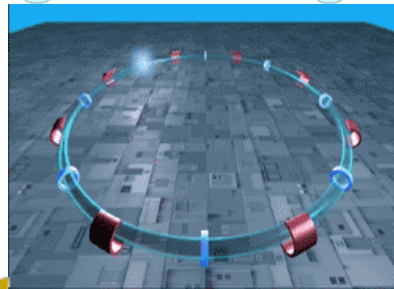


# VII Escola de Professores em Lingua Portuguesa



7th Portuguese Teachers School



CERN 2013



# Bem Vindos

## **Introdução ao CERN e à Física de Altas Energias (HEP)**

- A Organização
- O Laboratório
- Física de Altas Energias
- Os Aceleradores e as Experiências

**Filme sobre o CERN (15 min)**

**Visita dos itinerários  
previstos ( 2h )**

**Isto e' uma "escola" portanto...perguntem!!  
"Não há perguntas estúpidas"**

1949

Primeira tentativa de cooperação civil em Física Nuclear

1952

Criação do  
**Conseil Européen pour la Recherche Nucléaire**  
sob os auspícios da UNESCO

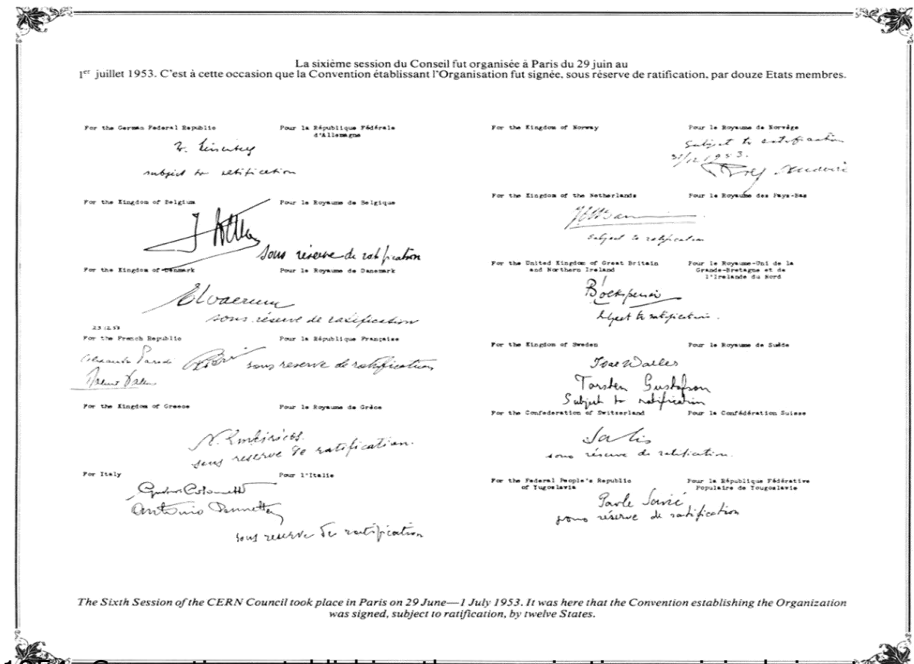
Outubro 1952

Escolha de Genebra para a localização do laboratório

Centro Europeu para Física de Partículas



- Fundado em 1954 por 12 países Europeus
- 20 países membros
- Há cerca de 11000 utilizadores , dos quais 2300 são funcionários e cerca de 1000 subvencionados (2013)
- Orçamento anual de ~1000 Milhões Francos Suíços (2013) (~900 M.Euros)



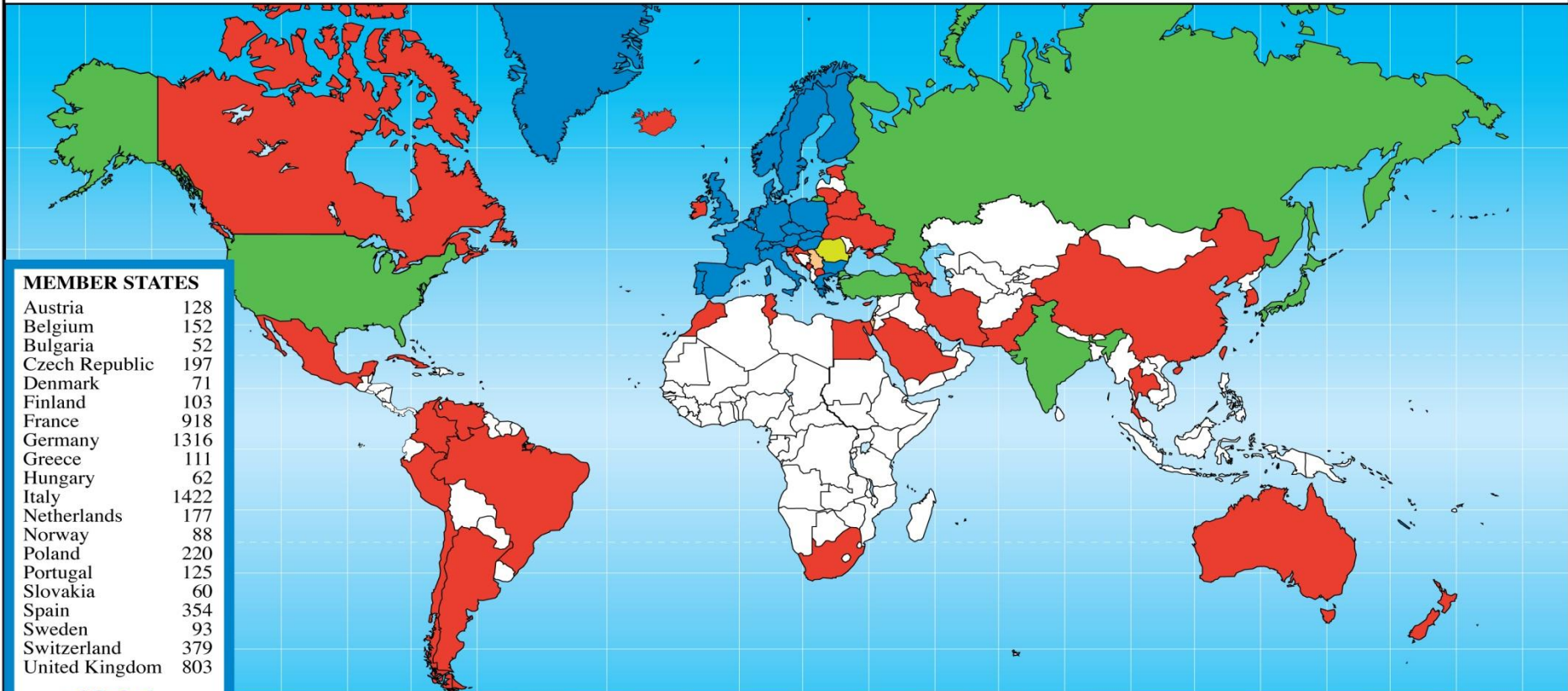
1954: Convention establishing the organisation - original signatures



2004: The 20 member states

# Distribuição dos Utilizadores do CERN por país/instituto (em 2013)

Distribution of All CERN Users by Location of Institute on 14 January 2013



**MEMBER STATES**

Austria	128
Belgium	152
Bulgaria	52
Czech Republic	197
Denmark	71
Finland	103
France	918
Germany	1316
Greece	111
Hungary	62
Italy	1422
Netherlands	177
Norway	88
Poland	220
Portugal	125
Slovakia	60
Spain	354
Sweden	93
Switzerland	379
United Kingdom	803

**6831**

**OBSERVERS**

India	146
Japan	238
Russia	883
Turkey	94
USA	1757

**3118**

**CANDIDATE FOR ACCESSION**

Romania	88
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**ASSOCIATE MEMBER IN THE PRE-STAGE TO MEMBERSHIP**

Israel	63
Serbia	31

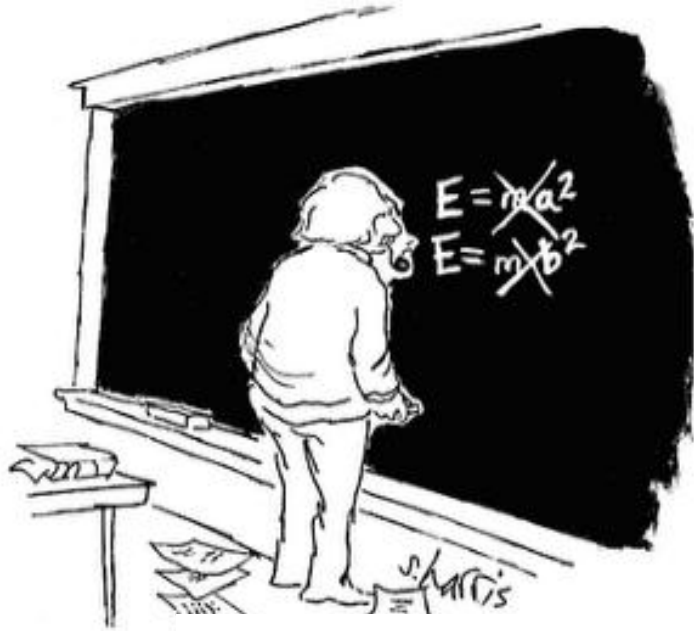
**OTHERS**

Chile	7	Georgia	10	Morocco	10	Tunisia	1
China	114	Iceland	4	New Zealand	9	Ukraine	25
China (Taipei)	69	Iran	23	Pakistan	22	Venezuela	1
Colombia	10	Ireland	8	Peru	2		
Australia	32	Korea	96	Saudi Arabia	3		
Azerbaijan	2	Lithuania	13	Slovenia	30		
Cuba	3	Malta	1	South Africa	25		
Belarus	22	Cyprus	7	Thailand	5		
Brazil	107	Egypt	11	Mexico	41		
Canada	168	Estonia	17	Montenegro	1		

**959**

## O CERN visto: pelos media:





$$r = r_0 \left[ 1 + \left( \frac{fr\omega}{c} \right) \cos(3\theta + \delta_0 + \delta_1 r) + \left( \frac{fr\omega}{c} \right)^2 \cos(5\theta + \delta_2 - \delta_3 r^2) + \left( \frac{fr\omega}{c} \right)^3 \cos(7\theta + \delta_4 - \delta_5 r^3) + \dots \right] \times \left\{ \frac{e^{3/5} r^2 \ln Z}{1 + \left( \frac{e}{r} \right)^{3/4}} \right\}$$

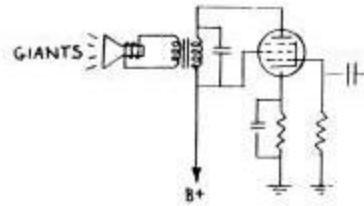
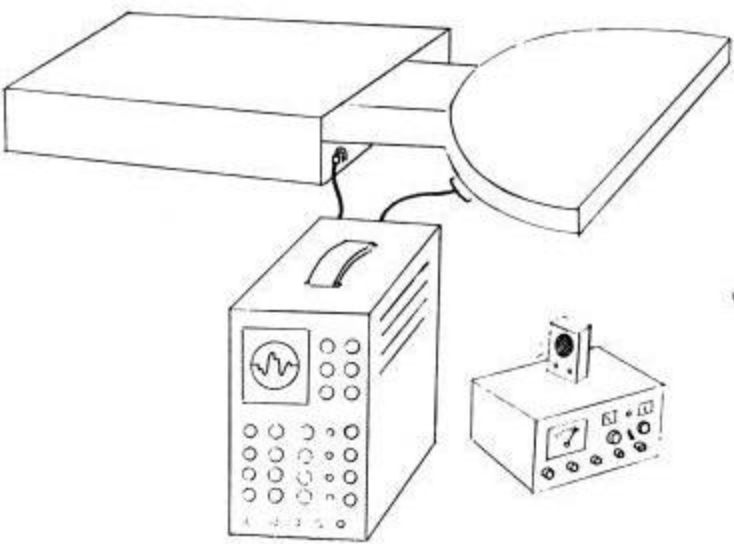
$$\frac{d\theta}{dt} = \left[ \sin(\omega t - k\phi) - \sin k\phi - \frac{3}{5} f f_1 f_2 f_3' \right] \frac{eV_0}{2\pi\omega}$$

...físico teórico

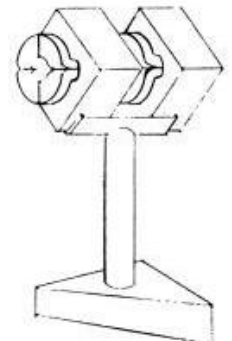
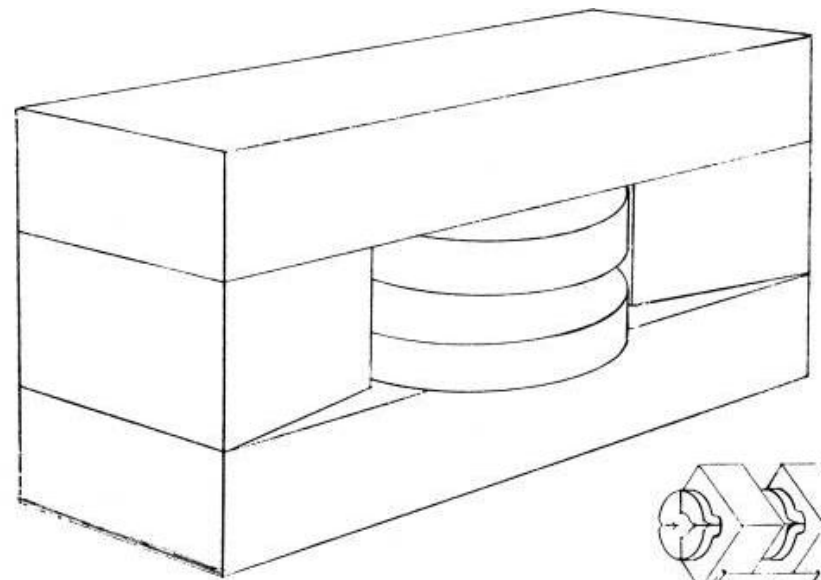


$p: 37.945067 \pm 0.0023 \text{ MeV}$   
 $0.03 \times 0.05 \text{ cm.}$   
 $\pm 0.000075 \text{ m rad.}$

...físico experimental

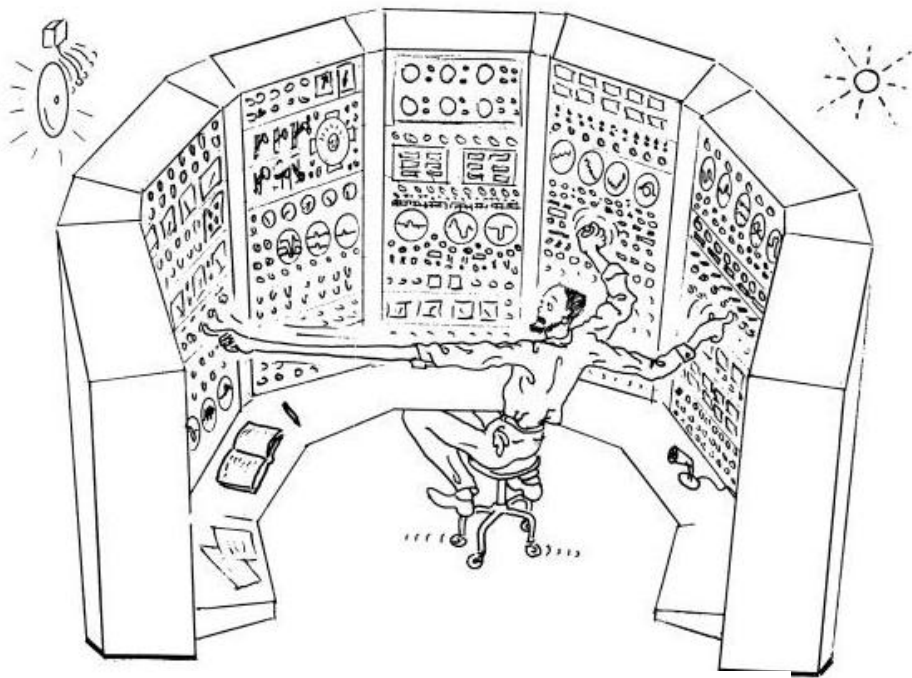


...Eng. Electrónica

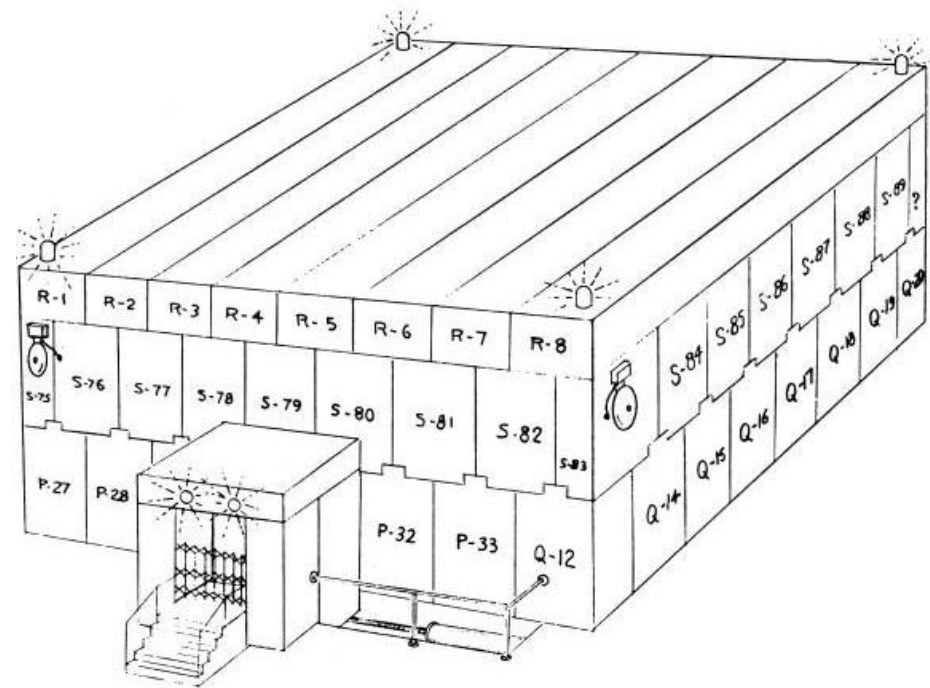


...Eng. mecânico

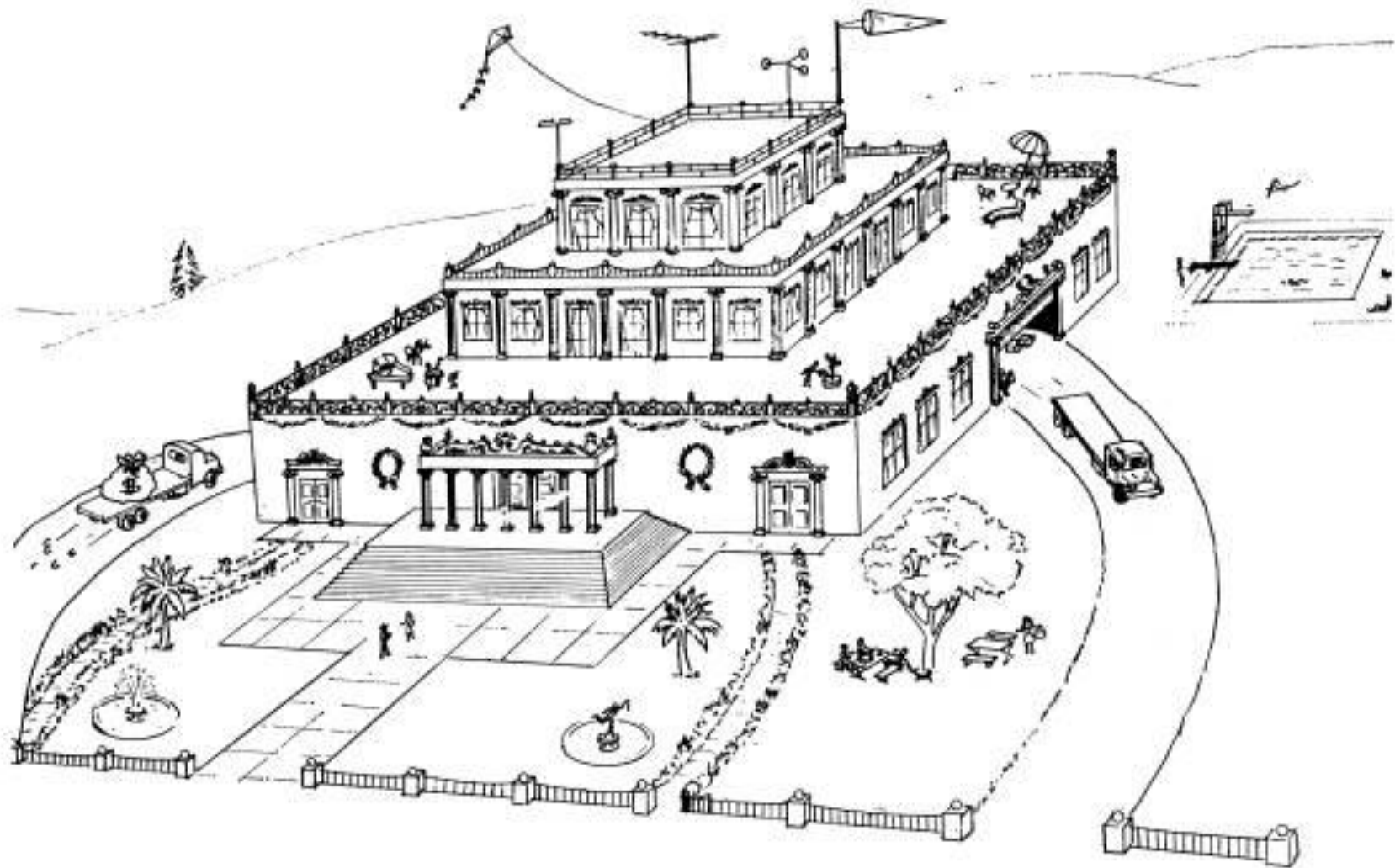




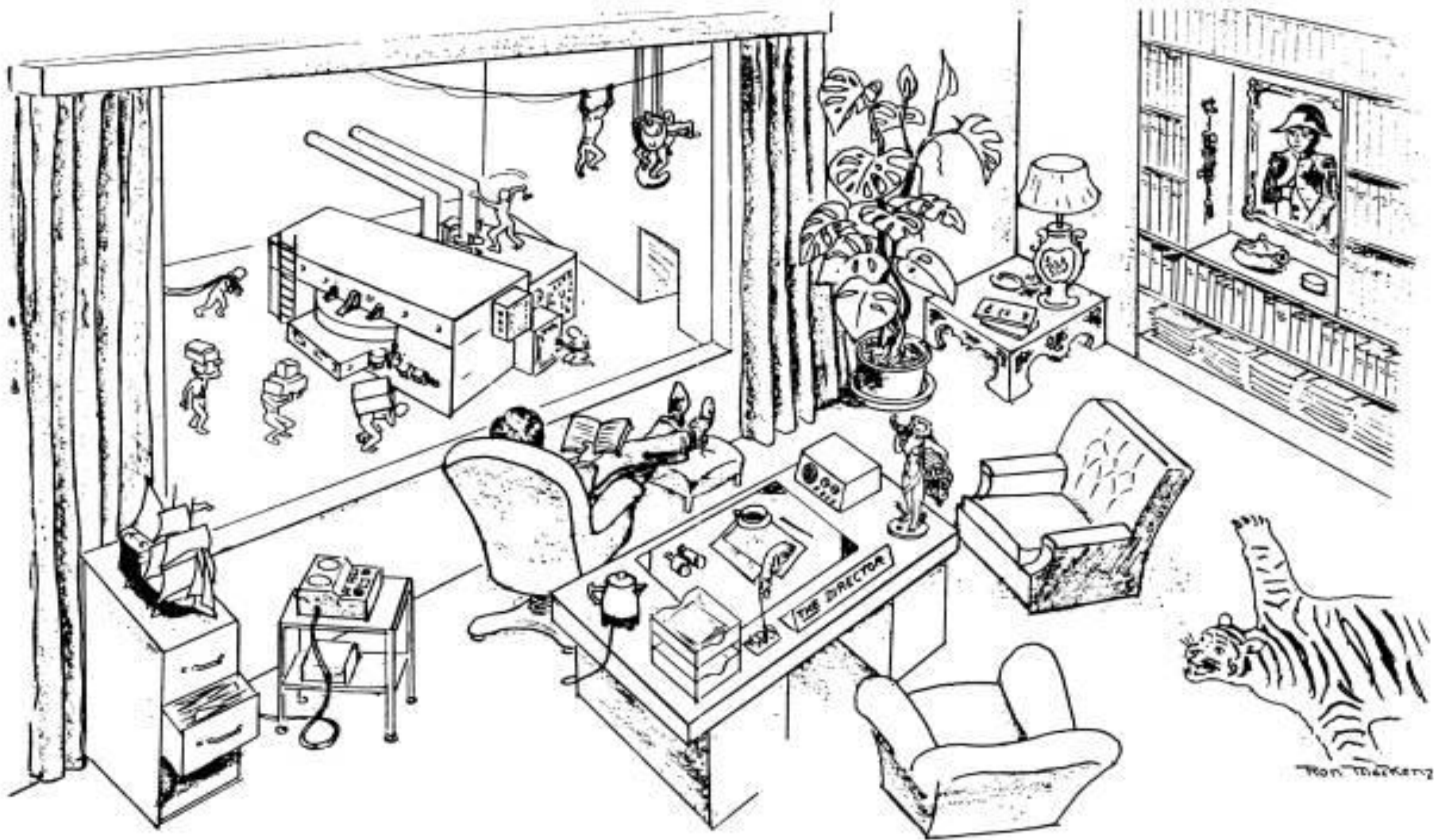
...operador



...rádio protecção

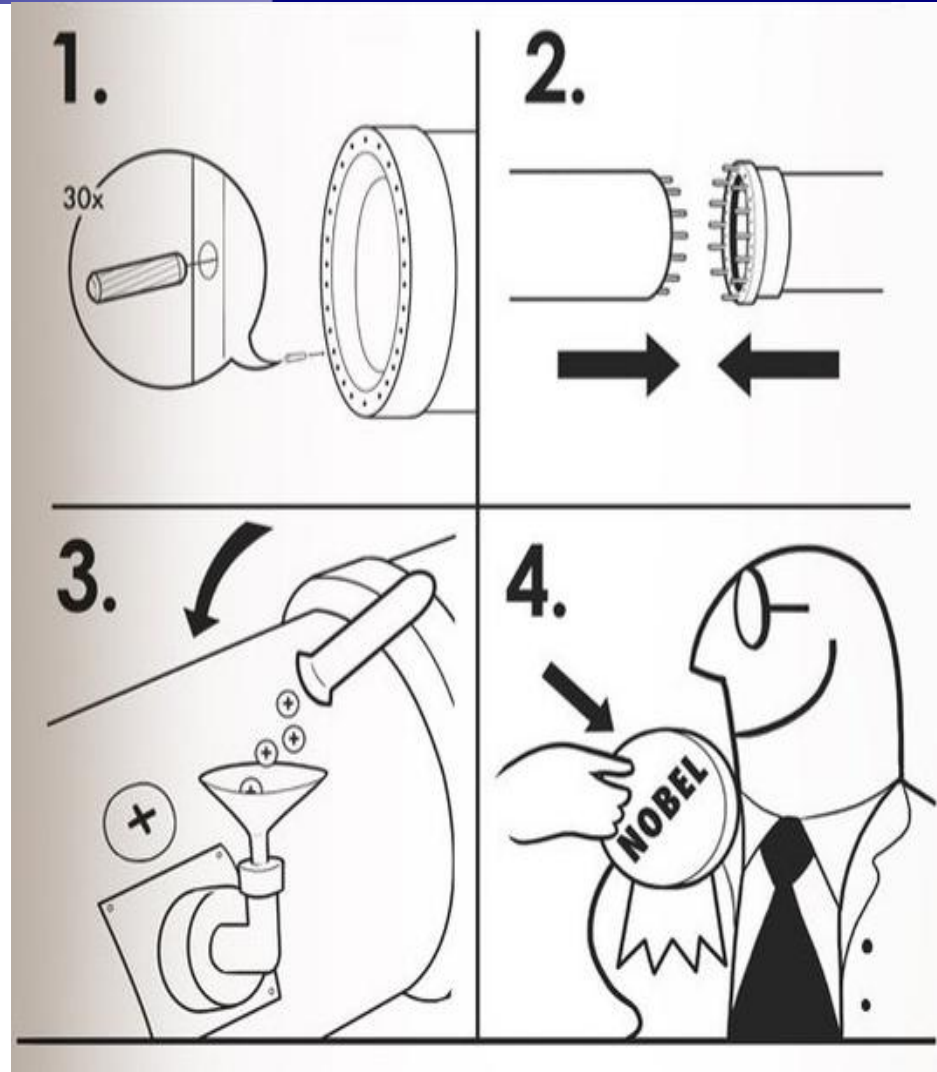
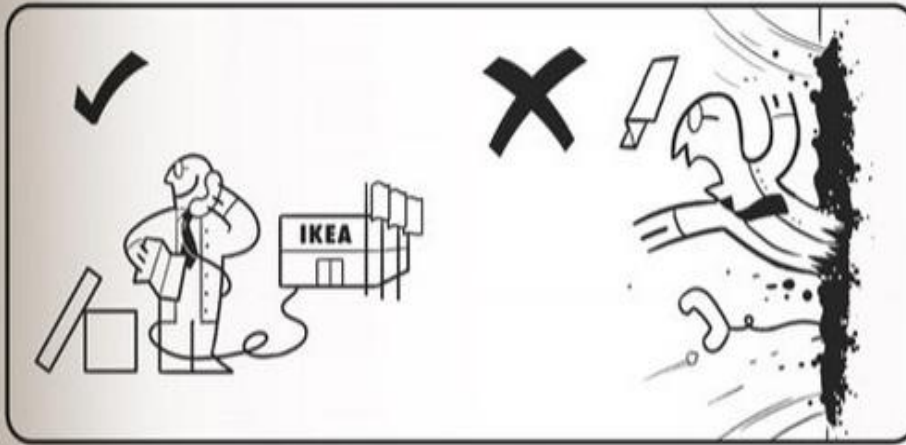
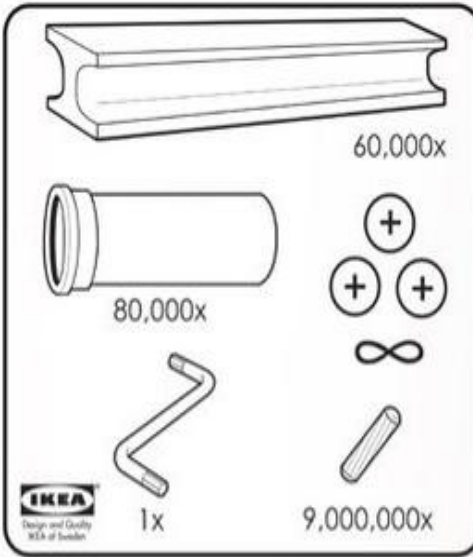
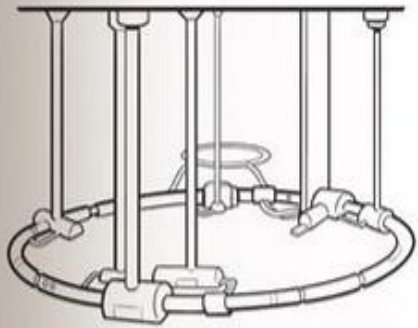


...agencias de financiamiento

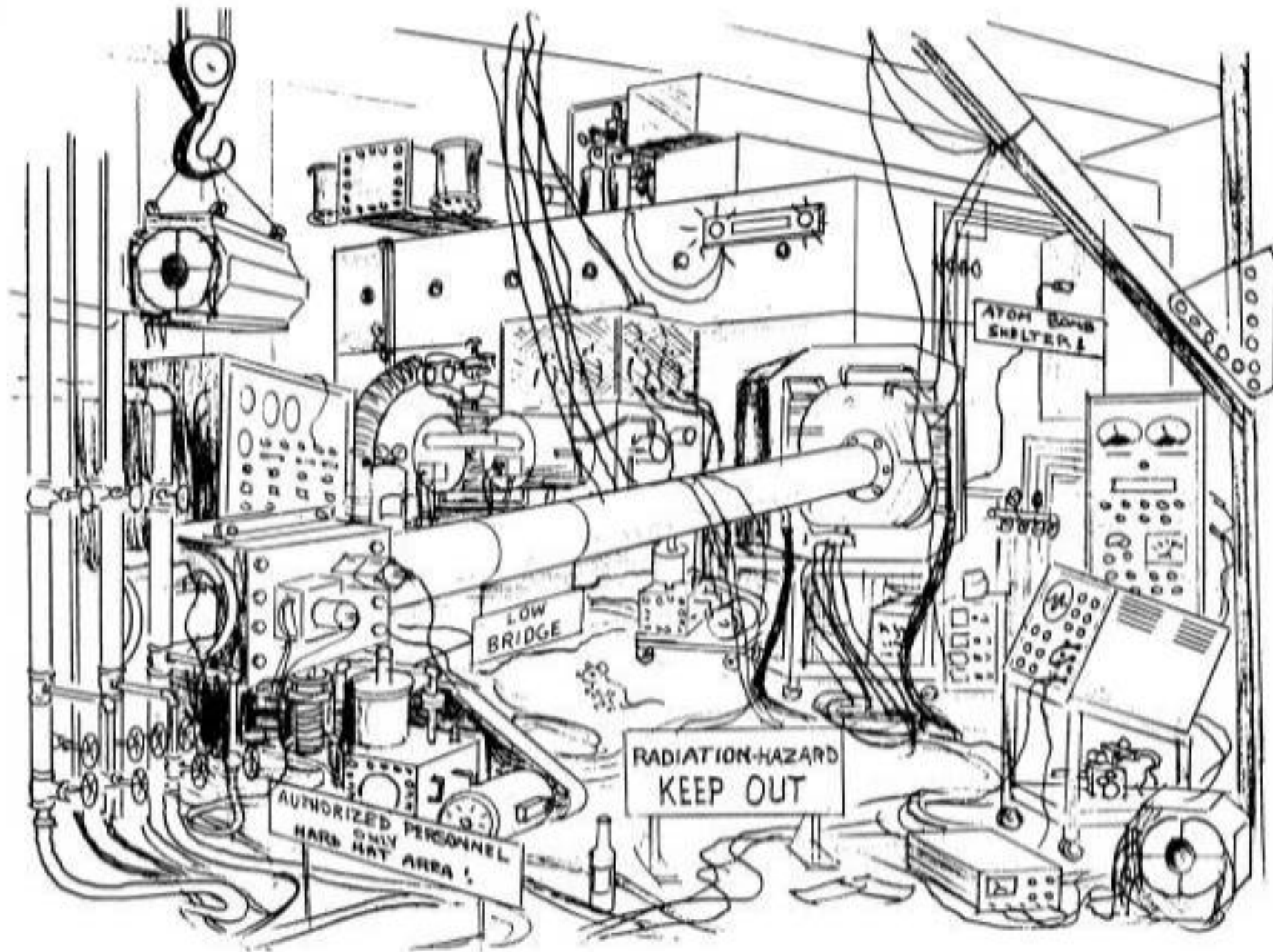


...director geral

# HÄDRÖNN CJÖLIDDER



...método IKEA



...por vocês!!



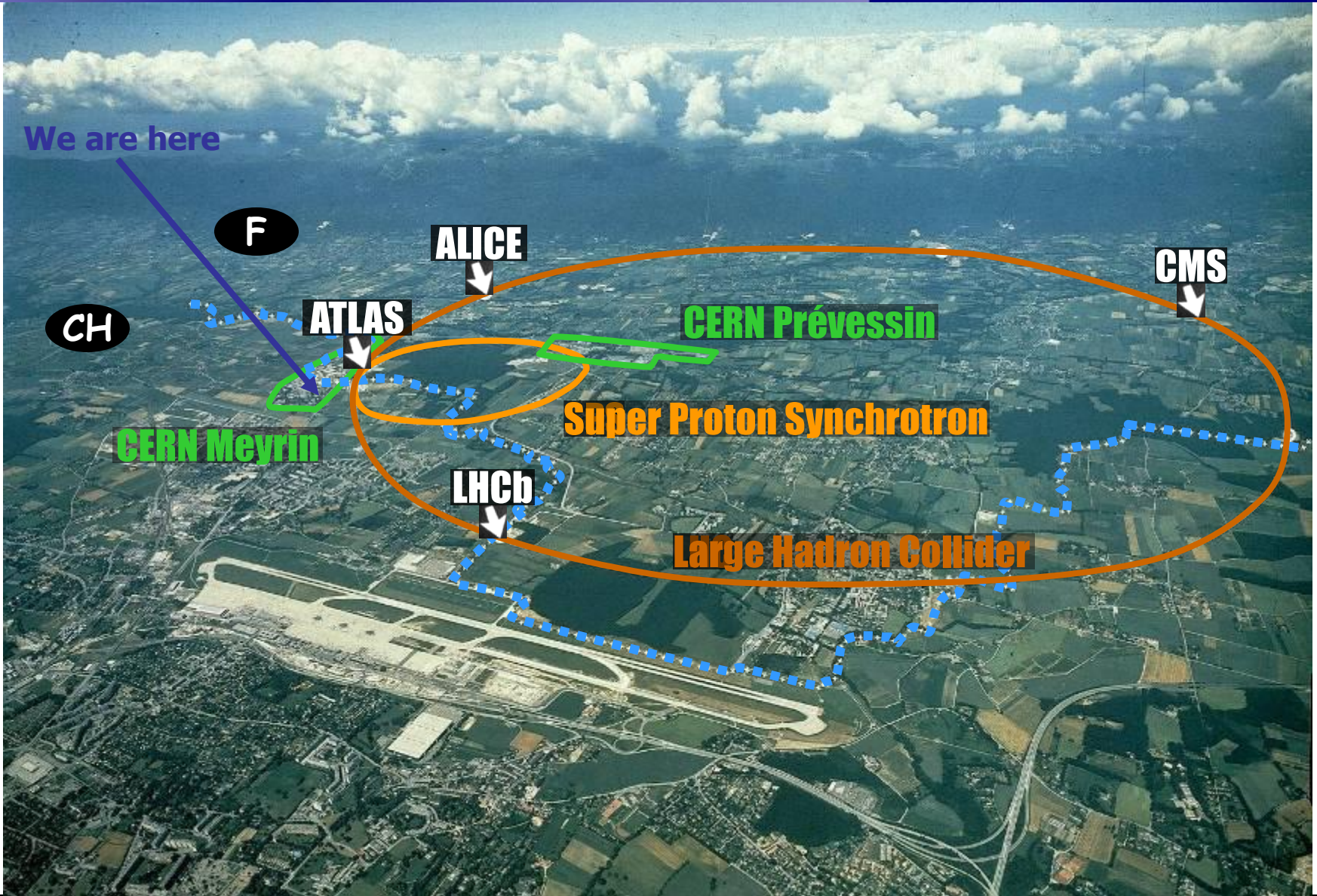
# CERN – O(s) Laboratório(s)



f.

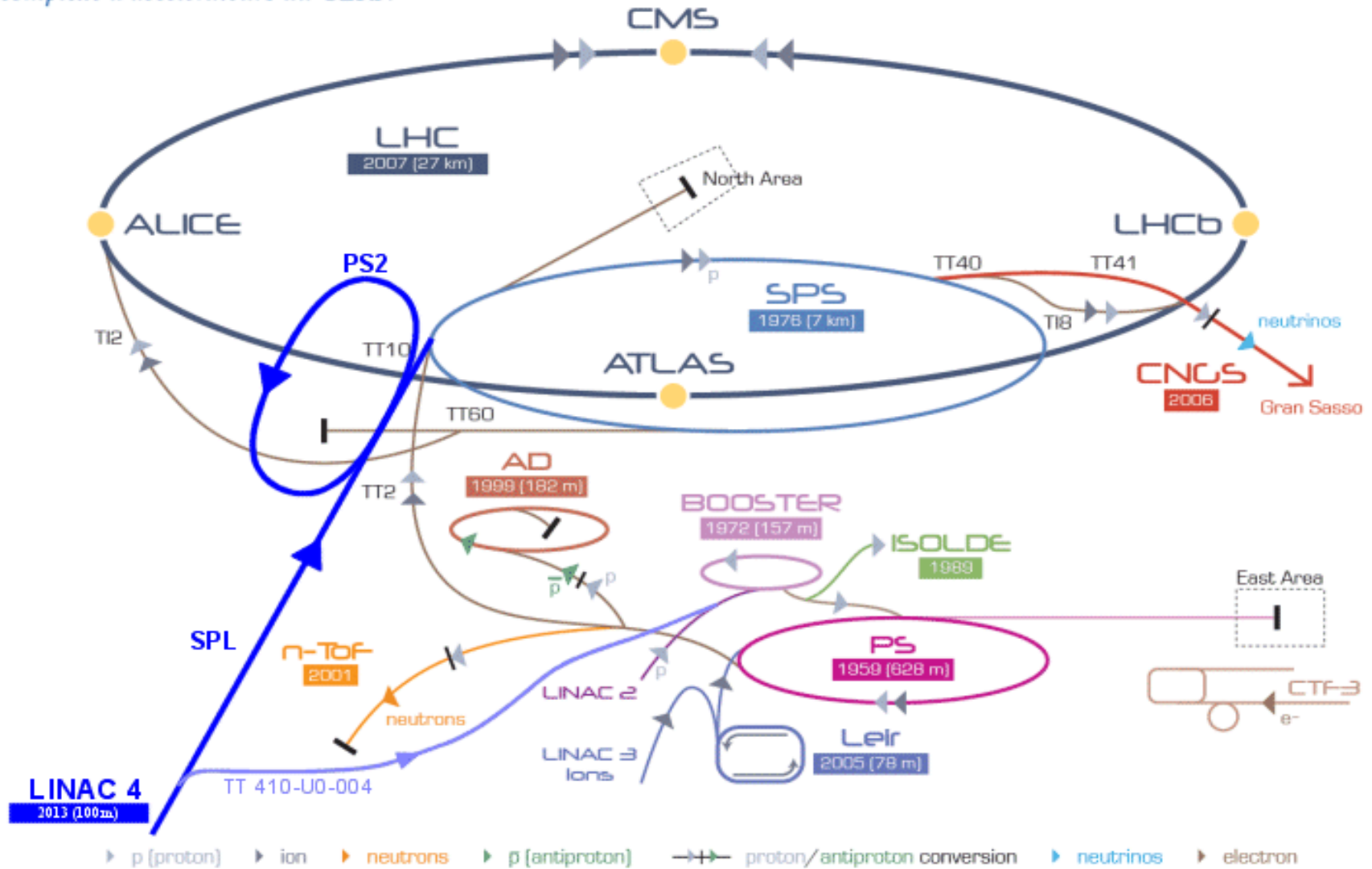


# The physical extents of CERN





Le complexe d'accélérateurs du CERN





~9000 magnetos  
supracondutores

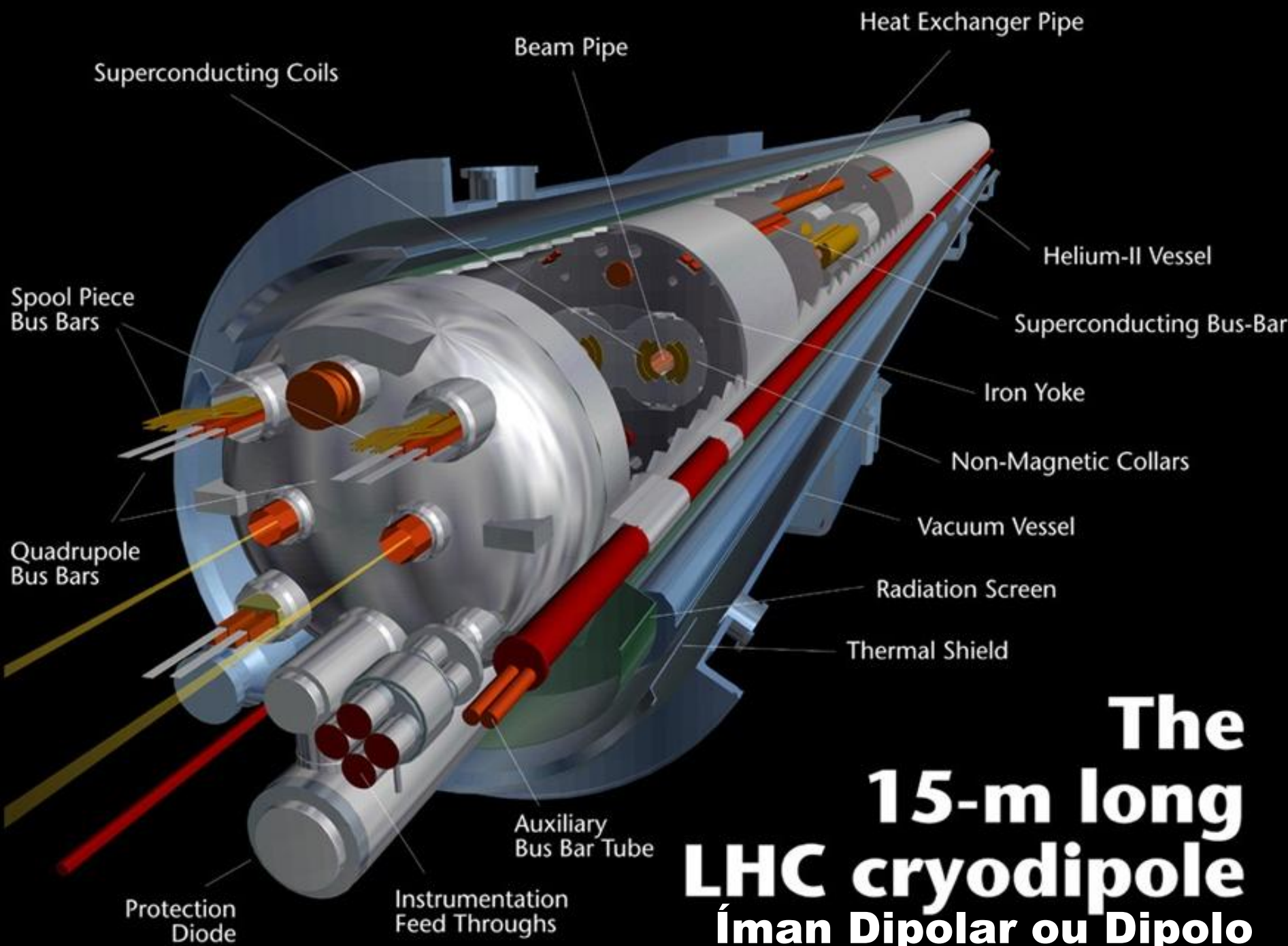
27 Km hélio superfluido

2 Kelvin (-271 célsius)

13 000 Amp (14 TeV)

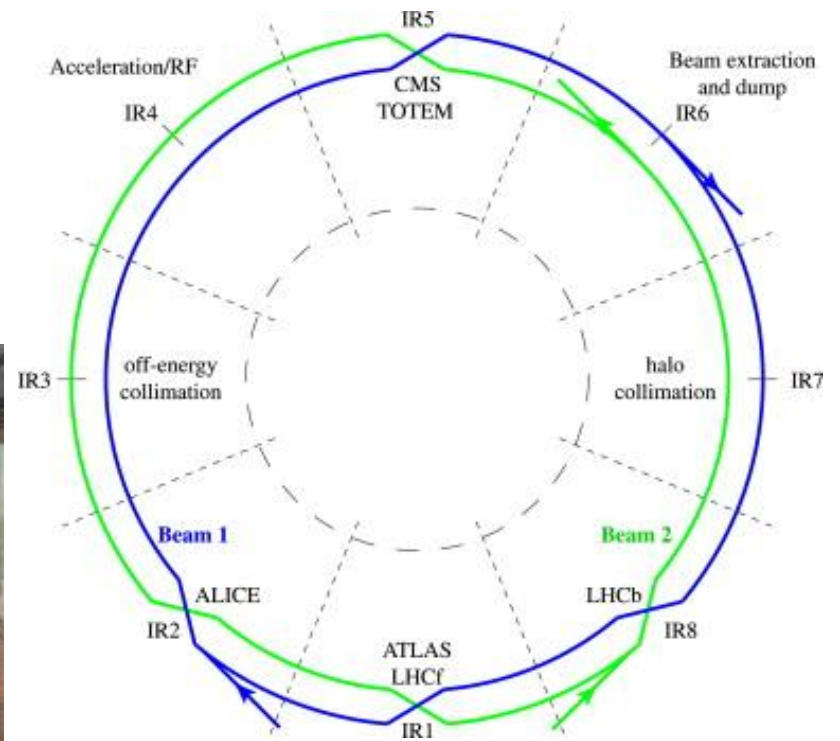
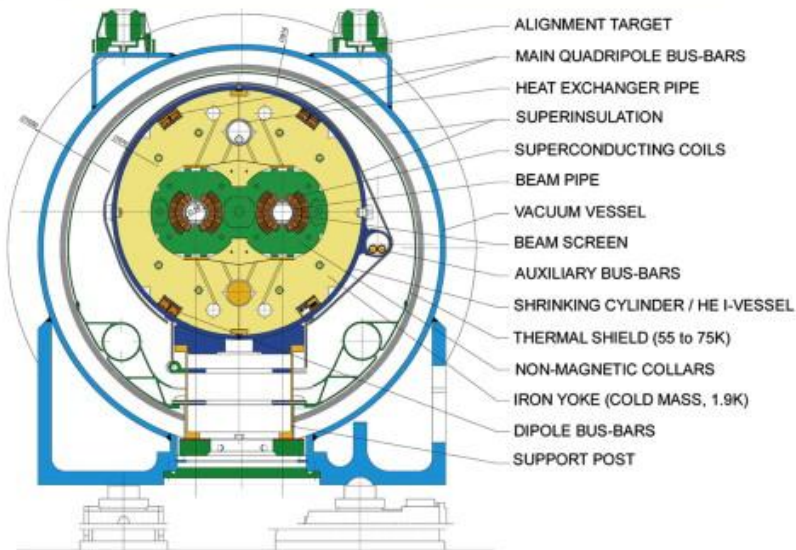
1232 dipolos

392 quadripolos

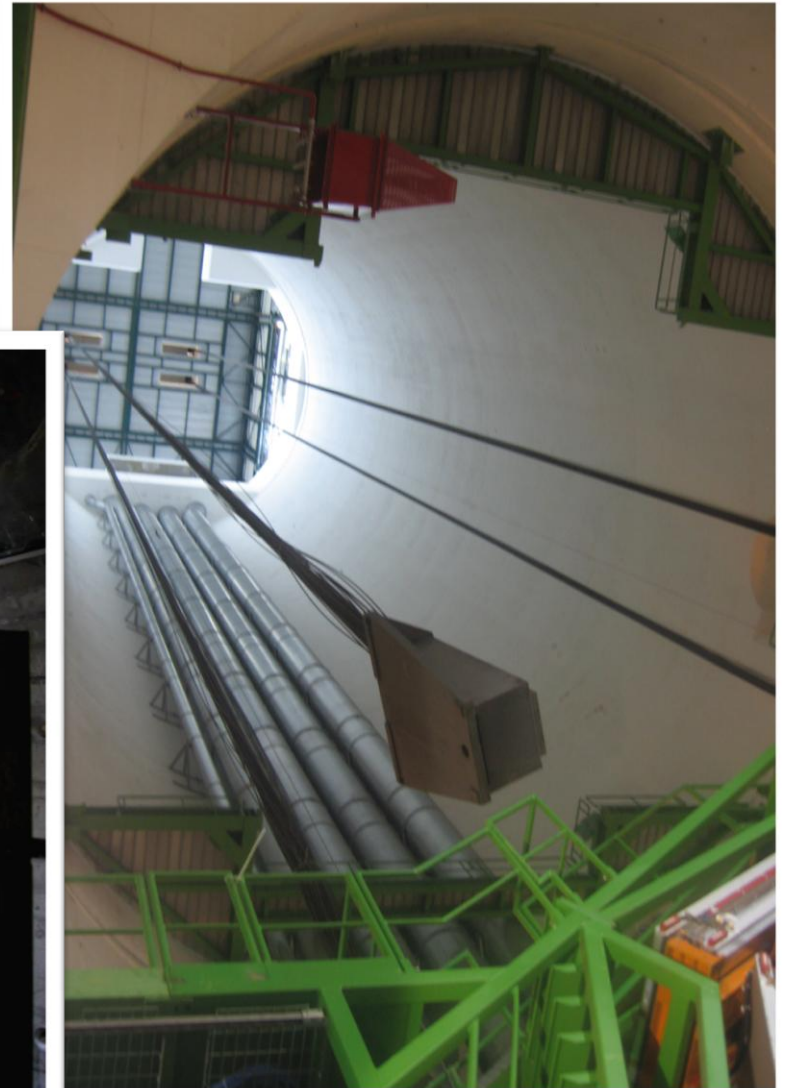


**The  
15-m long  
LHC cryodipole  
Íman Dipolar ou Dipolo**

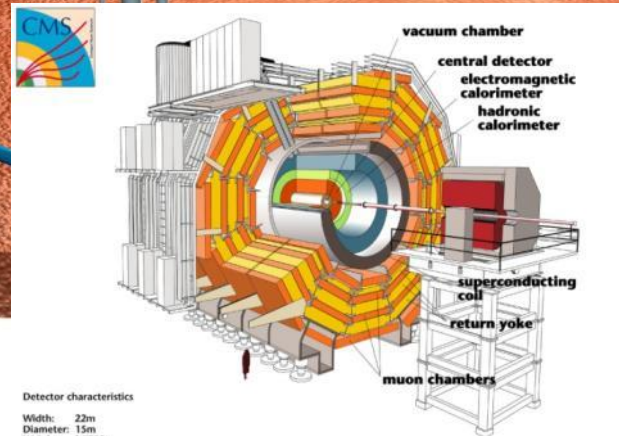
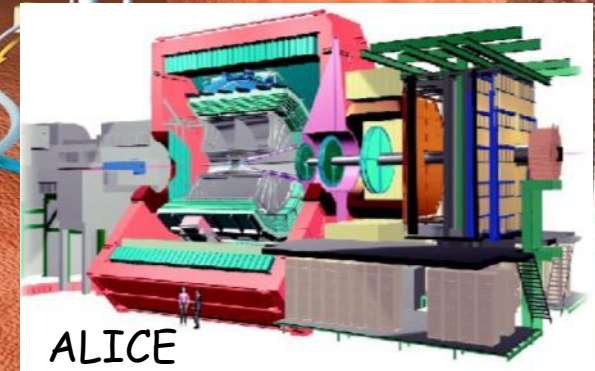
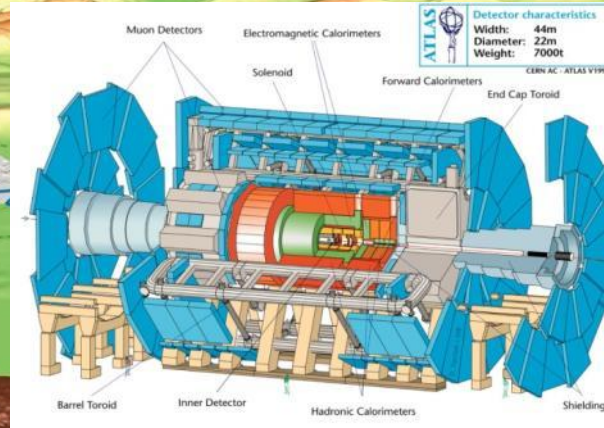
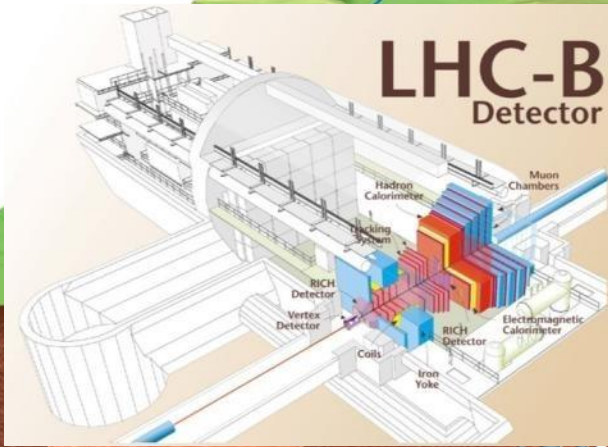
### LHC DIPOLE : STANDARD CROSS-SECTION



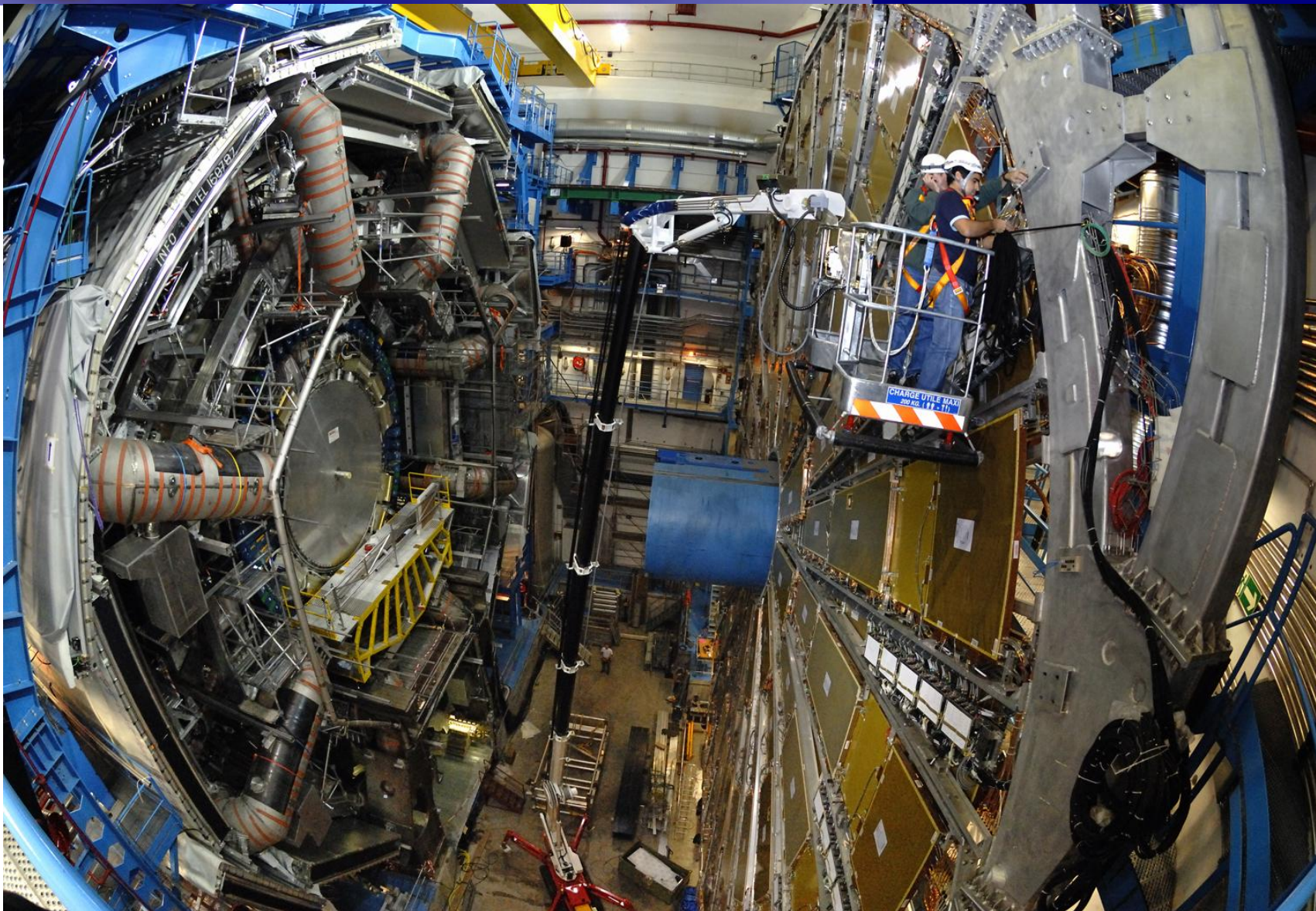
27 km perímetro  
100 m profundidade



LHC Point 5 - UXC 55 Cavern - Point 6 headwall - 20-06-2003 - CERN ST/CE



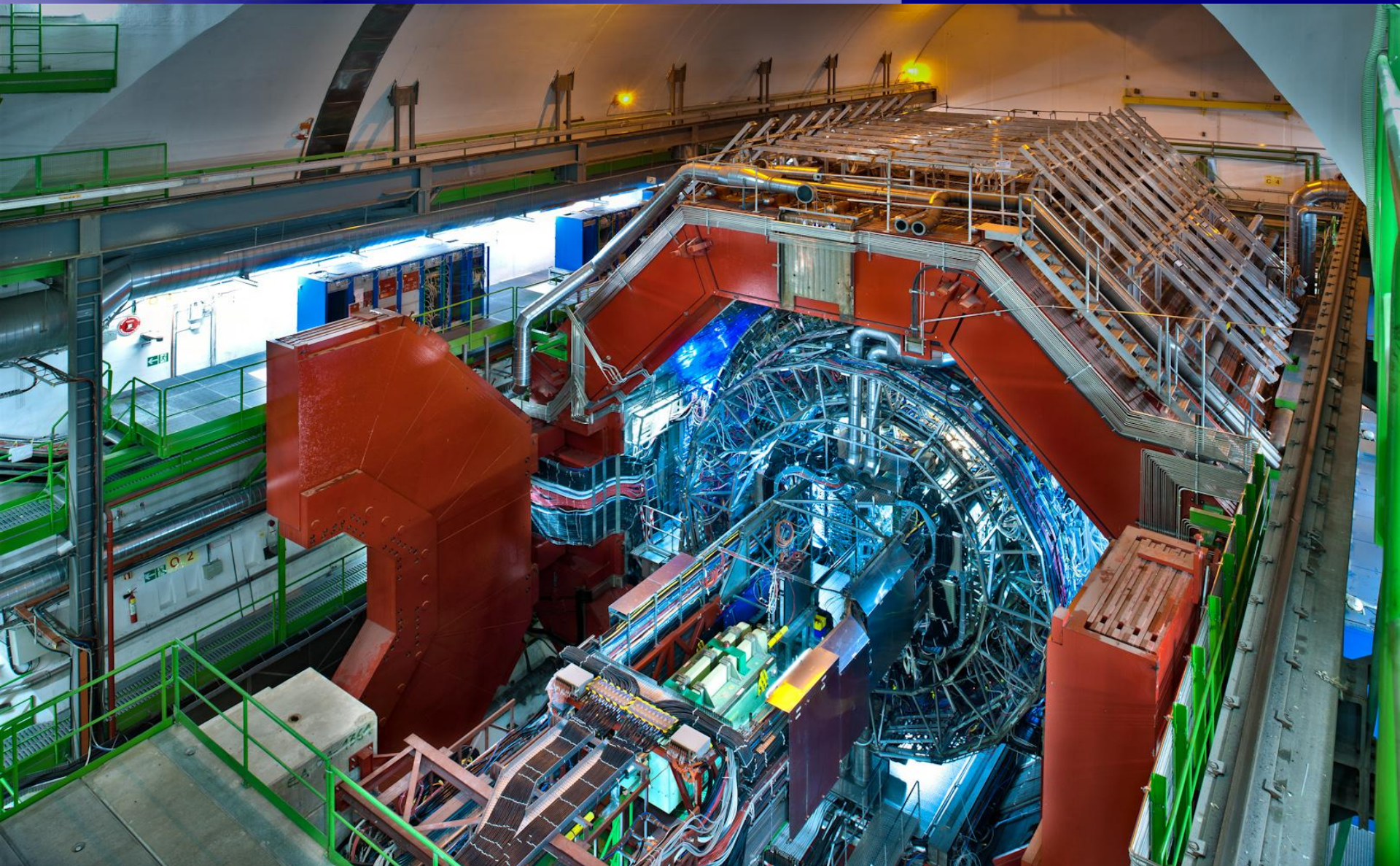
Detector characteristics  
Width: 22m  
Diameter: 15m  
Weight: 14500t





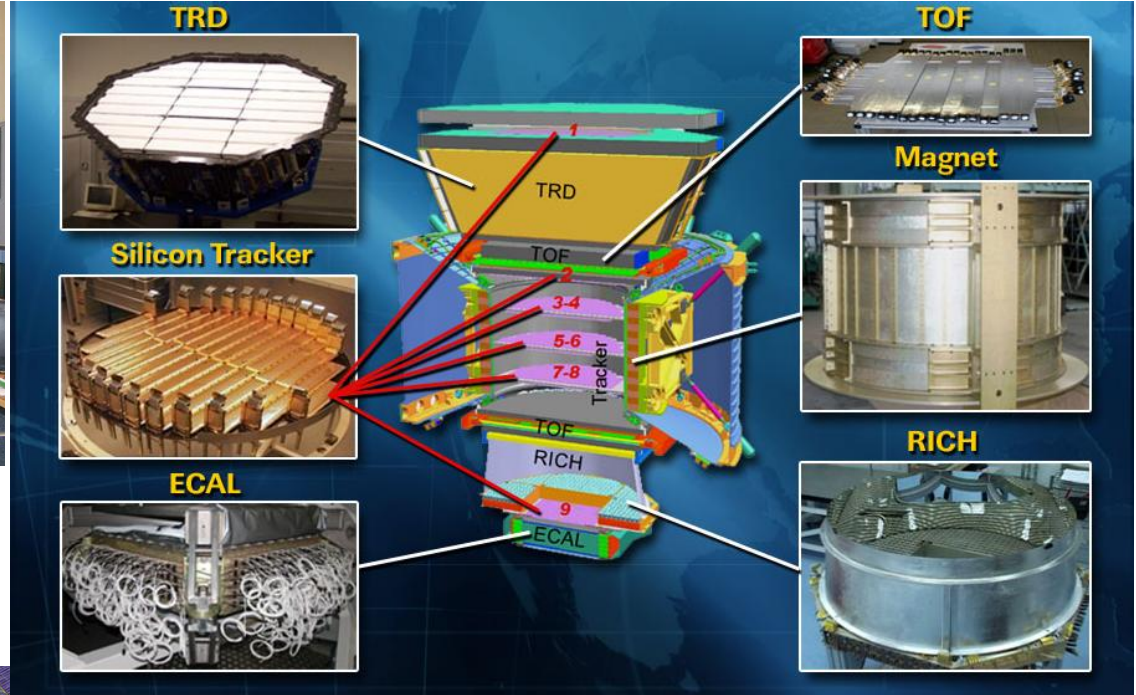




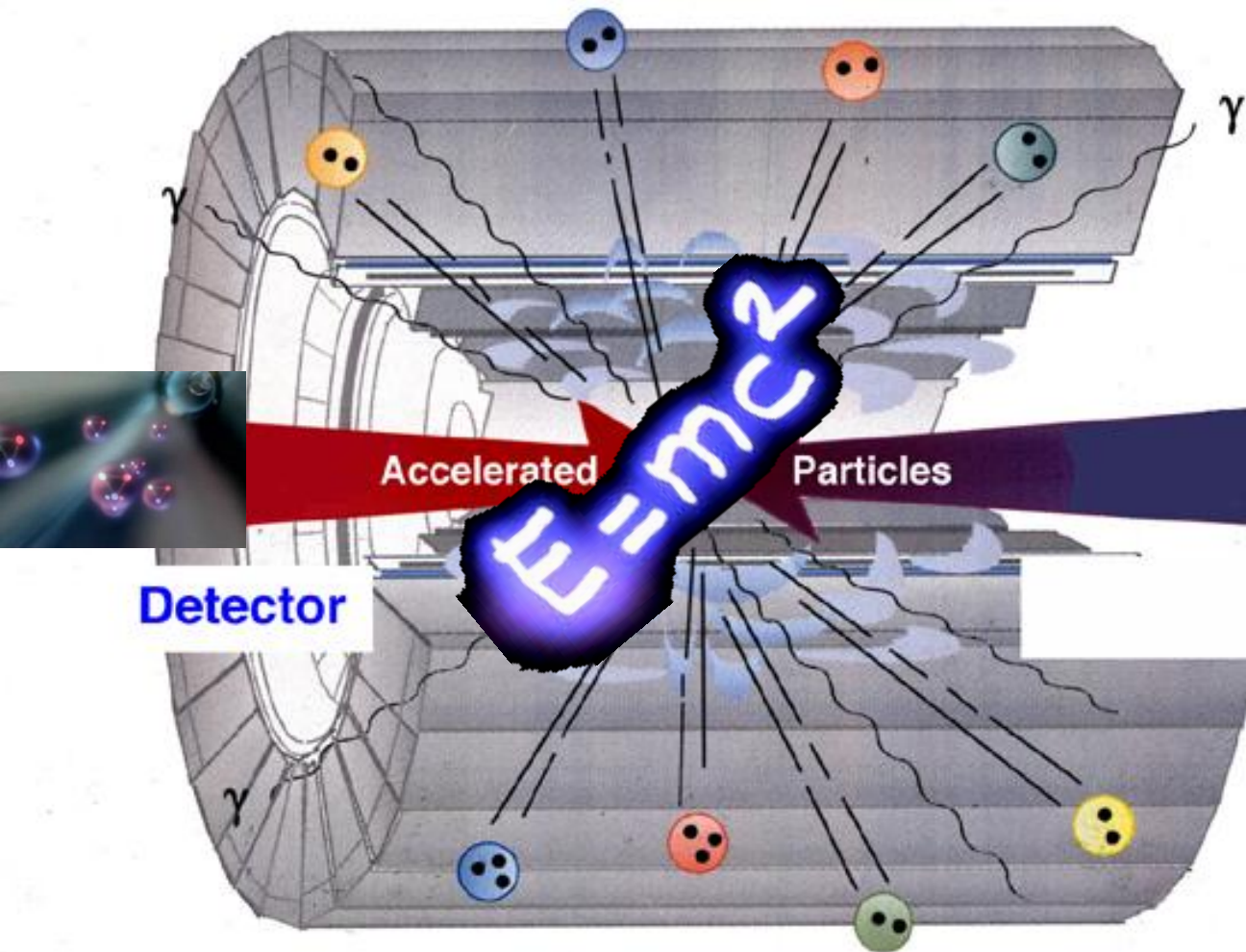




AMS Centro de Operações  
@CERN Preveissin

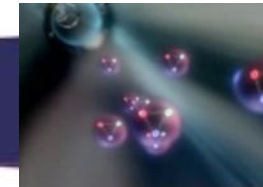


# Detectores em Física de Partículas



Particles with very high energy of movement are produced.

The particles are brought to collision (similar conditions as in the big bang).

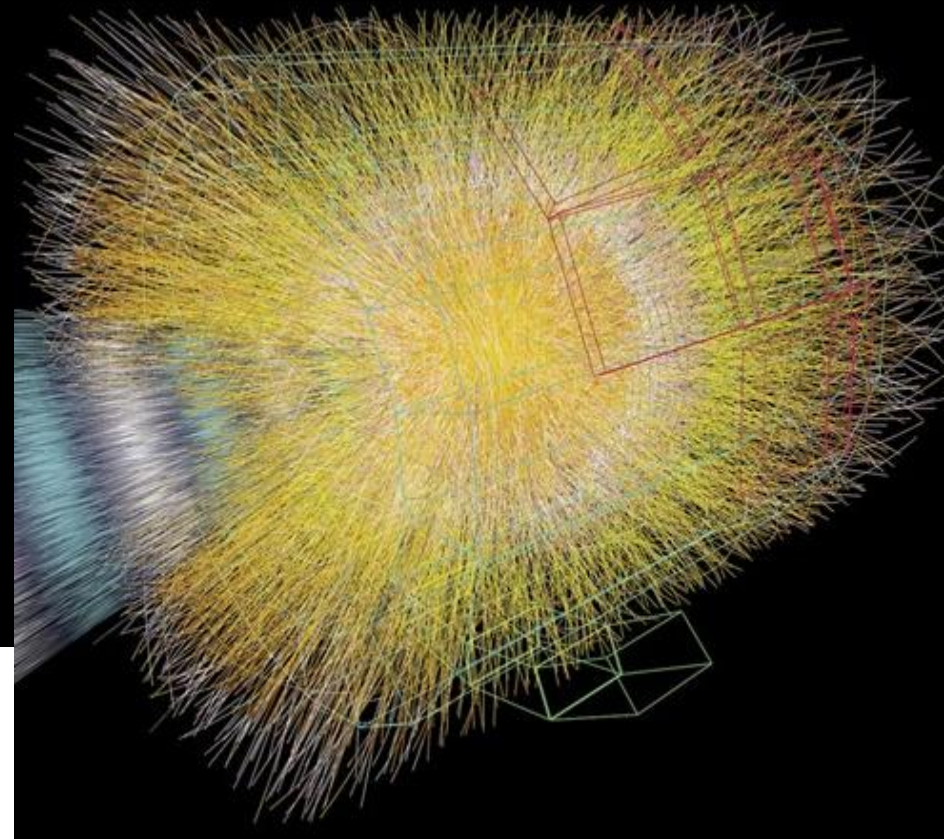


The particles that are created are recorded by detectors.

# Colisões : passado vs. futuro



LHC  
(ALICE)



Experiencia Anterior  
(DELPHI, LEP)

# The GRID: a possible solution to CERN computing needs



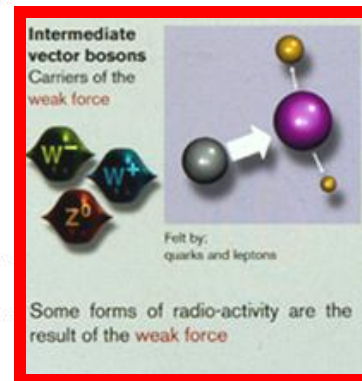
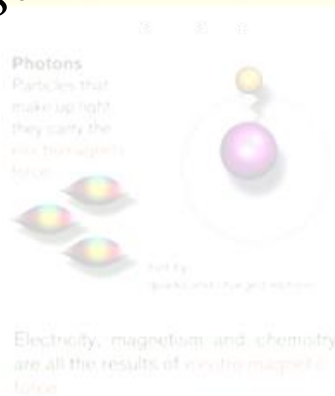


**Carlo Rubbia**



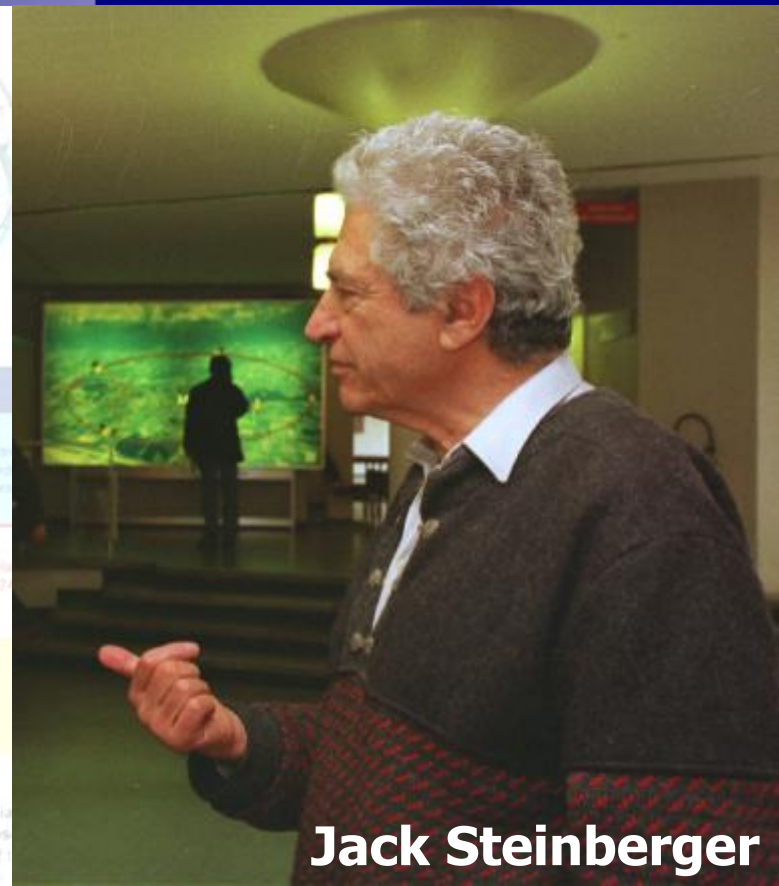
**Simon van der Meer**

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



All the weight we experience is the result of the gravitational force

LEPTONS	
<b>Electron</b> Responsible for electricity and chemical reactions; it has a charge of -1.	<b>Electron neutrino</b> Particle with no electric charge, and possibly no mass; billions fly through your body every second.
<b>Muon</b> A heavier relative of the electron; it lives for two-millionths of a second.	<b>Muon neutrino</b> Created along with muons when some particles decay.
<b>Tau</b> The heaviest and shortest-lived of the leptons; discovered in 1975.	<b>Tau neutrino</b> Discovered in 1980.



**Jack Steinberger**

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



Como não podemos ir ao shopping buscar os detectores que precisamos...

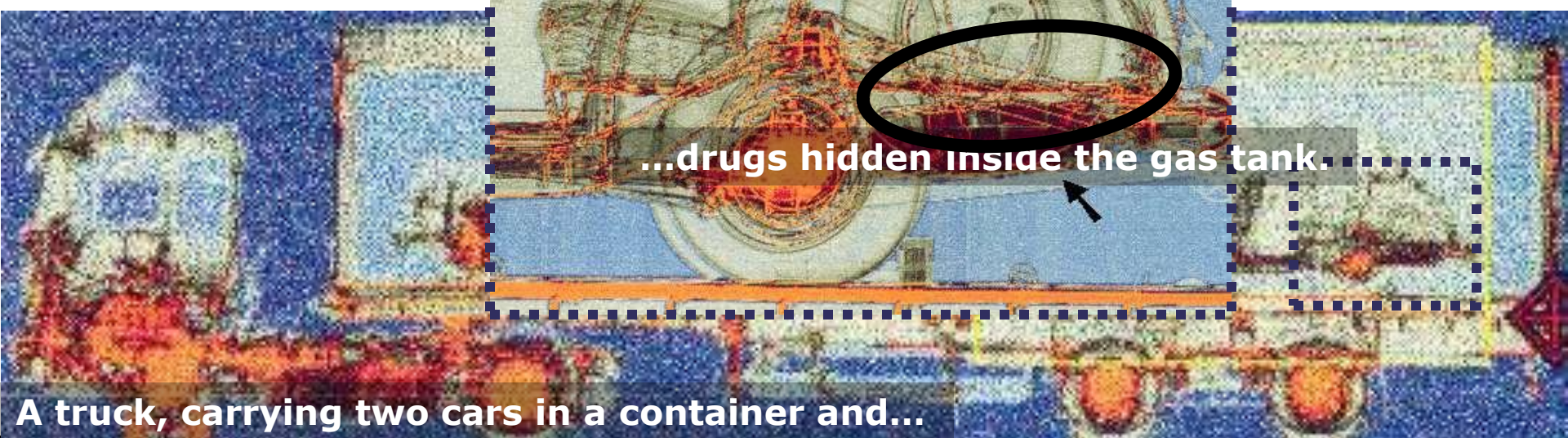
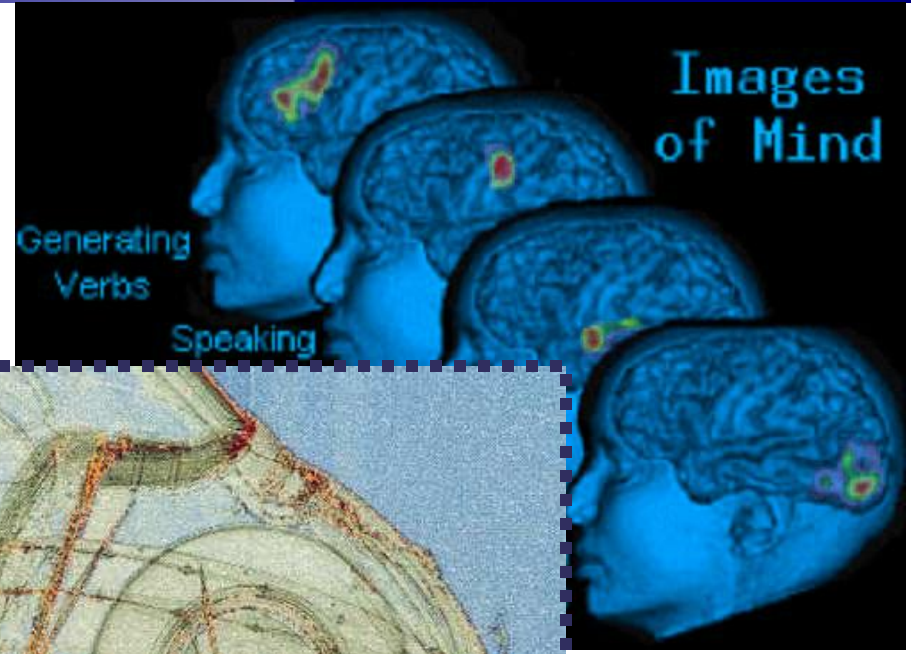
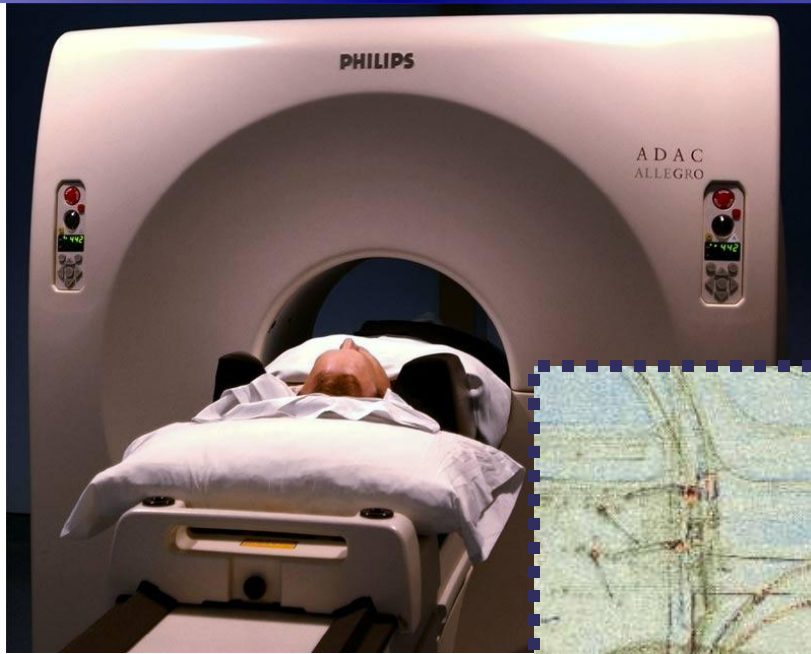
Inventamo-los!

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

Qual o próximo Nobel?

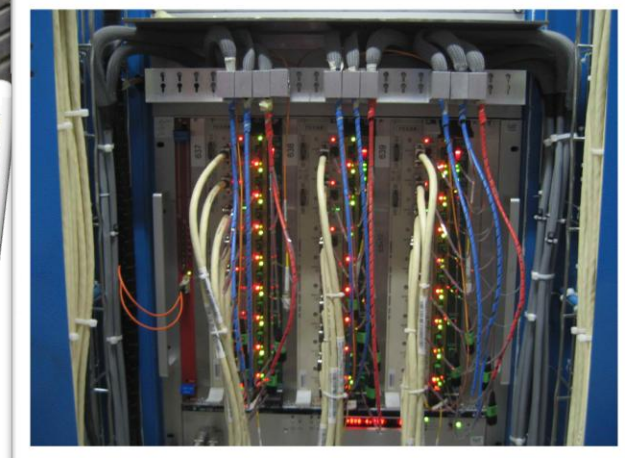
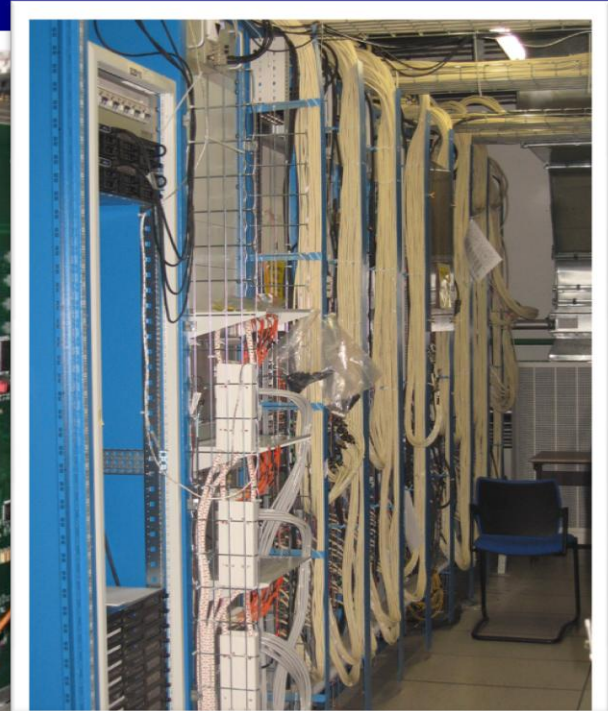
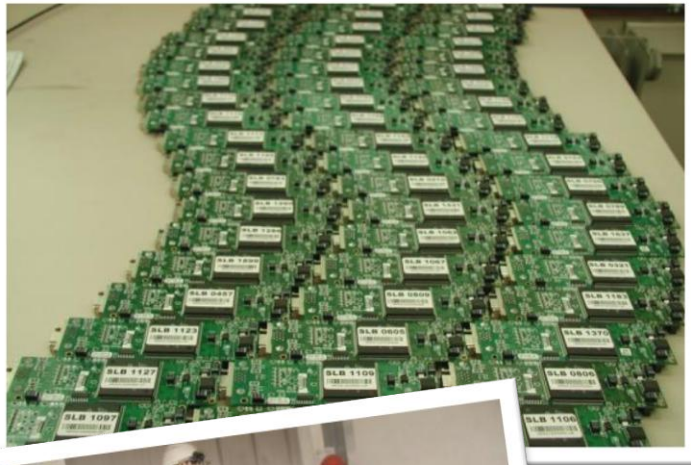


**Georges Charpak**

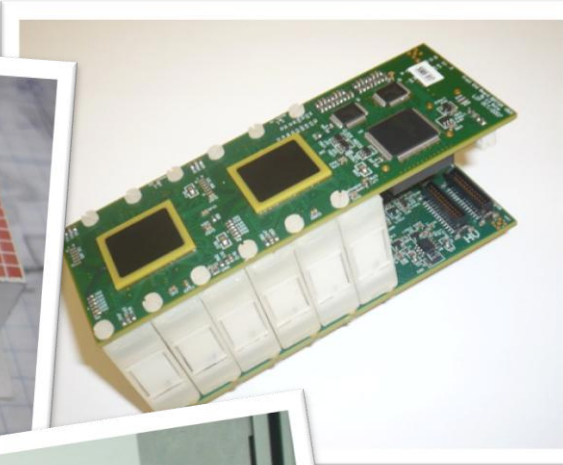


A truck, carrying two cars in a container and...

# "home made" (CMS, PET, MT)



# “home made” (CMS, PET, MT)



# Obrigado e Uma Boa Escola!

Colaboração  
Internacional

Formação

Tecnologia

Pesquisa  
Física  
Fundamental

