Technology Transfer through procurements: the CERN case

Sandro Centro
Italian Liaison Officer @ CERN
<centro@pd.infn.it>

ERF Technology Transfer and Industrial Relations in Research Infrastructures
NH Hotel / Trieste, Italy / 6-7 June 2013

elettra

TT task

Technology Transfer mission is a **difficult task**.

All major Research Institute are sensitive to this issue but a **consolidate practice does not exists**.

In fact some TT were realized ***in spite*** of the Organization rather than with its support.

An example? **The most relevant TT from CERN is in my view the WEB, that in fact was realized without any support from the Organization.**

One thing is anyway clear: **TT works if the involved PEOPLE work for it**.

In the following slides I'll try to show how TT can be *also* **stimulated** by **procurements practices that were specially relevant during LHC design and construction**.

Outline

- CERN mission
- European Industry and CERN
- Industrial Returns
- I.L.O. function
- Perspectives and Conclusions

CERN structure

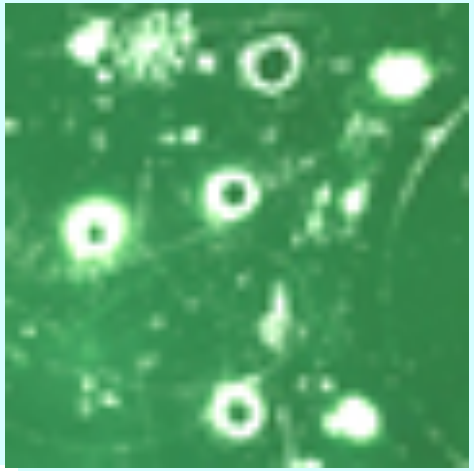
CERN: European Organization for Nuclear Research, the largest center for the physics of elementary particles.
The primary function of CERN is to provide scientists the **tools** for studying the elementary constituents of matter and the forces that hold it together: the **accelerators and the detectors.**

CERN was founded in 1954 and is the **first joint venture** among European Countries.
It currently comprises 20 Member States.
It homes approximately 6500 scientists (staff + visitors) from 500 University.

Particle Physics research

The whole world around us is made up of a small number of bricks (12), the elementary particles, which obey a few fundamental forces (4).
Some particles are stable and form the visible matter around us, some are unstable and live for very small fractions of a second.
At the moment of the Big Bang all coexisted.

Today only the enormous energies of accelerators can recreate them: to study their nature is like going back in time to investigate the origins the Universe.



LHC & Detectors

The accelerator, LHC, is capable to accelerate particles up to very high energies to collide with other particles of the same energy.

Around the points of collision detectors are placed for identifying the products of these interactions.
Detectors also are also huge machines which differ in the specific phenomena they want to investigate.

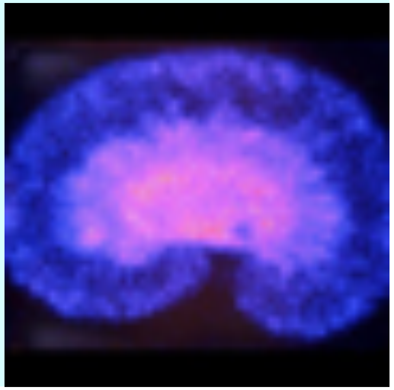
Research Spin-off

Accelerators and detectors require a **cutting-edge technology**.

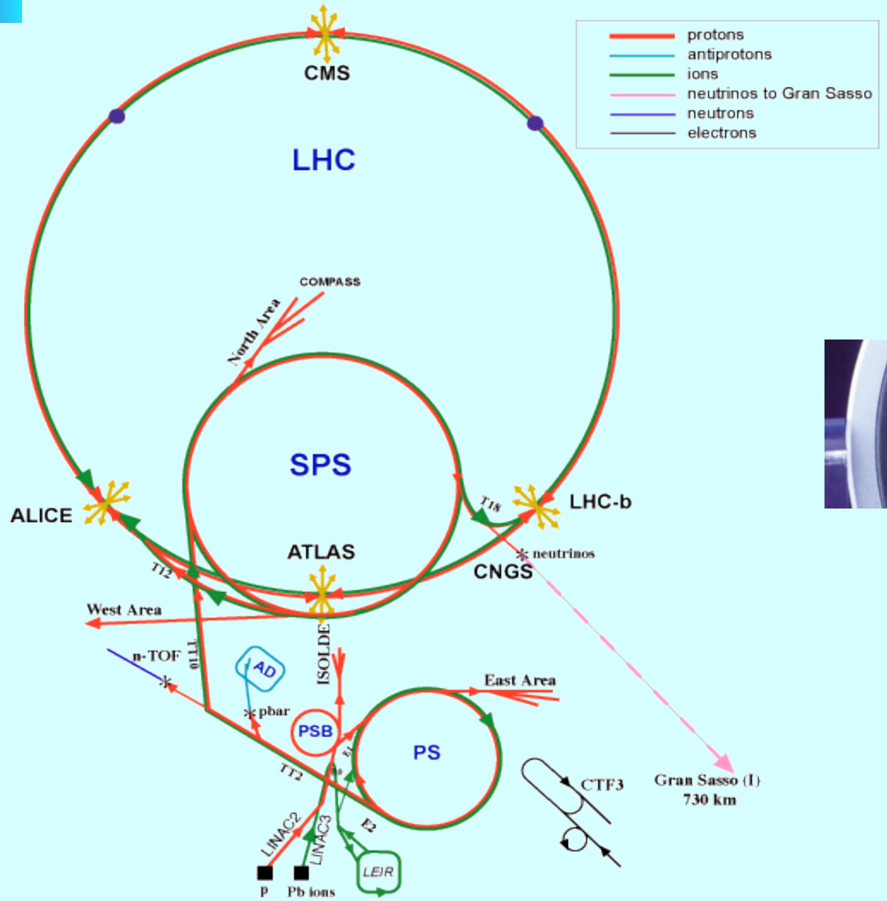
CERN always operates in close cooperation with the **Member States industries**. **LHC was an opportunity for a continue TT experience.**

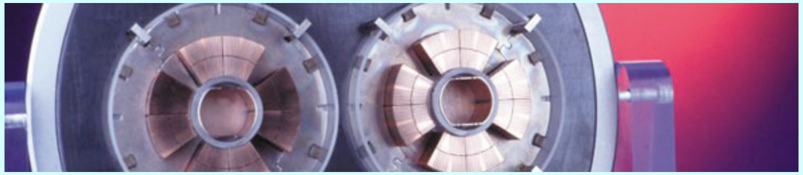
In addition to fundamental results in ***good*** research, **spin-offs, in different domains**, have become part of everyday life:

diagnostic and therapeutic techniques, *techniques for non-destructive materials investigation, superconductivity, sophisticated instruments, µelectronics, www (World Wide Web), GRID, etc.*

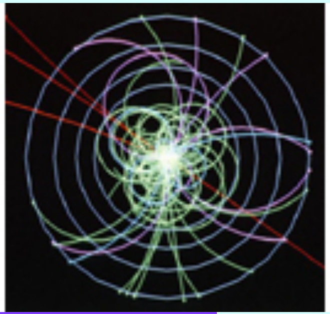


CERN accelerators *SYSTEM*





LHC

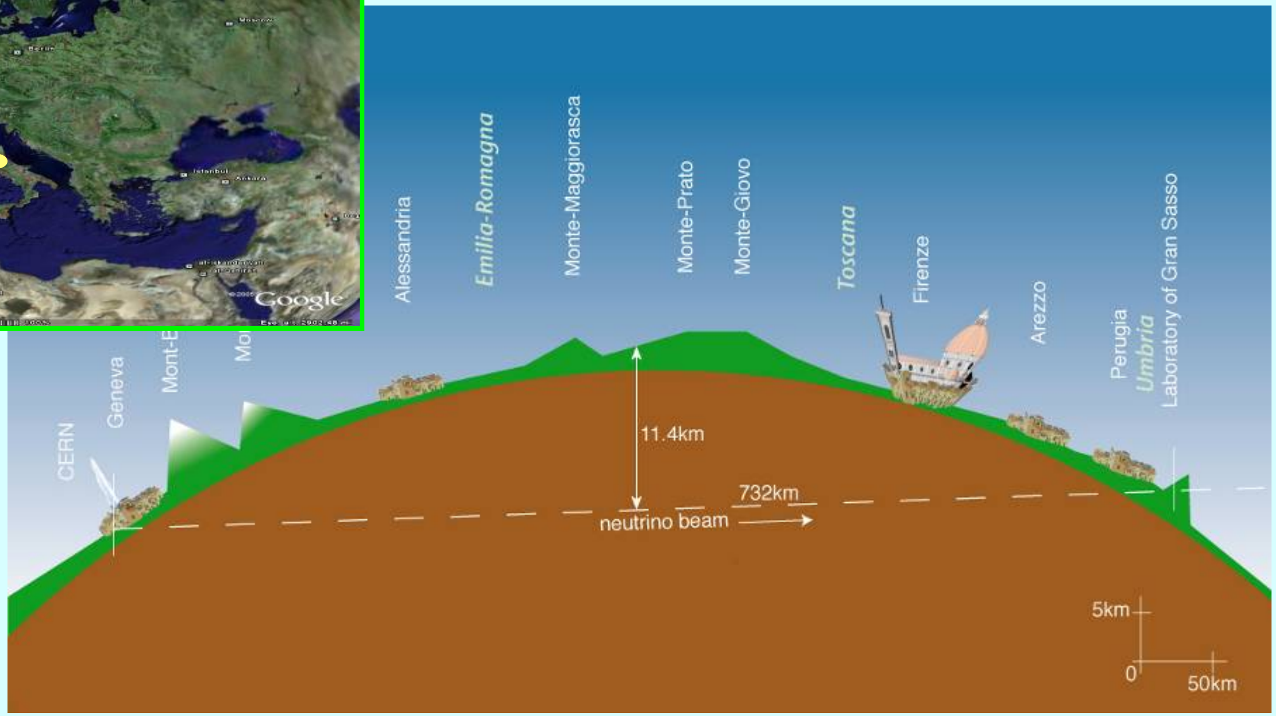


L = large, **H** = hadron, **C** = collider,
Large for the dimensions, about 27 km circumference,
Hadron because it accelerates protons or ions,
Collider because two beams that run in opposite directions collide in four sections of the circumference.
Each proton beam can reach an energy of 7 TeV,
the beams then collide at 14 TeV (T = 1012) energy of 14 TeV (T = 10^{12})
[1TEV ~ energy needed for a mosquito to fly, but confined in a volume a million billion times smaller (10^{-15})!].

Main parameters

Accelerated particles: protons and heavy ions
Circumference: 26,659 Km
Energy injection: 450Gev
Collision energy: 7 Tev
Magnetic field dipoles: 8.33 Tesla
Dipoles Temperature: 1.9 K
Number dipoles: 1232
Total number of corrector magnets: ~ 7000
RF accelerating cavities: 8 per beam
RF frequency: 400.8 MHz
Power required: 120MW

CNGS (CERN Neutrinos to Gran Sasso)



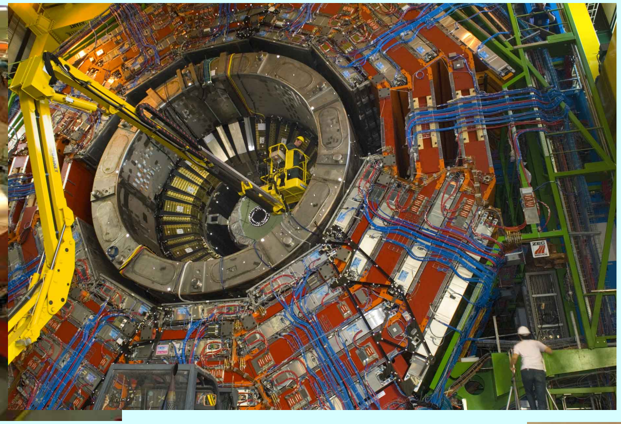
Direct evidence of the oscillationone $\nu_\mu \rightarrow \nu_\tau$ (appearance experiment)

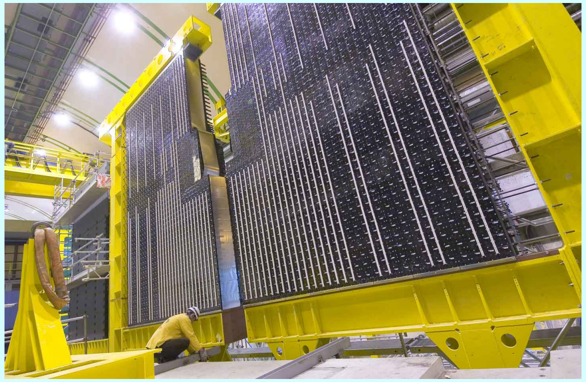
Budget LHC + esperimenti (4)

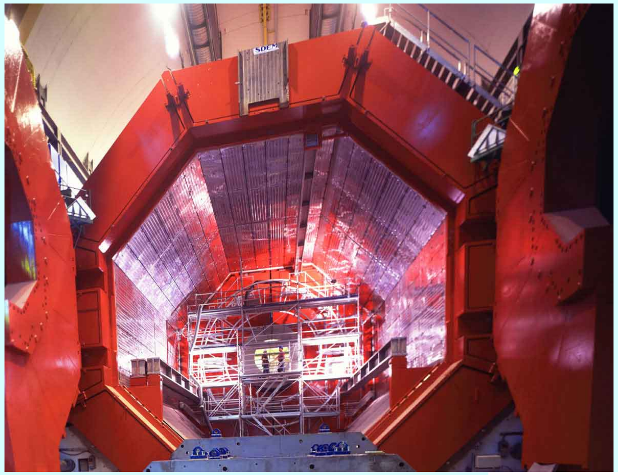
LHC	**~**	**6000 M€**	
ATLAS	**~**	**336 M€**	*(INFN 35 M€ -> 10.5%)*
CMS	**~**	**320 M€**	*(INFN 43 M€ -> 13.4%)*
ALICE	**~**	**92 M€**	*(INFN 21 M€ -> 23.2%)*
LHCb	**~**	**47 M€**	*(INFN 7 M€ -> 14.4%)*
CNGS	**~**	**48 M€**	*(INFN 38 M€ -> 80.3%)*
totale	**~**	**843 M€**	*(INFN**144 M€ -> 17%**)*

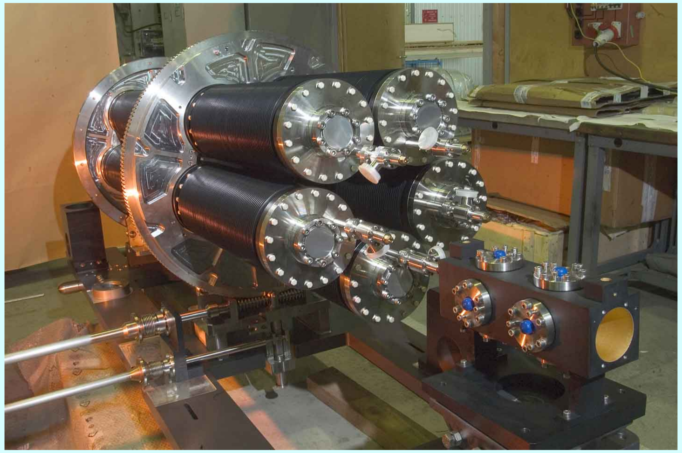
CERN takes part in all the experiments for ~ 20% of the their total cost -> ~ 200 M €.

I grandi rivelatori (4) e CNGS



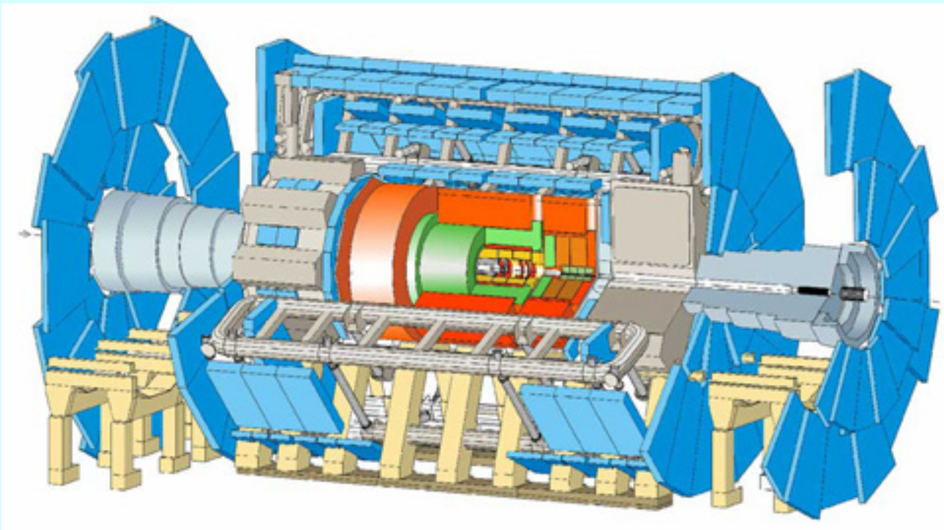






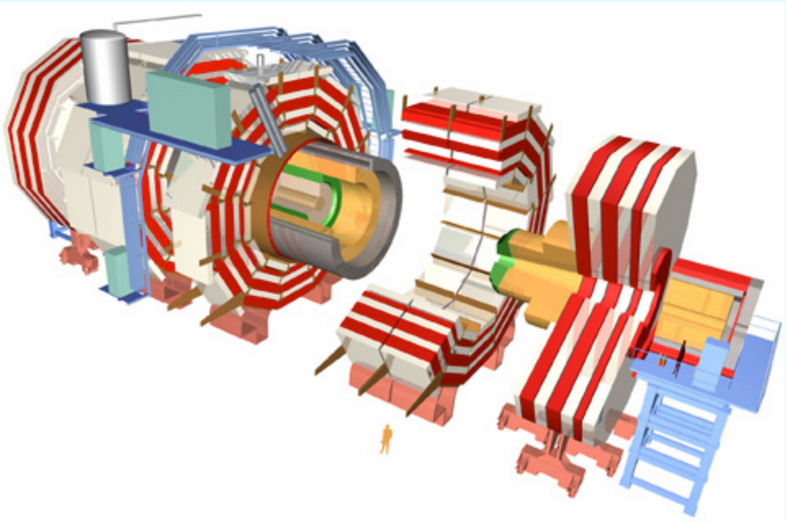
ATLAS

ATLAS detector Size:
46 m long, 25 m high and 25 m wide.
The ATLAS detector is the largest volume particle detector ever constructed. Weight: 7000 tons
Design: barrel plus end caps



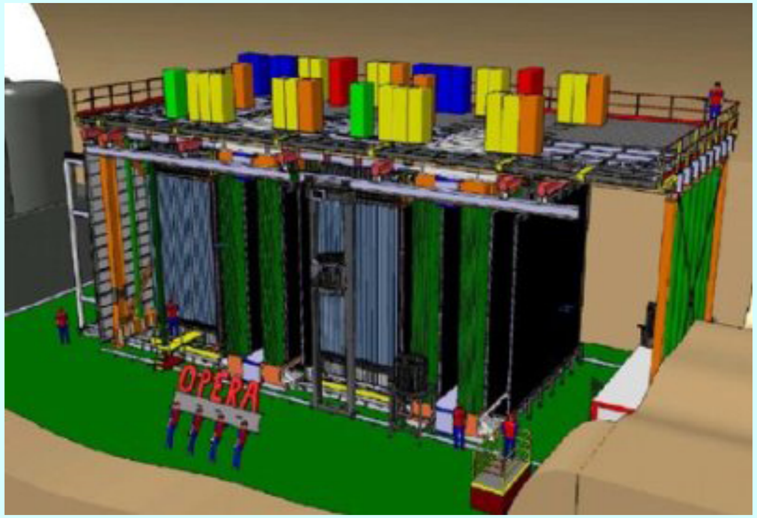
CMS

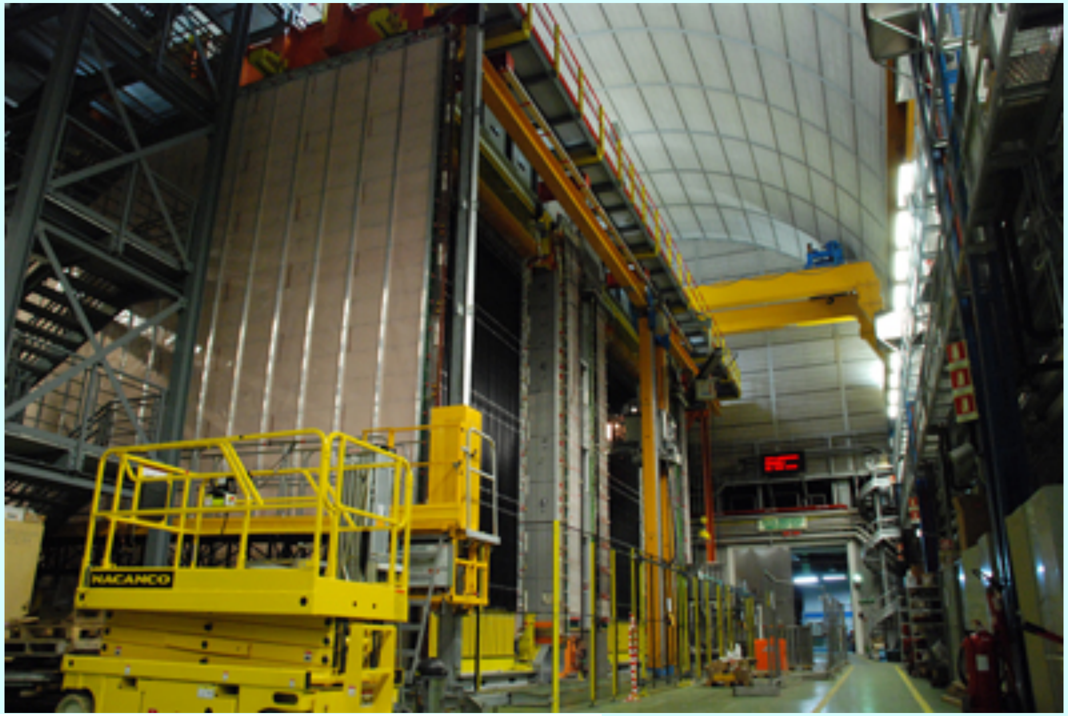
CMS detector
Size: 21 m long, 15 m wide and 15 m high.
Weight: 12.500 tons
Design: barrel plus end caps



OPERA

LNGS



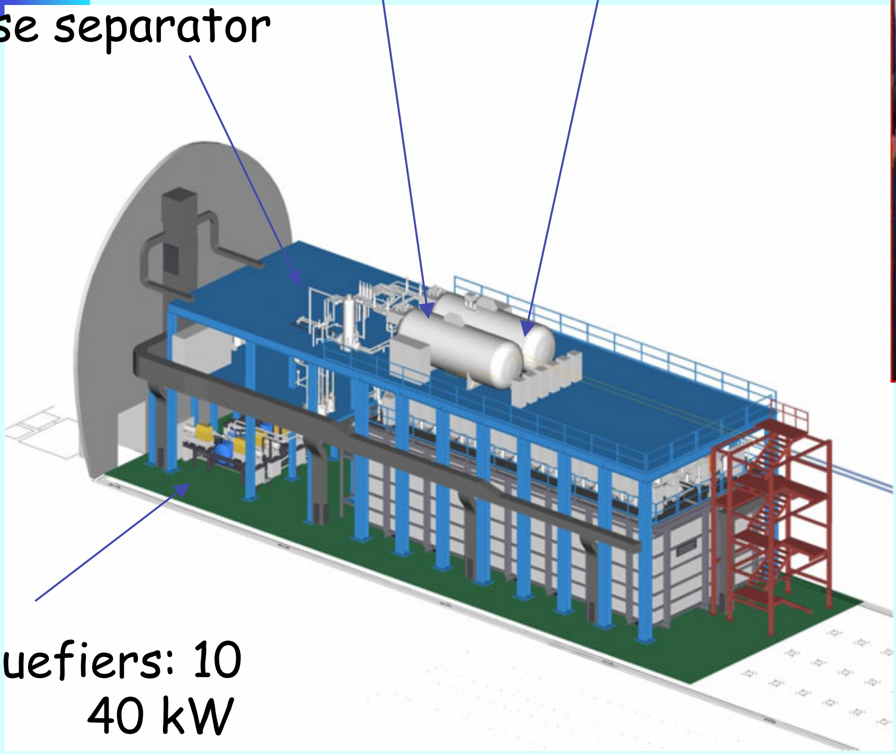


ICARUS T600 in LNGS Hall B

30 m^3 LAr Vessel

30 m^3 LN_2 Vessel

N_2 Phase separator



N_2 liquefiers: 10 units, 40 kW cryo-power

Budget 2013

Germania	219kCHF	20,24%	Norvegia	27kCHF	2,48%
UK	147kCHF	13,58%	Austria	24kCHF	2,18%
Francia	168kCHF	15,52%	Danimarca	20kCHF	1,83%
Italia	**121kCHF**	**11,15%**	Finlandia	15kCHF	1,38%
Spagna	88kCHF	8,10%	Grecia	18kCHF	1,64%
Olanda	50kCHF	4,59%	Portogallo	13kCHF	1,25%
Svizzera	56kCHF	5,14%	Cekia	11kCHF	0,97%
Belgio	31kCHF	2,84%	Ungheria	7kCHF	0,63%
Svezia	30kCHF	2,75%	Slovacchia	5kCHF	0,48%
Polonia	50kCHF	4,59%	Bulgaria	3kCHF	0,28%

Total **100%** **1’ 093’ 669’ 300 CHF**

Industrial Liaison Officer

Each member state has an Industrial Liaison Officer who treats industrial relations of his country with CERN. The I. L.O. attends meetings of the **Finance Committee** and provides support and advice to companies.

Twice a year **ILO-Forum** meets to discuss purchasing policies and TT results.

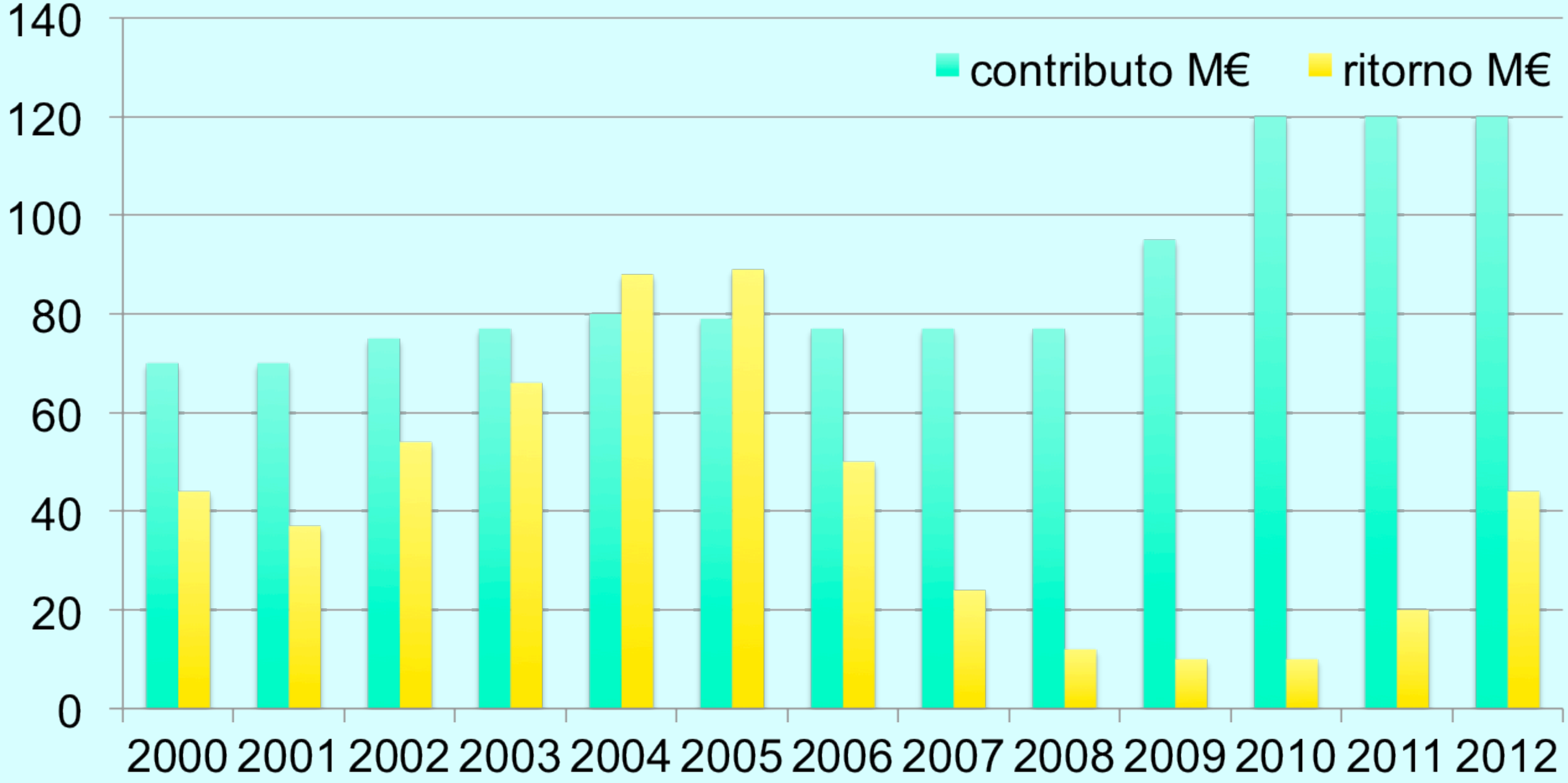
ILO-Forum was created (2008) by Italian initiative.

Return Coefficient

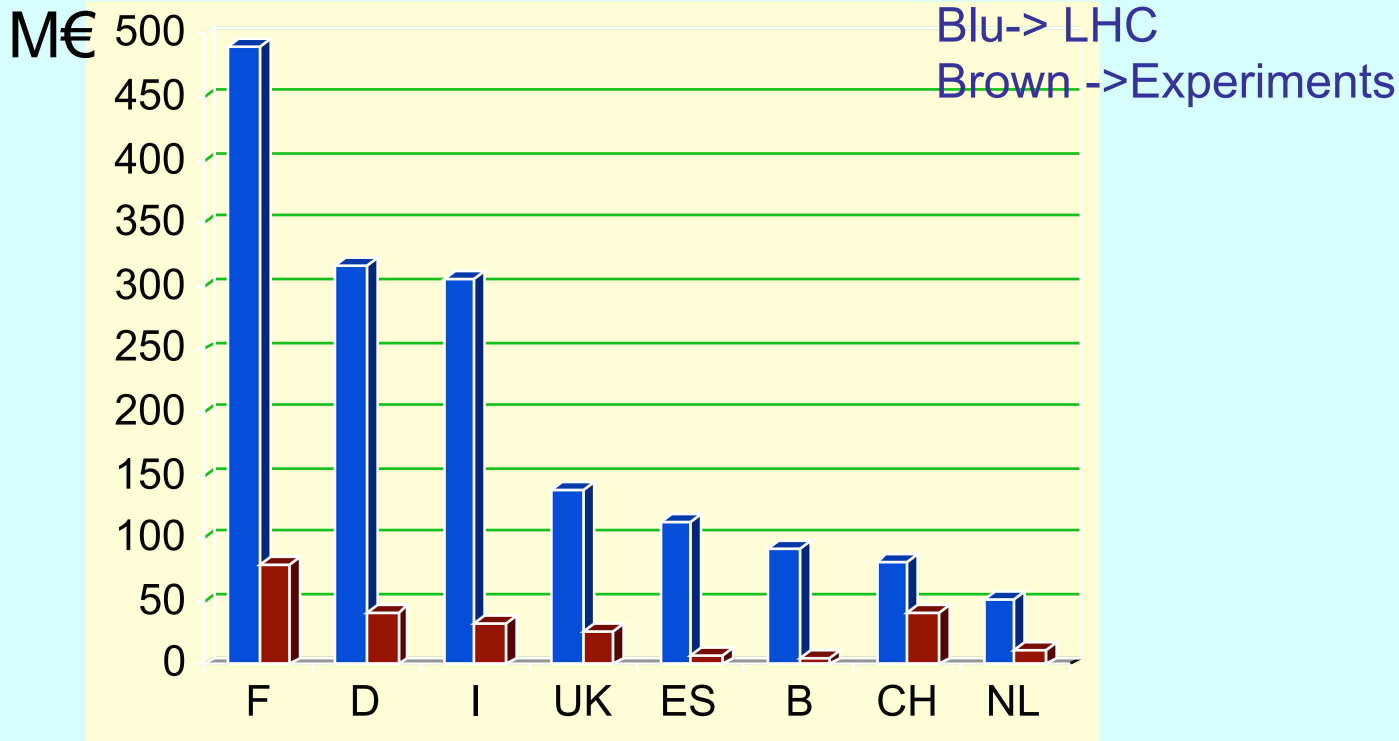
Return Coefficient is the ***ratio*** between the ***percentage of expenditure*** in an individual Member State and the Member State's ***percentage contribution to the Budget.***

I.L.O. monitors the Return Coefficient.
His mandate is to keep his country well balanced.

Italy's Contributions and Industrial Returns



LHC related returns + experiments



Total for Italy 305,26+32,13=337,39M€

1.01.1995-31.03.2008

ERF Technology Transfer and Industrial Relations in Research Infrastructures
NH Hotel / Trieste, Italy / 6-7 June 2013
elettra

Italian Return Coefficient

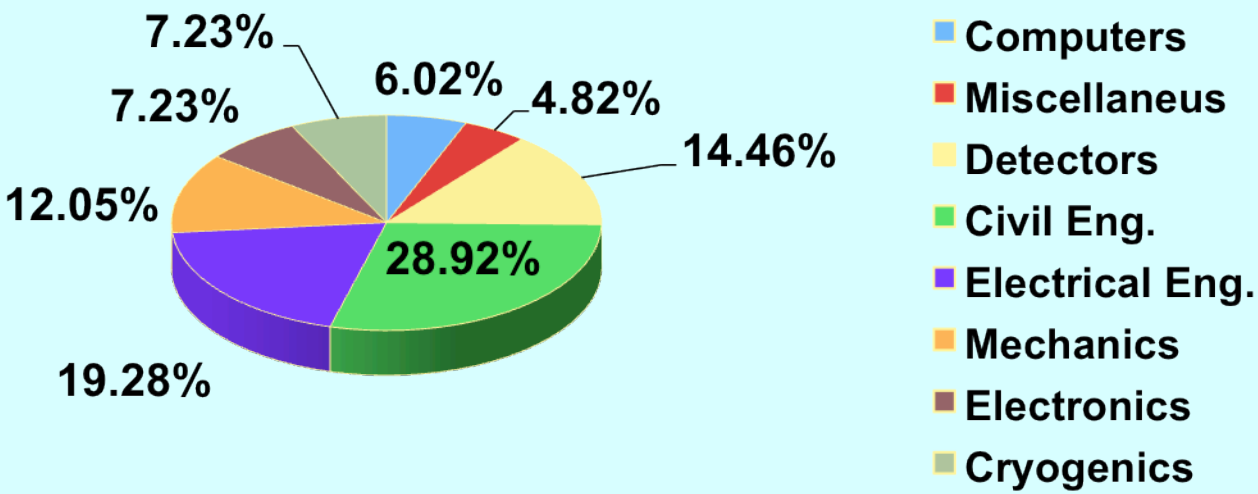
Italian Return Coefficient based **on 2012** purchasing is **0.91**, while average on last three years was 0.60.

Target Return Coefficient is 0.91

Presently **only four** Member States are above the target coefficient (well balanced):

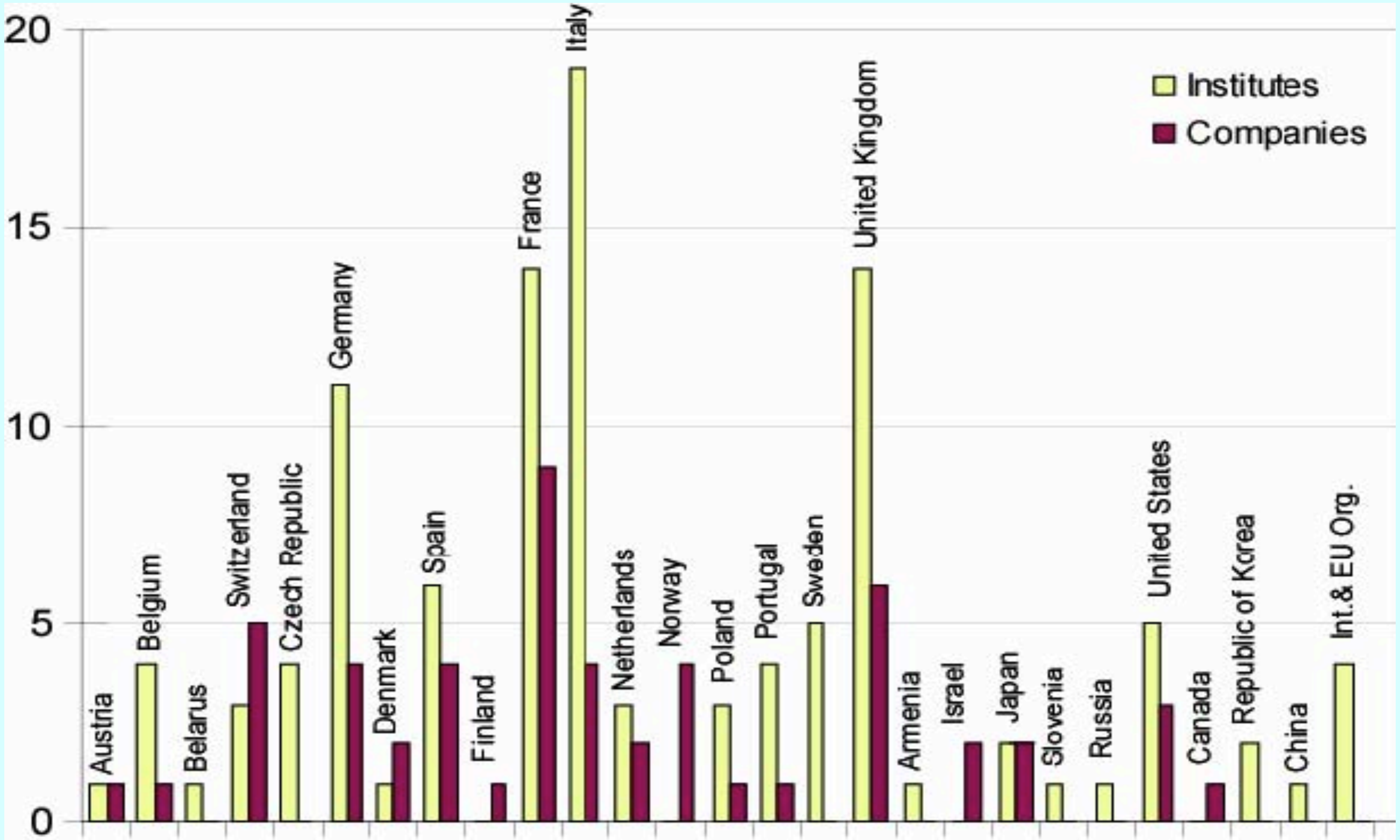
France, Switzerland, Portugal, Czech Rep.

Italian Supplies 2012



Total 43,5 MCHF

TT agreements between CERN & other subjects



ERF Technology Transfer and Industrial Relations in Research Infrastructures
NH Hotel / Trieste, Italy / 6-7 June 2013
elettra

Apprendimento tecnologico da commesse LHC

E. Autio, M. Streit-Bianchi A.P. Hameri

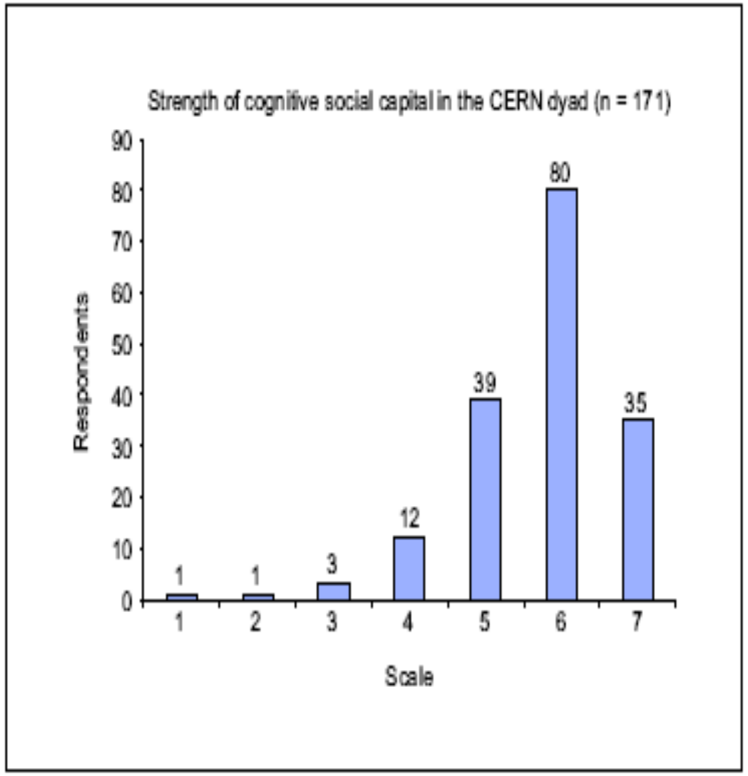


Fig. 37 Cognitive social capital built into the relationship

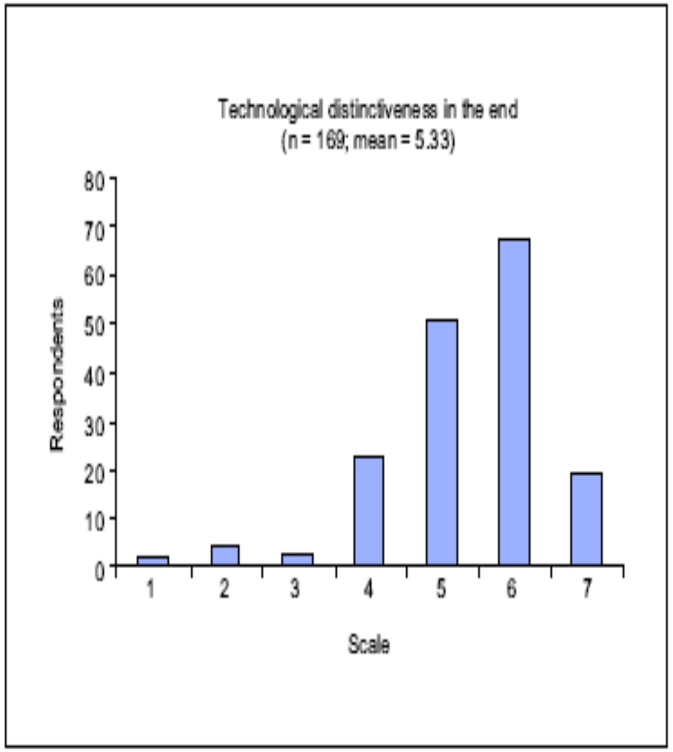


Fig. 7 Technological distinctiveness of the respondent companies at the end of the project

Conclusions

*The LHC project was a **great opportunity** for the European and Italian **industrial system**.*

*Providing CERN is a **growth factor** for companies.*

*CERN will continue to be **qualified expenses** although with lower profile.*

*Since many years Italy is among the three **strong suppliers** of CERN.*