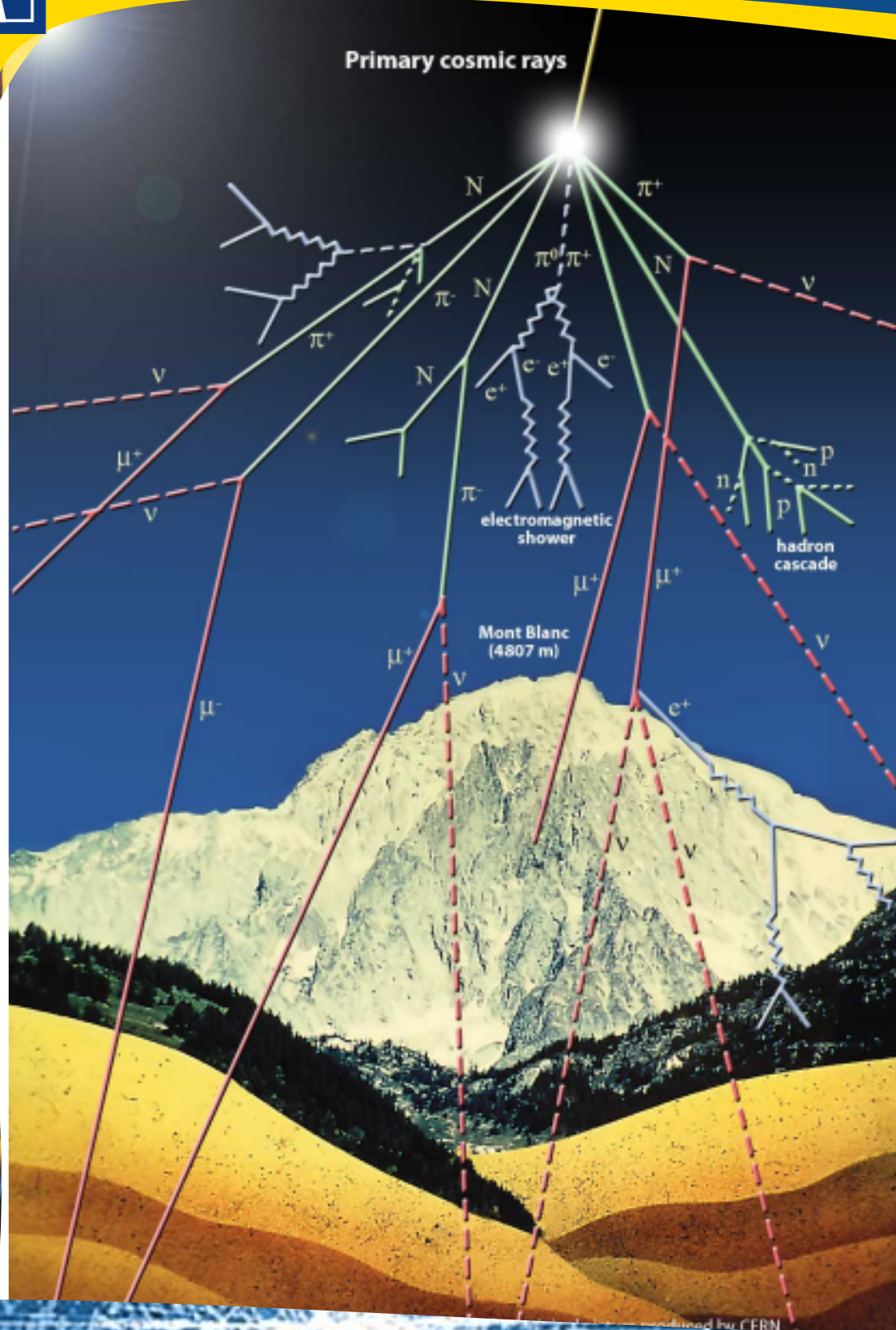
Strong

Weak

Bosons

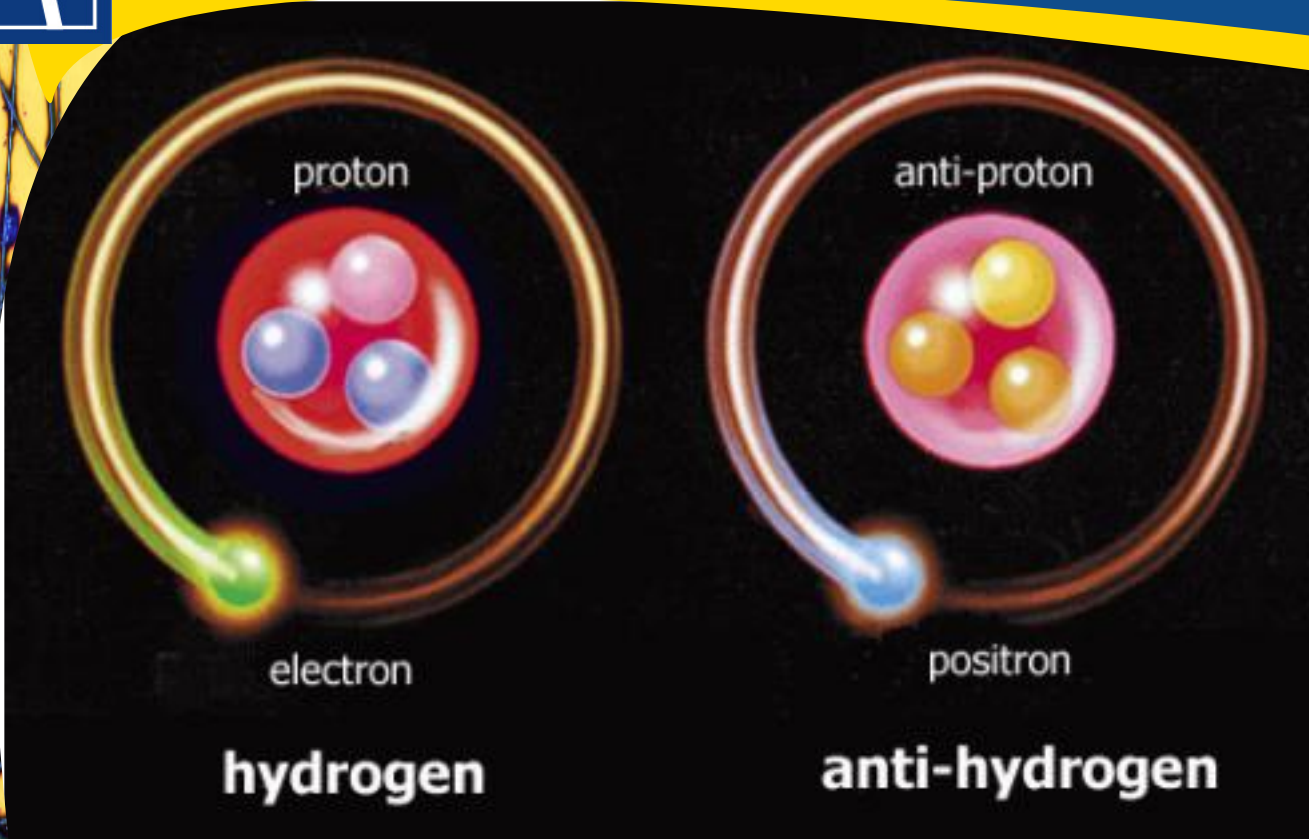


Alta energia: Raggi cosmici

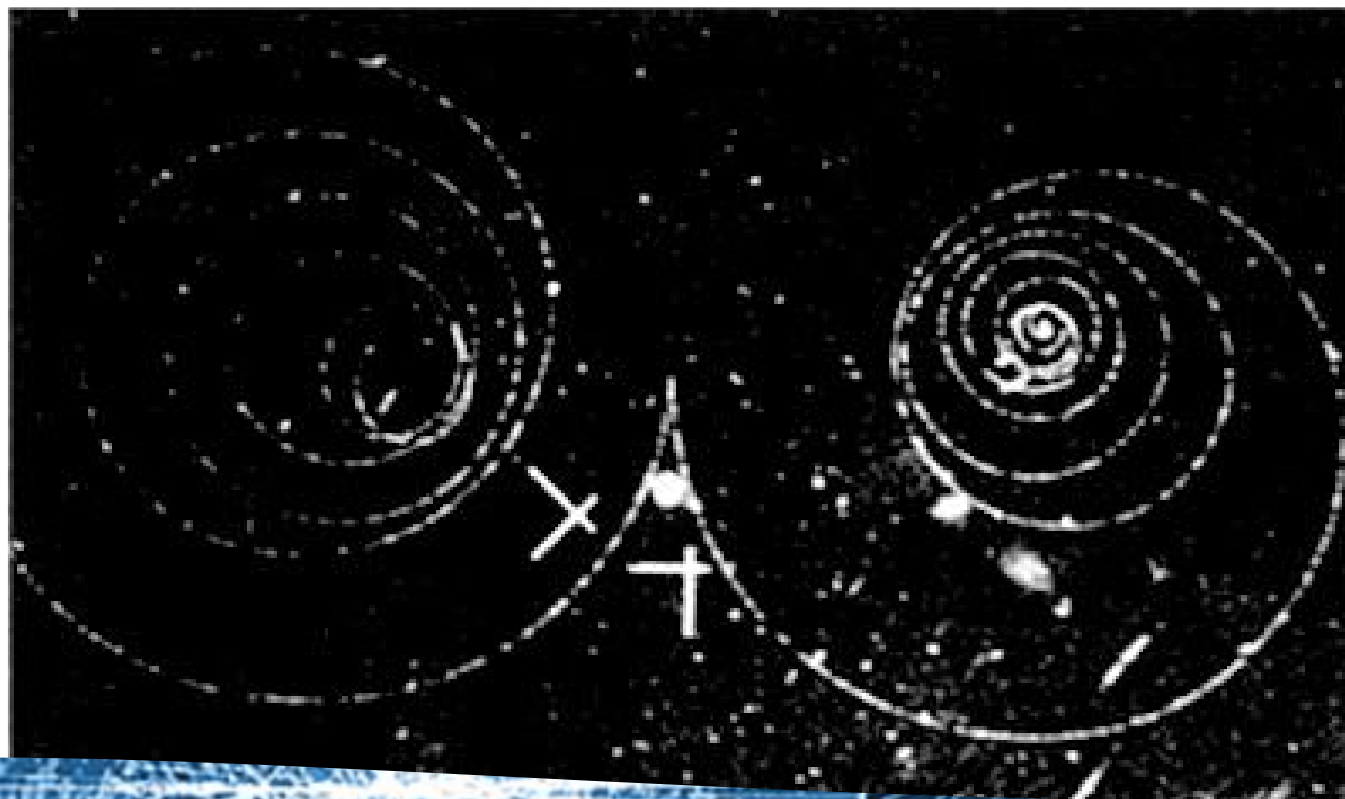




Materia e... ...antimateria!

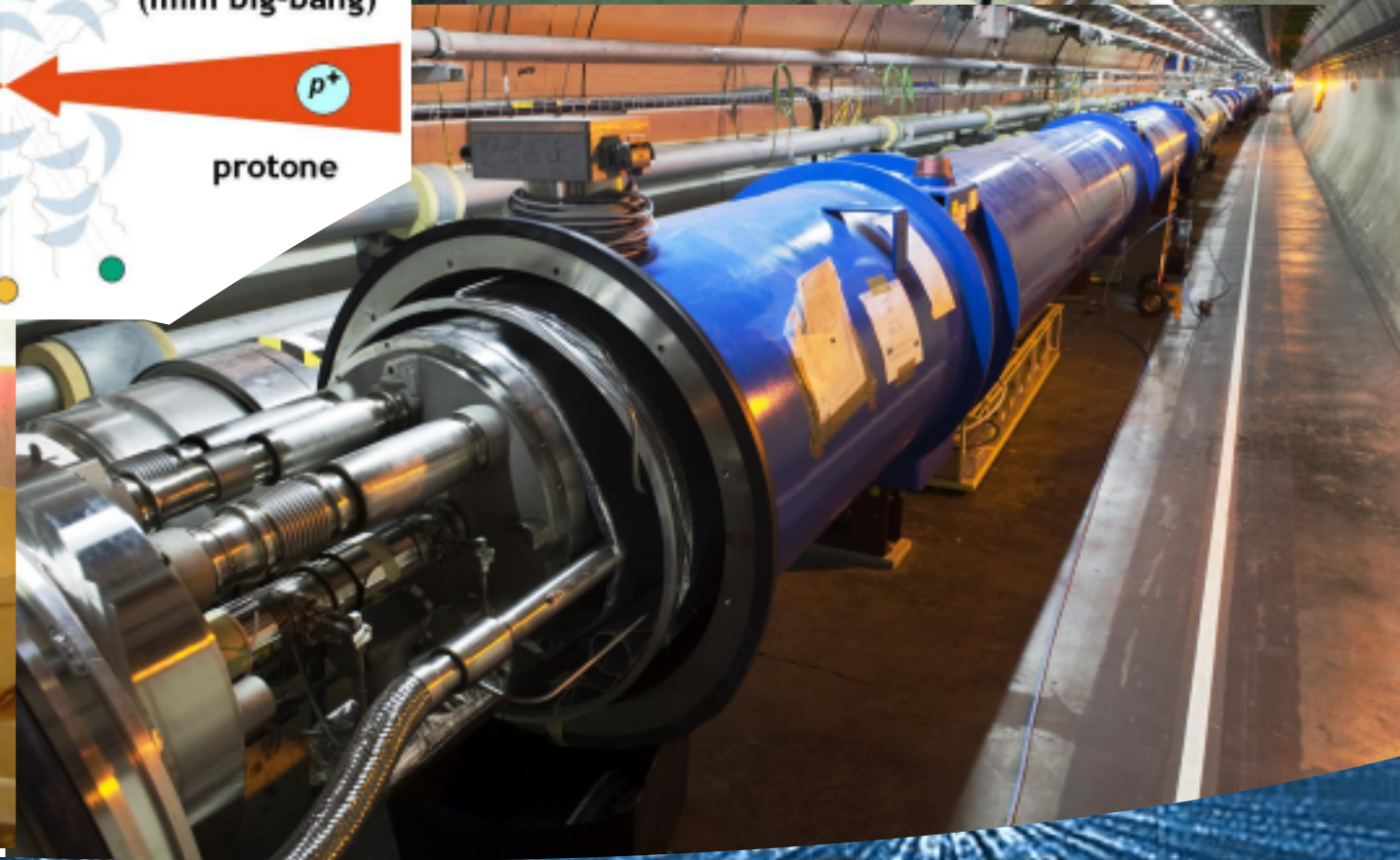
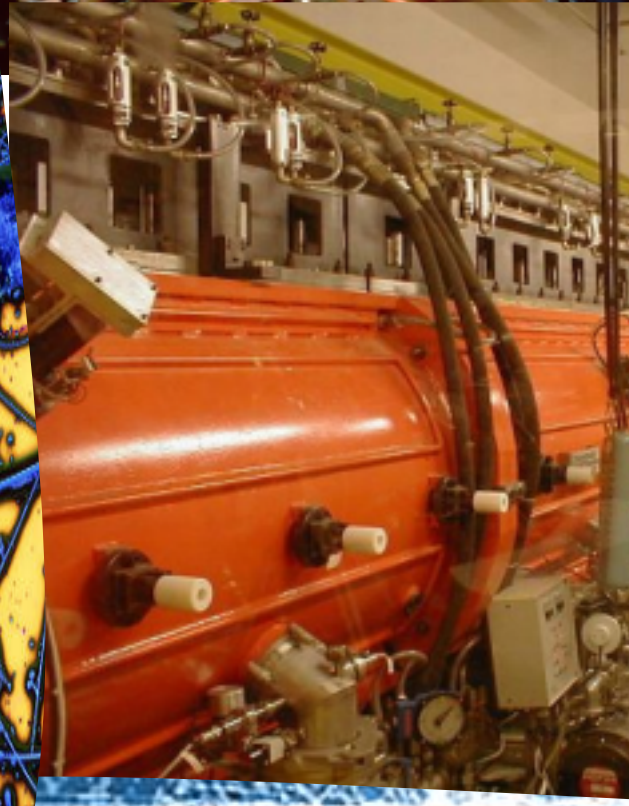
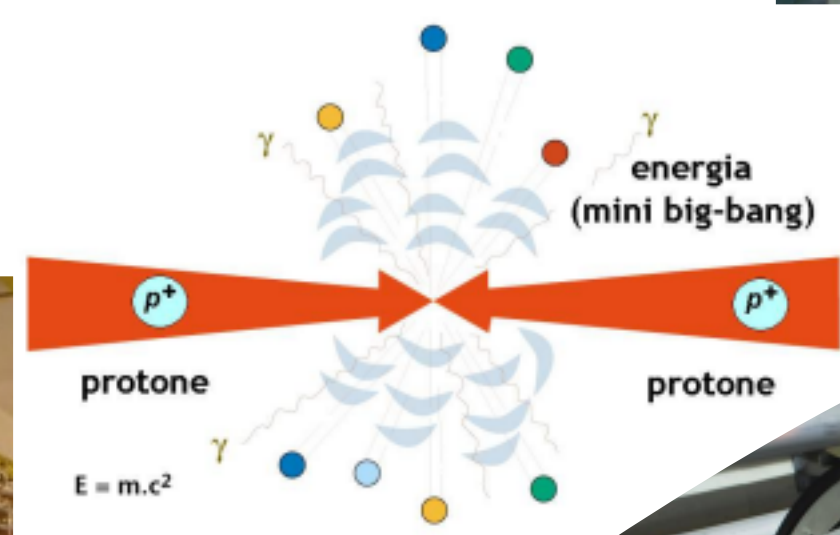
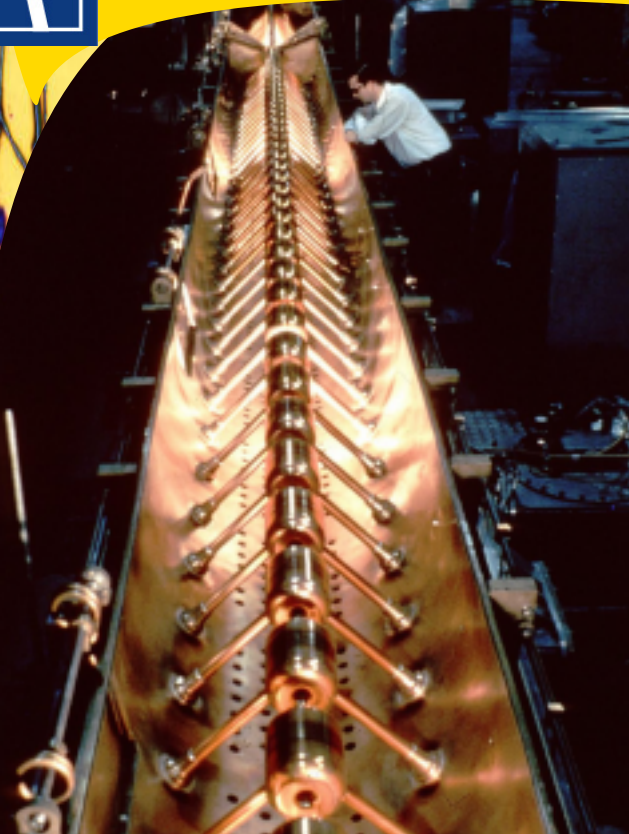
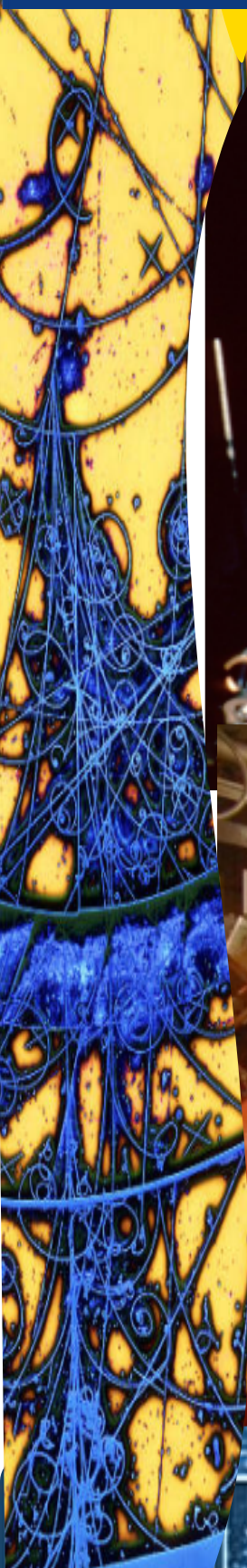


Quarks		Anti-quarks	
u	d	$\bar{u}$	$\bar{d}$
up	down		
t	b	$\bar{t}$	$\bar{b}$
top	bottom		
s	c	$\bar{s}$	$\bar{c}$
strange	charm		
Leptons		Anti-leptons	
e	ν_e	e^+	$\bar{\nu}_e$
electron	electron neutrino		
μ	ν_μ	$\bar{\mu}$	$\bar{\nu}_\mu$
muon	muon neutrino		
τ	ν_τ	$\bar{\tau}$	$\bar{\nu}_\tau$
tau	tau neutrino		



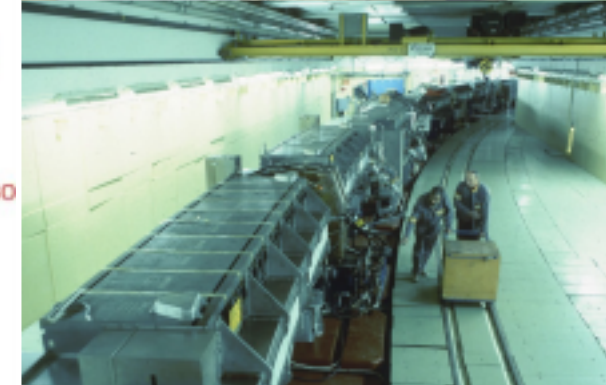
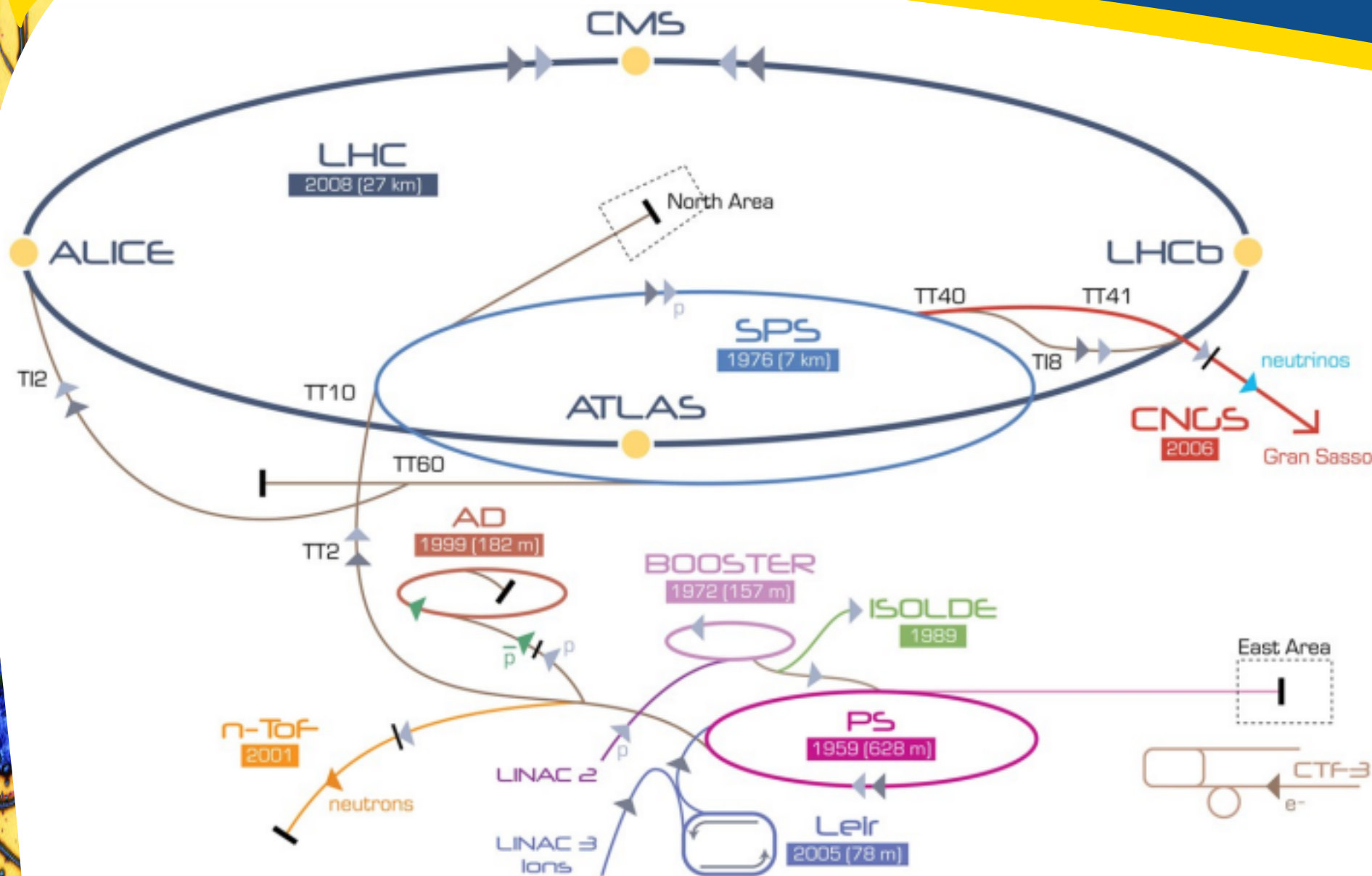


Alta energia: acceleratori





Acceleratori del CERN



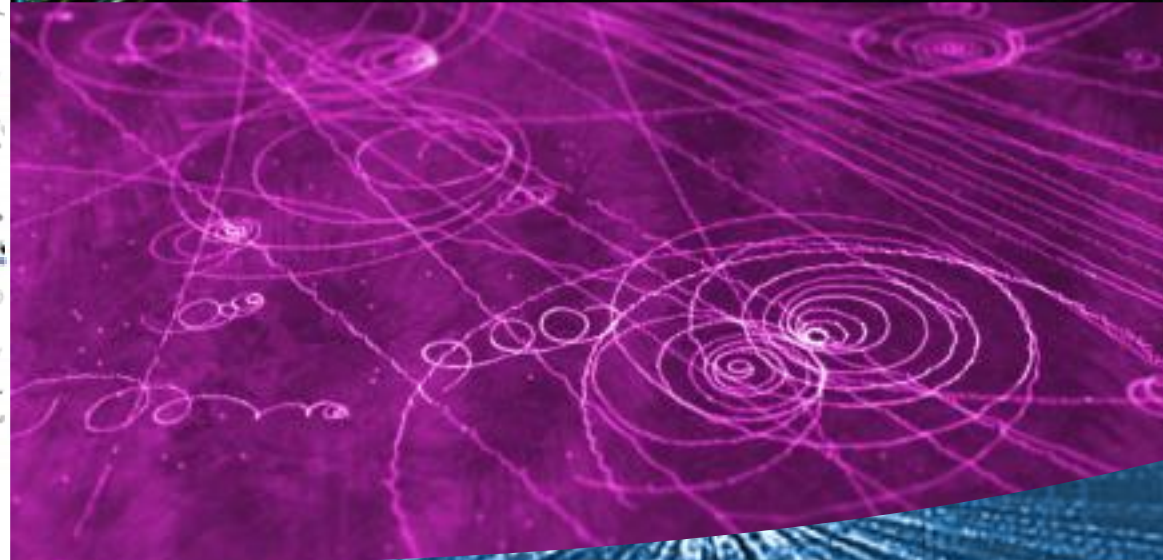
p [proton] ion neutrons $\bar{p}$ [antiproton] proton/antiproton conversion neutrinos electron

LHC Large Hadron Collider SPS Super Proton Synchrotron PS Proton Synchrotron

Antiproton Decelerator CTF-3 Clic Test Facility CNGS CERN Neutrinos to Gran Sasso ISOLDE Isotope Separator OnLine DEvice
Linear Emulsion Ring LINAC LINEAR ACcelerator n-ToF Neutrons Time Of Flight

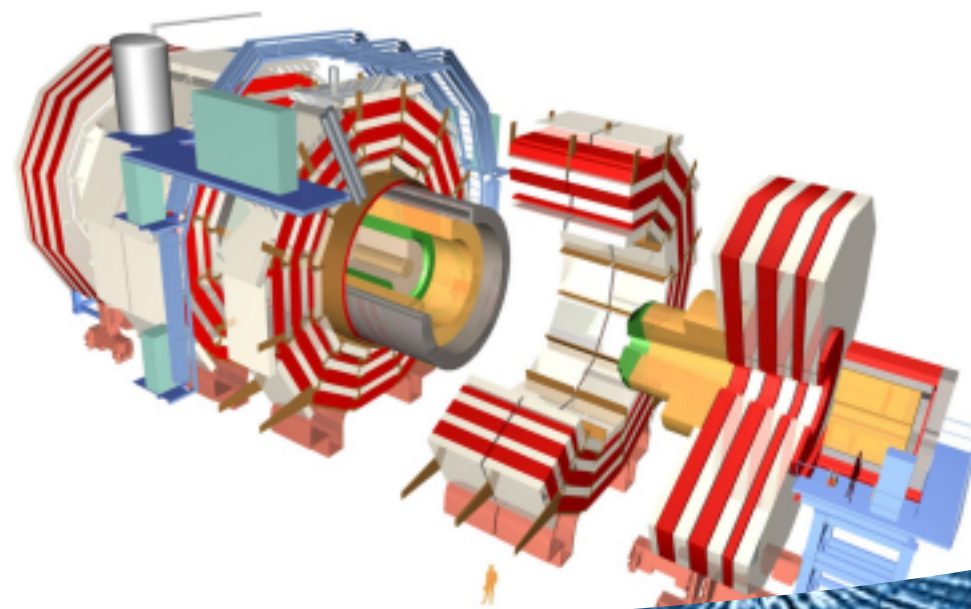
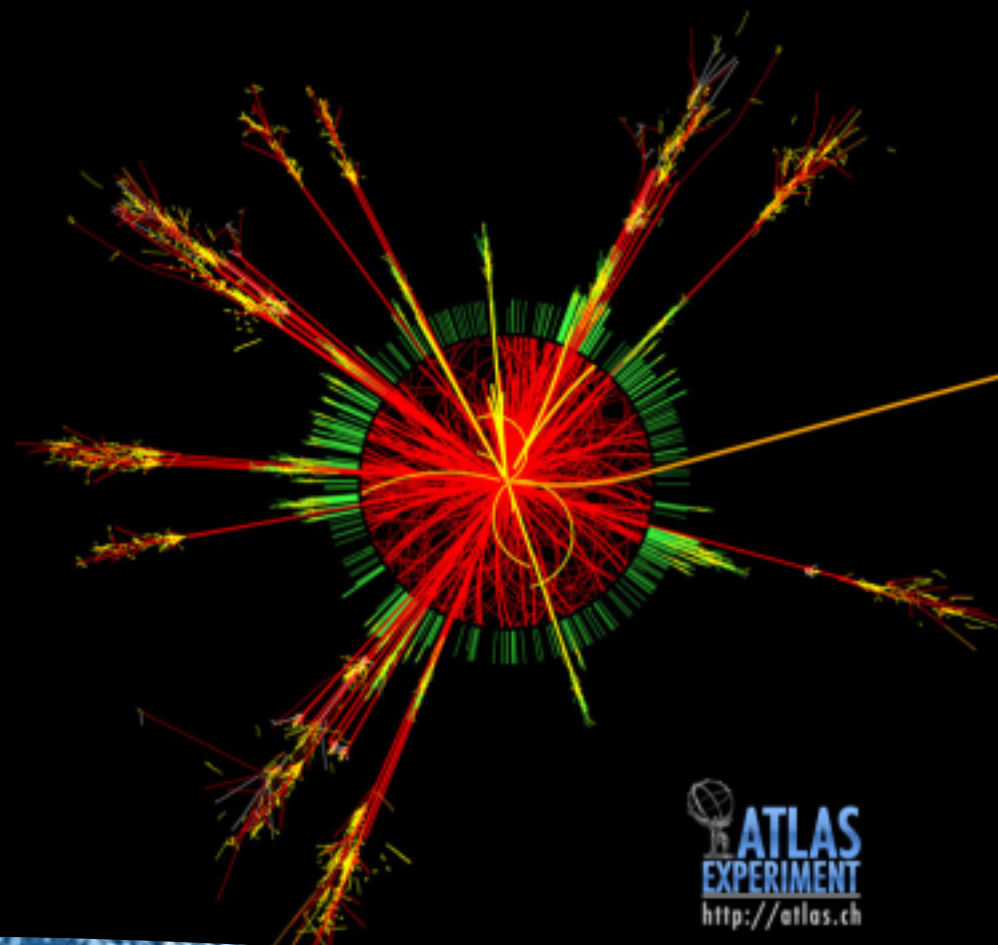
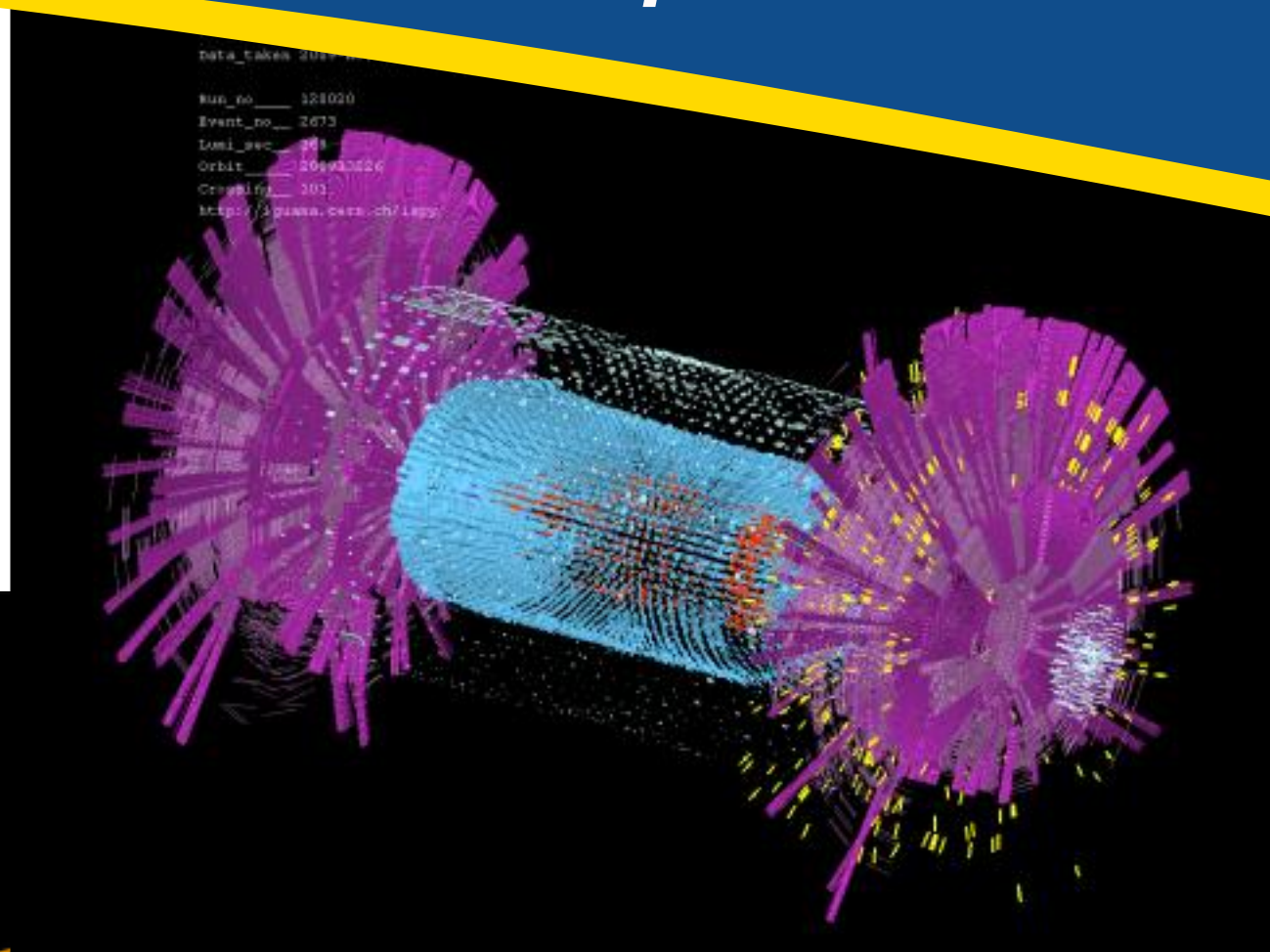
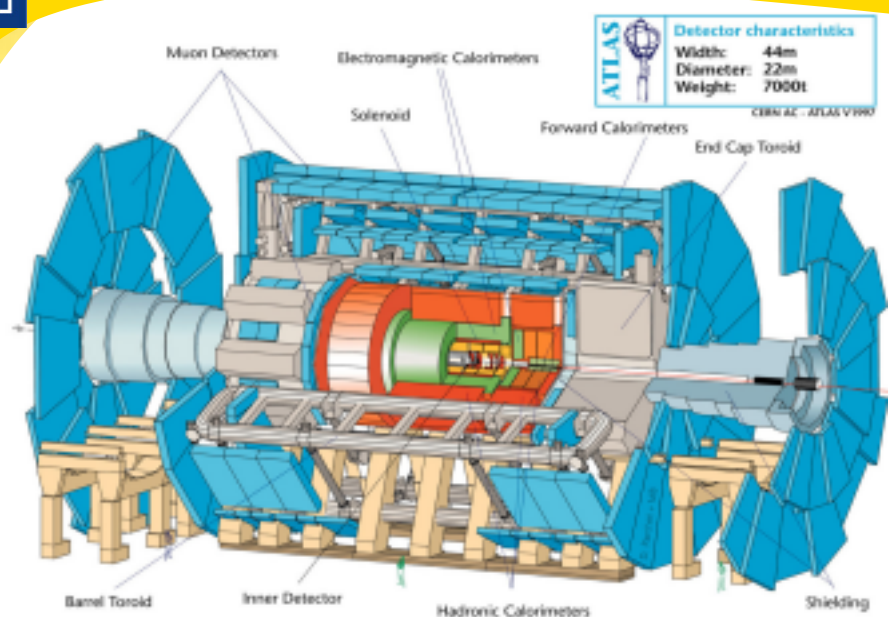


Collisioni da fotografare



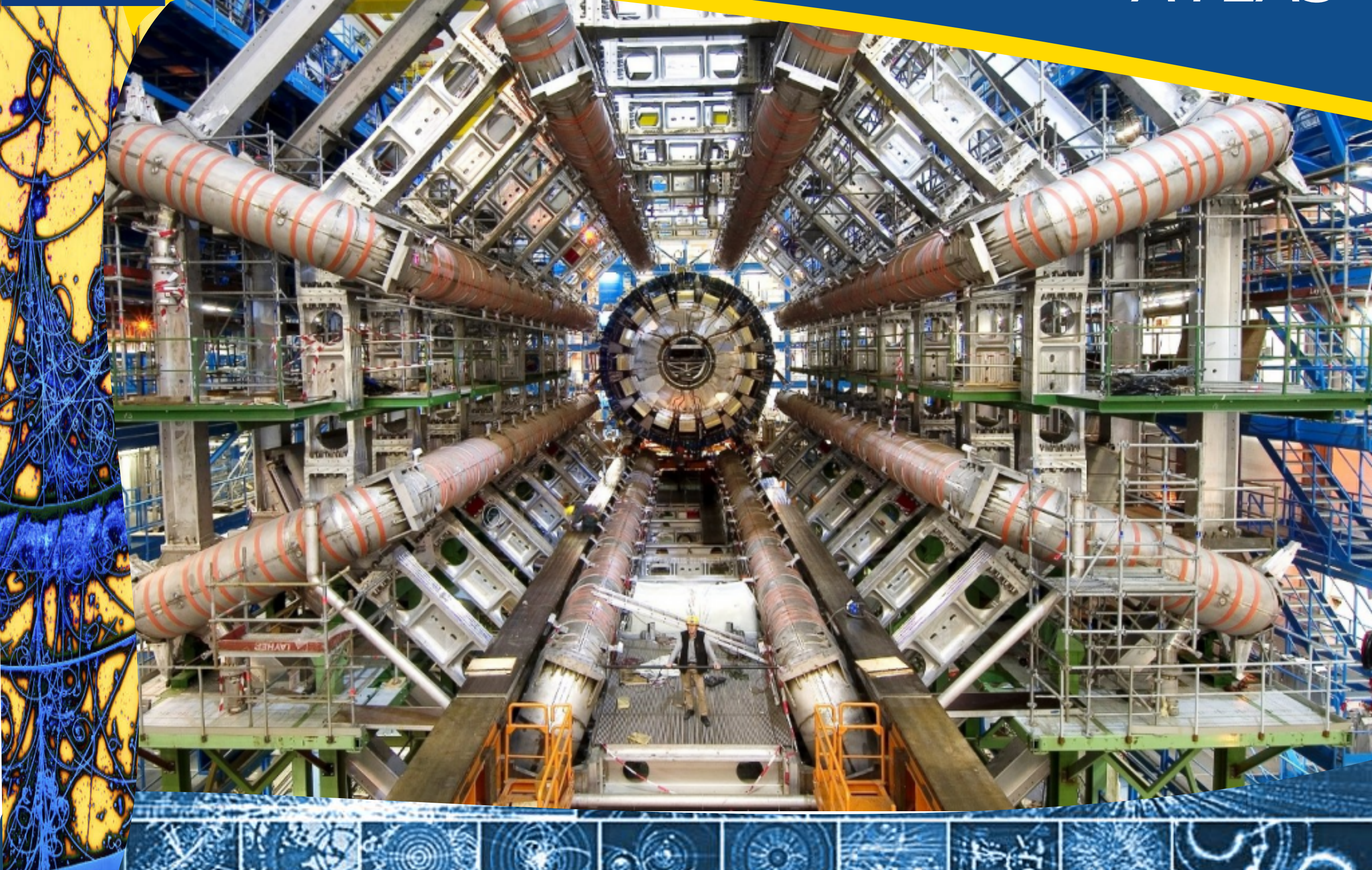


Tracciatori di particelle





Rivelatore **ATLAS**







Rivelatore CMS

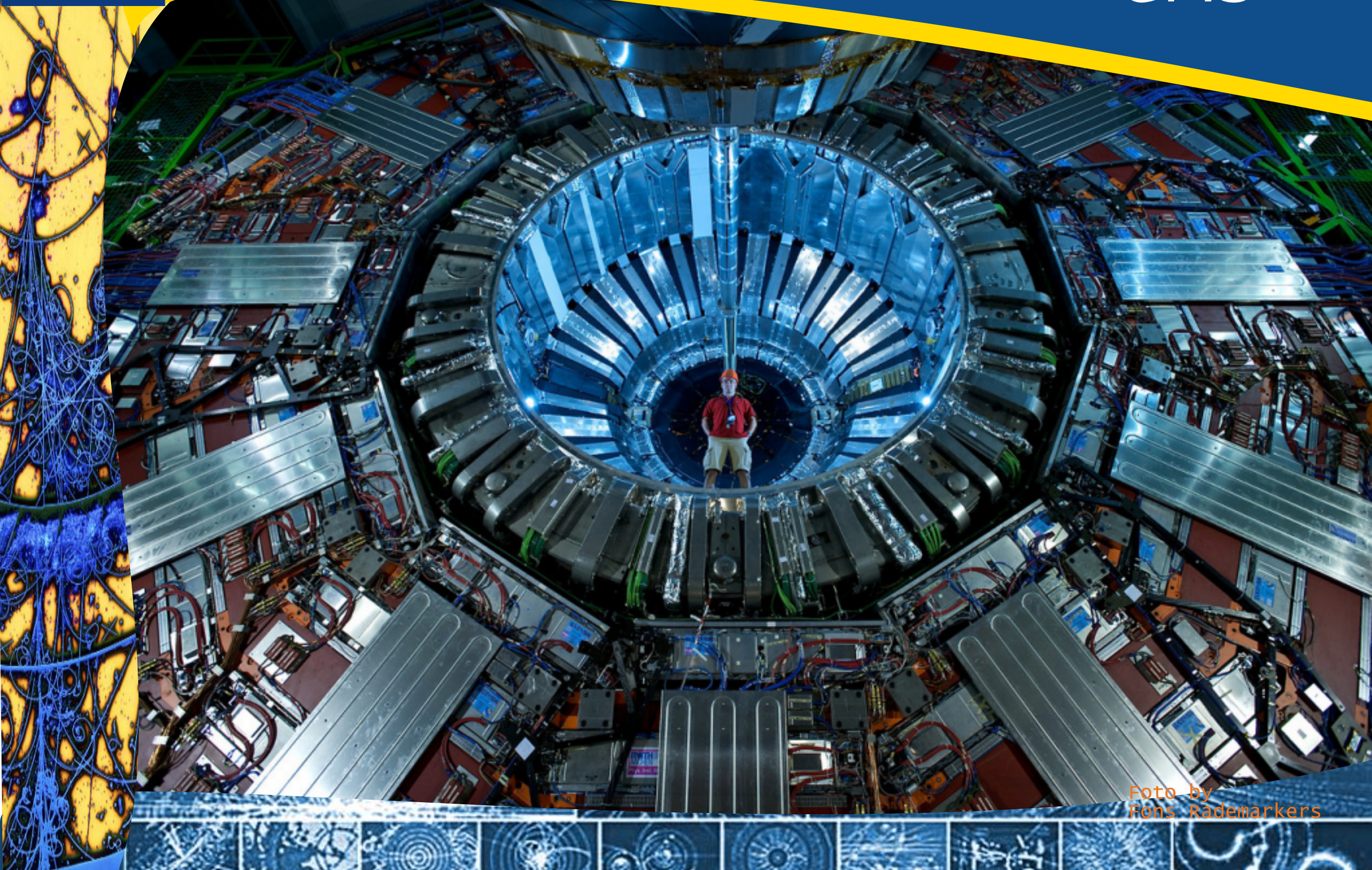


Foto by
Fons Rademarkers

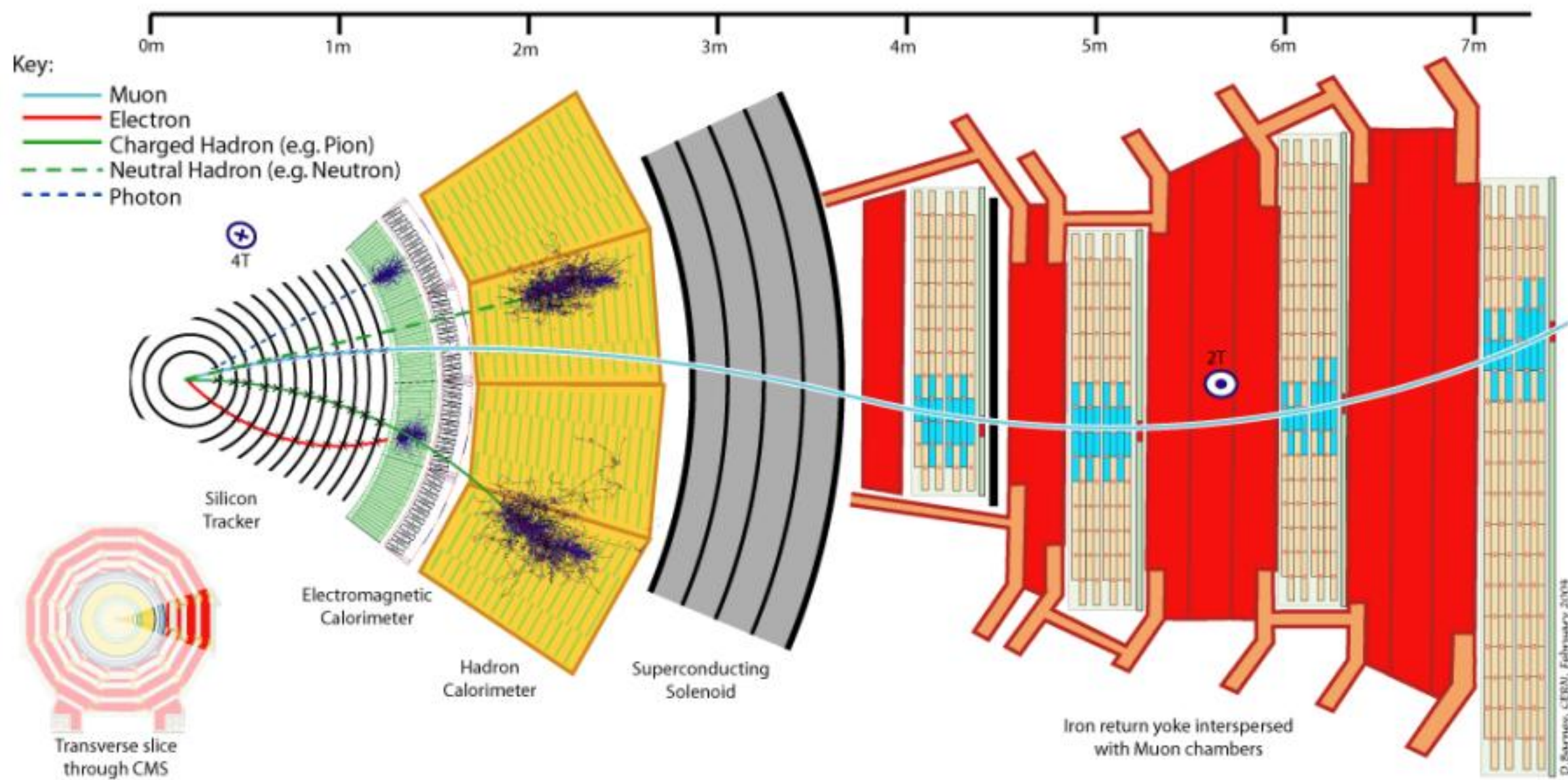


Rivelatore LHCb



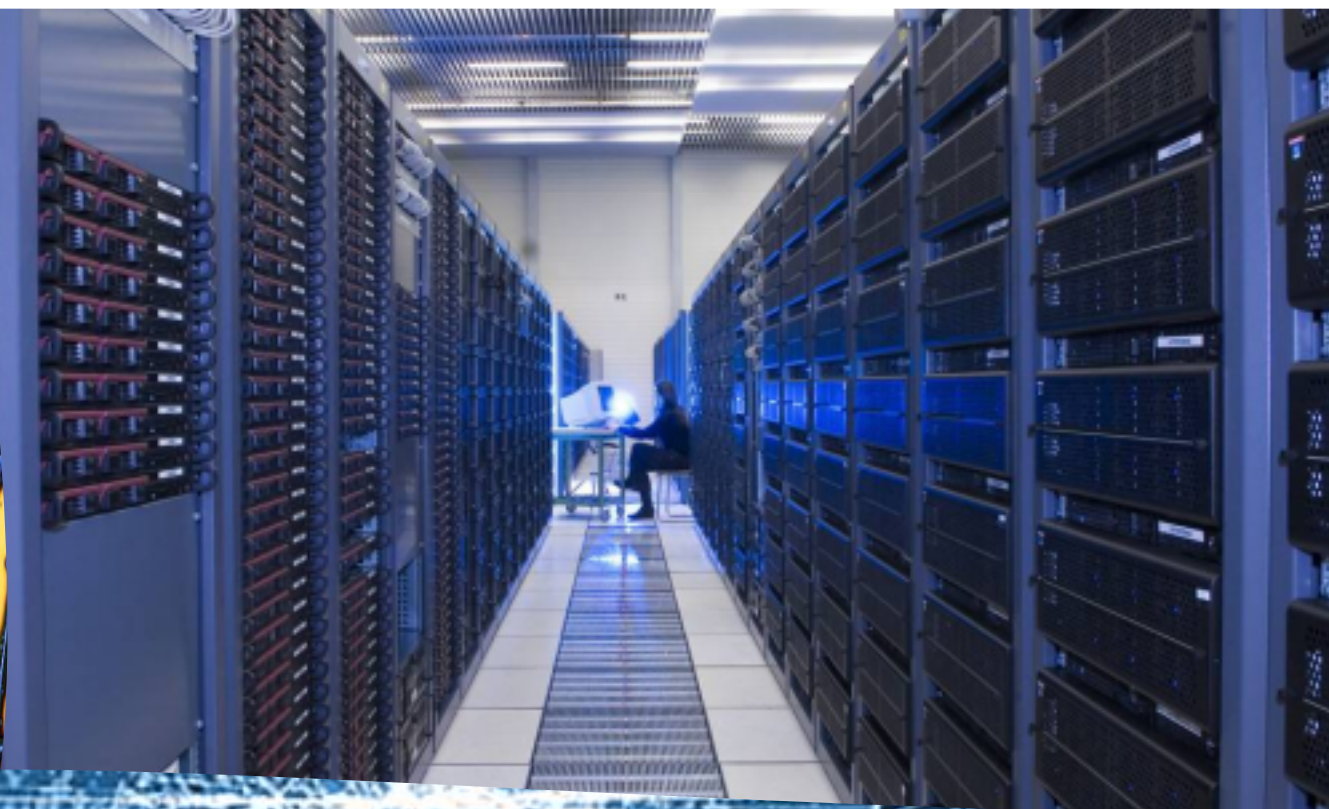


Perche' cosi grandi?



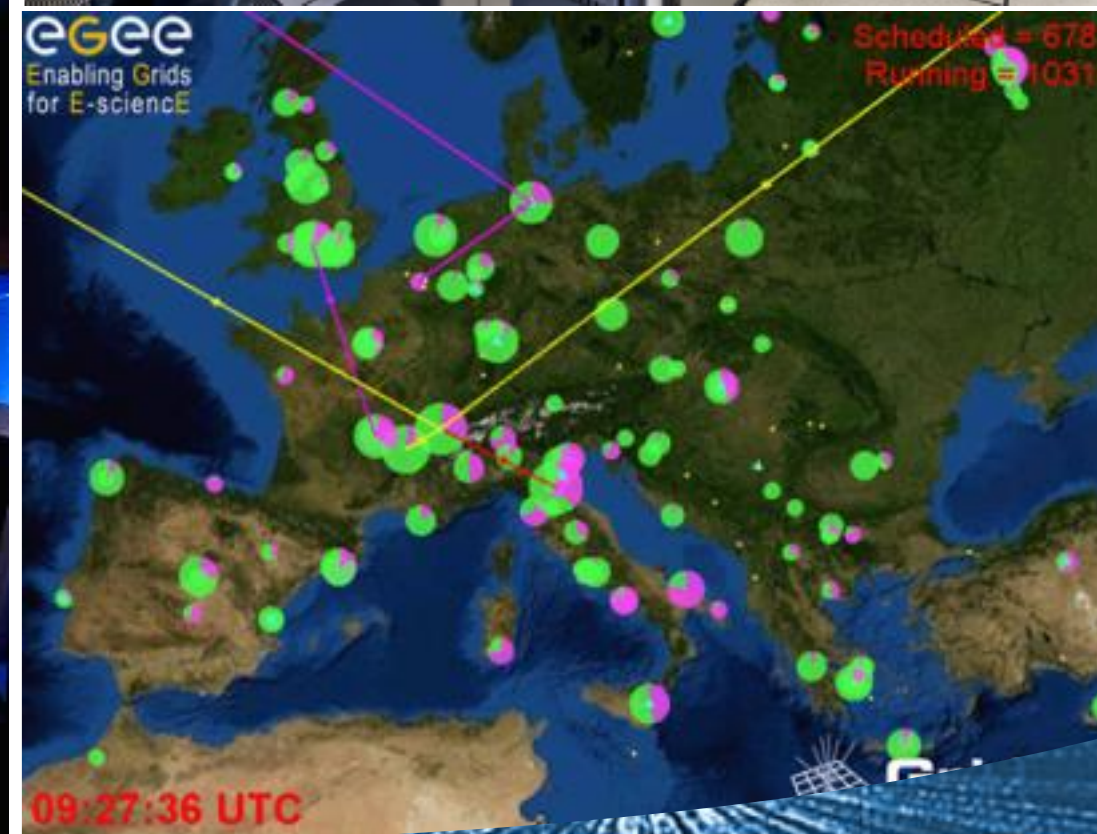


CERN Computer Center





GRID computing





World Wide Web

<http://info.cern.ch>



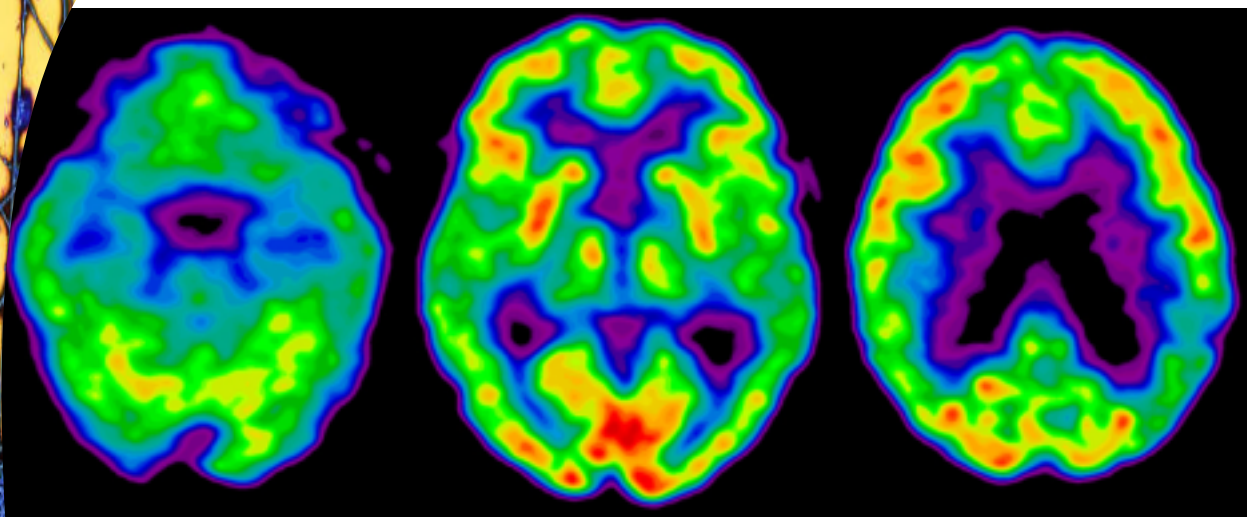
Google Search I'm Feeling Lucky

[Advanced Search](#)
[Preferences](#)
[Language Tools](#)





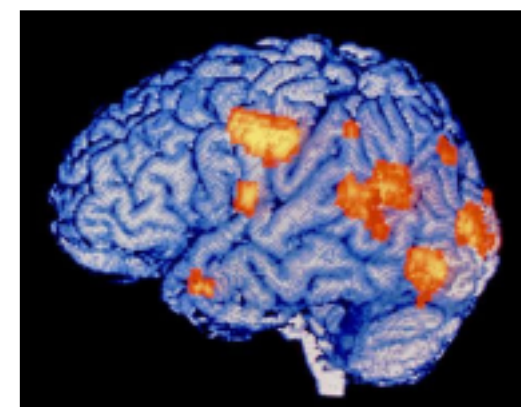
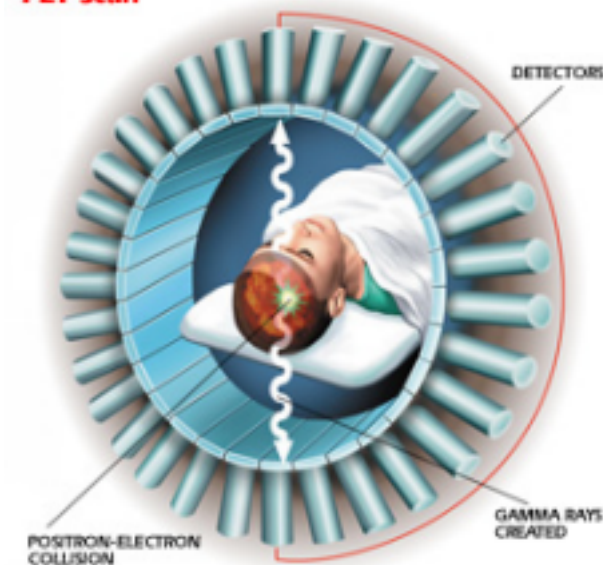
Applicazioni mediche



PET



PET Scan



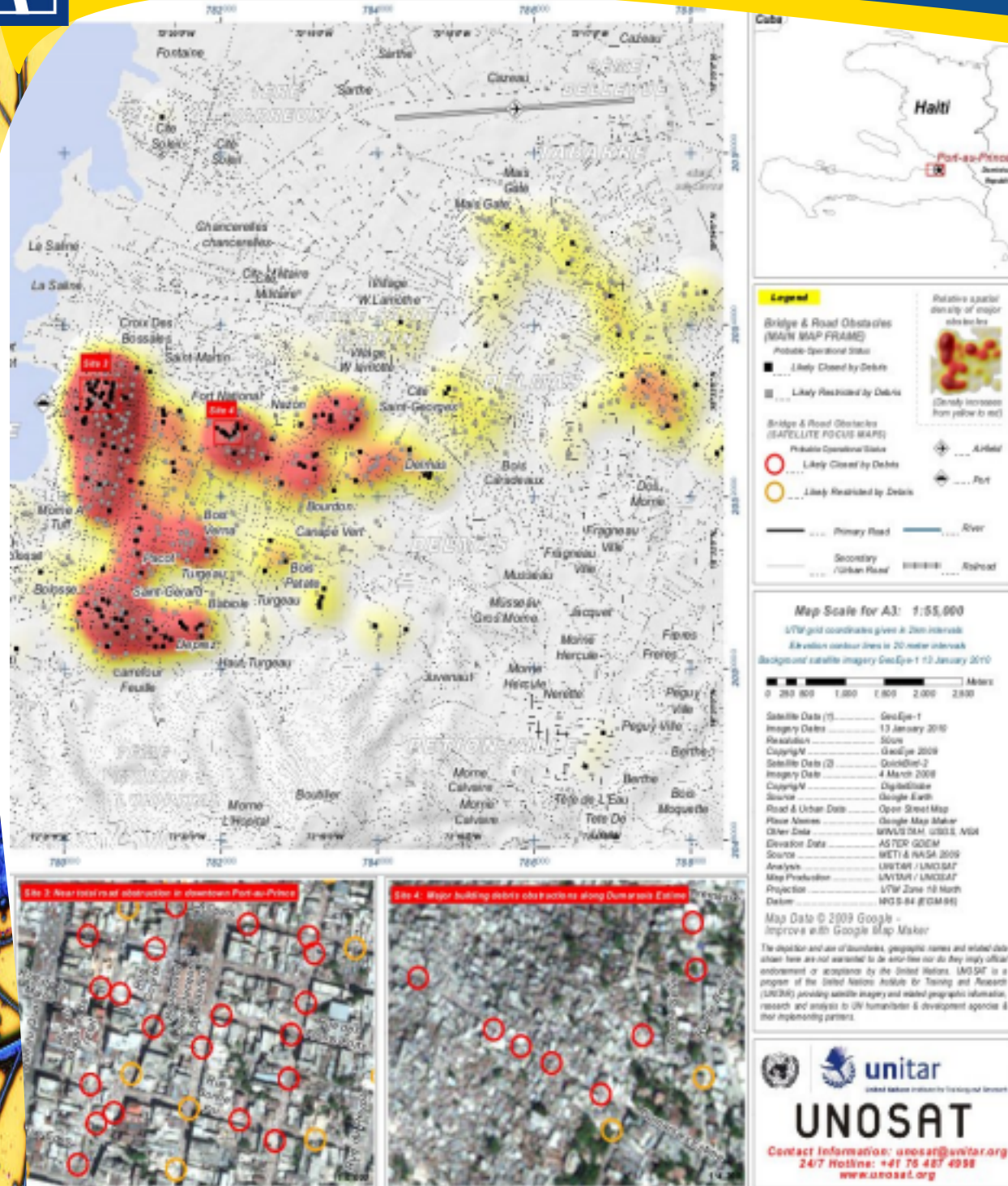
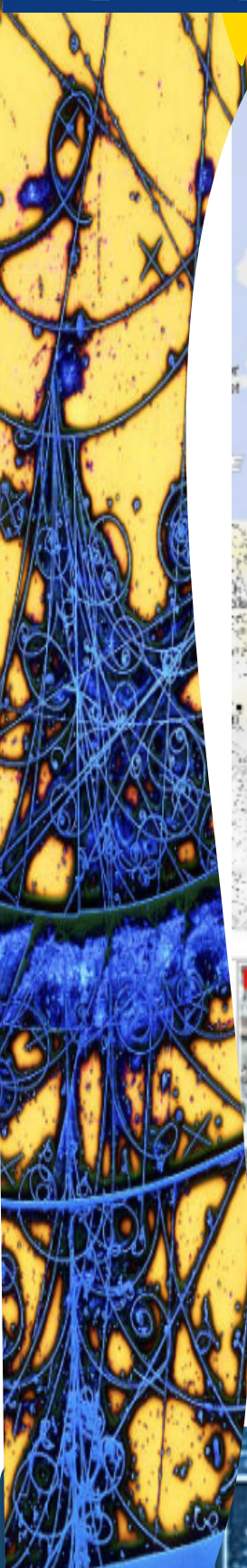


Acceleratori ospedalieri

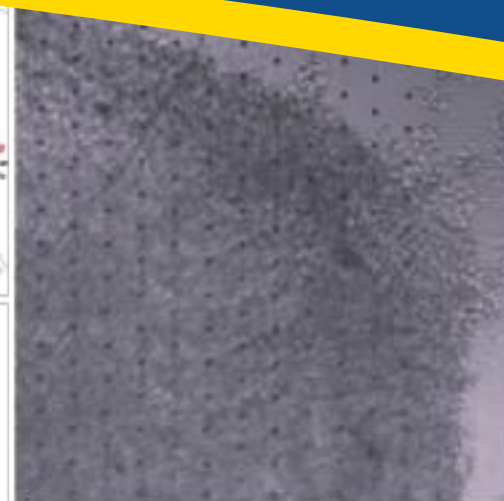




Ricadute tecnologiche



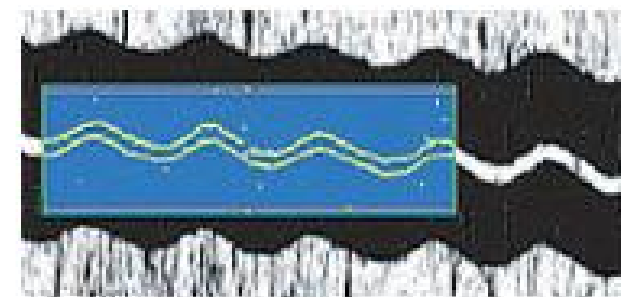
Progetto UnoSat



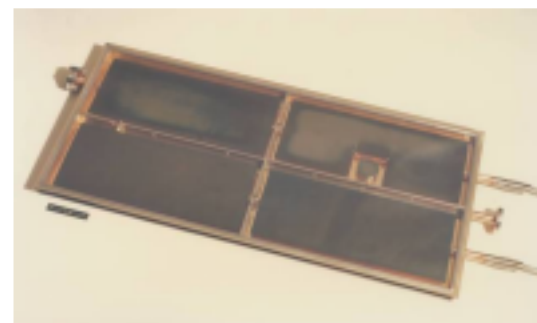
Progetto Retina



PixScan



UltraSound



Energia Solare vuoto spinto





Cosa resta da scoprire

Che cosa e' la massa? Higgs?

Come si e' formata la materia?

**Di cosa e' fatto il 96% dell'Universo?
Materia oscura?
Energia oscura?**

**Perche' viviamo in un mondo
di materia e non di antimateria?**

**Abbiamo trovato le 12 particelle
fondamentali oppure esistono
strutture piu elementari?**

... e molto molto altro ancora!





Atomi per la pace



Israeli-Palestinian party, CERN Summer Student Program 2007



Buona Visita!



Approfondimenti su
www.cern.ch
luigi.gallerani@cern.ch

