CERN and IEEE:
A Shared Destiny

IEEE's 125th Anniversary

Technical University Munich

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CERN

IEEE and CERN

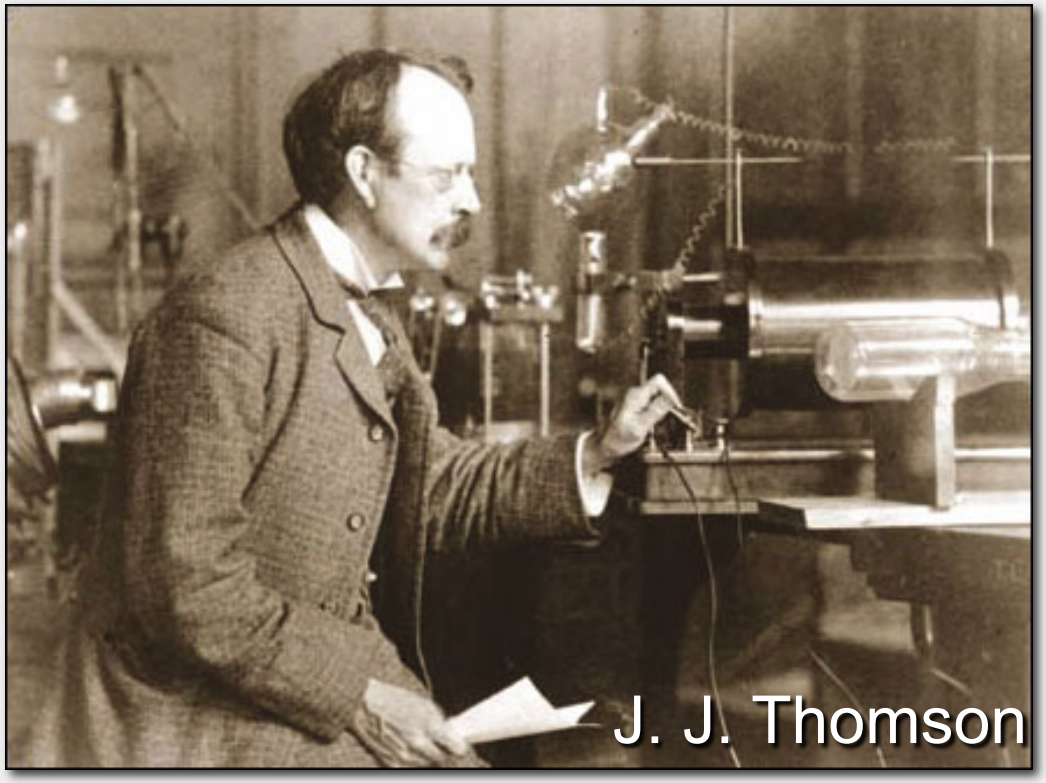
1884: American Institute of Electrical Engineers (AIEE) was founded in New York

Electrical engineering was at its infancy

Particle Physics has not yet been conceived

What difference 125 years can make!

The Birth of Particle Physics



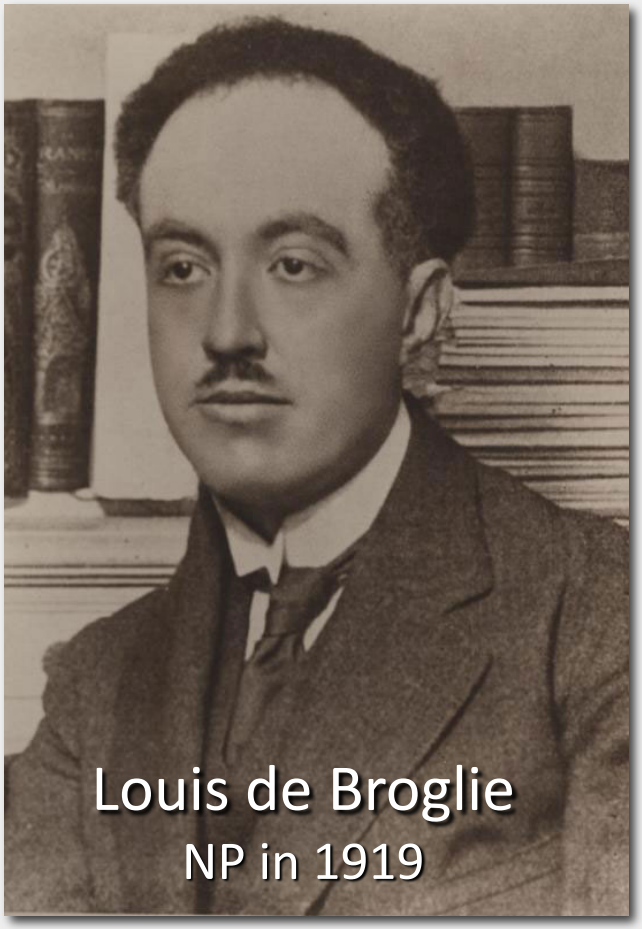
Thomson's device was a masterpiece of contemporary electrical engineering

1897:
J.J. Thomson discovered the electron

"A particle so small that nobody had ever seen one"

Particle physics and the IEEE were natural partners from the very start.

The Birth of CERN



1949:

First public airing of the idea for a **world class European Laboratory for basic physics**

Louis De Broglie:

*"A laboratory where it would be possible to carry out **scientific work** above and beyond the framework of the various nations taking part ……*
an engine for peaceful collaboration across borders"

CERN's Dual Mission

CERN founded in **1954** with a **dual mission:**
Research and collaboration for the betterment of humanity


Start of construction work in Meyrin (Geneva)

Founding principle of AIEE:
Support professionals in their fields and aid them to apply innovation for the betterment of humanity

55 Years of CERN

CERN was founded as collaboration of nations:

12 Member States in 1954

Today: 20 Member States

Today:

- Collaboration agreements with some 40 other countries
- > 100 nationalities represented in the CERN user community

IRE + AIEE = IEEE

Common goal: Sharing knowledge through conferences and publications, ensuring an optimal platform for innovation

1912:
Institute of Radio Engineers (**IRE**) founded as a support network

1884:
AIEE founded as a support network

1963: IRE + AIEE = **IEEE**

At that time:
IEEE a largely American Organization
CERN turns nine! a largely European Organization

Today:
Both are global in scope

CERN's Core Mission

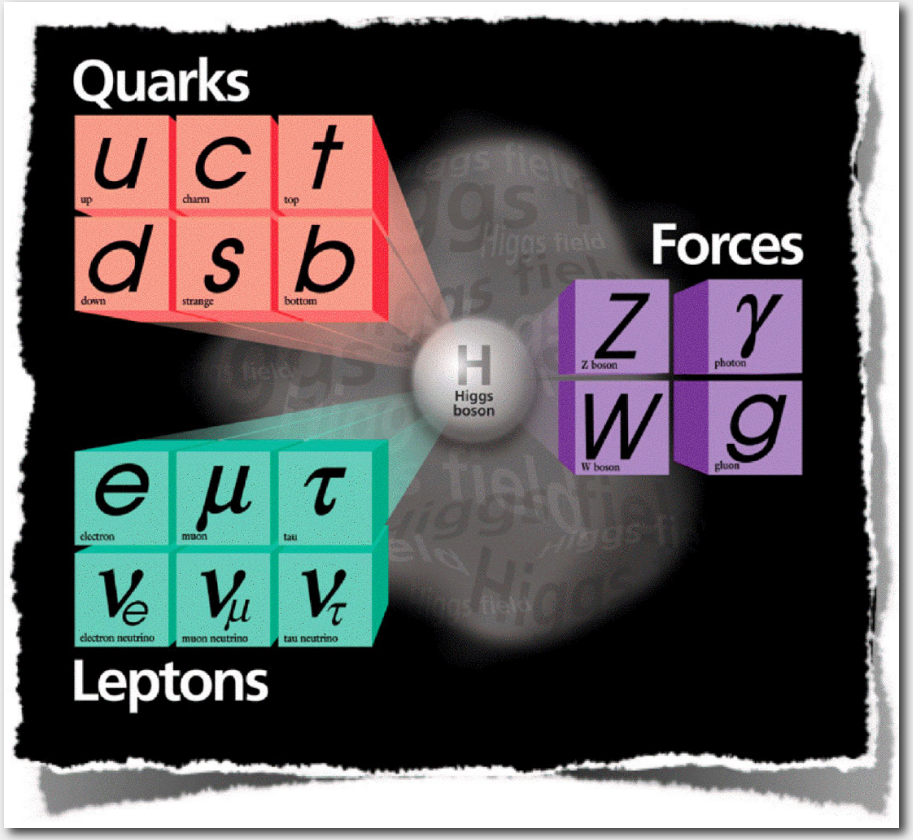
CERN is a Laboratory devoted to **basic research**, pushing forward the **frontiers** of human **knowledge.**

CERN's scientists have made important contributions in many areas

Nobel Prize in 1984:

- C. Rubbia for **basic research**
- S. van der Meer for a **technical innovation**

The Standard Model of Particle Physics

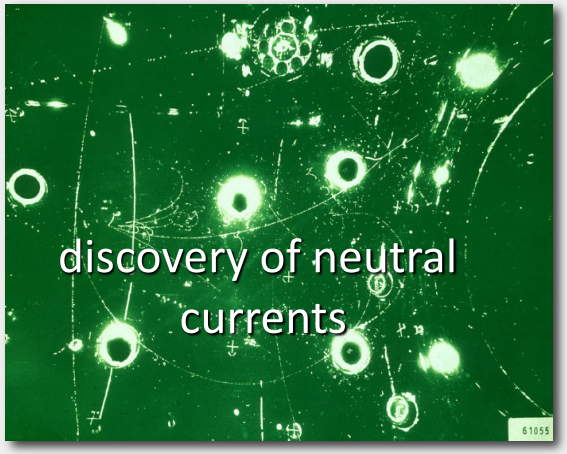


The Standard Model encapsulates our knowledge of the **fundamental particles** and the **forces** that act between them

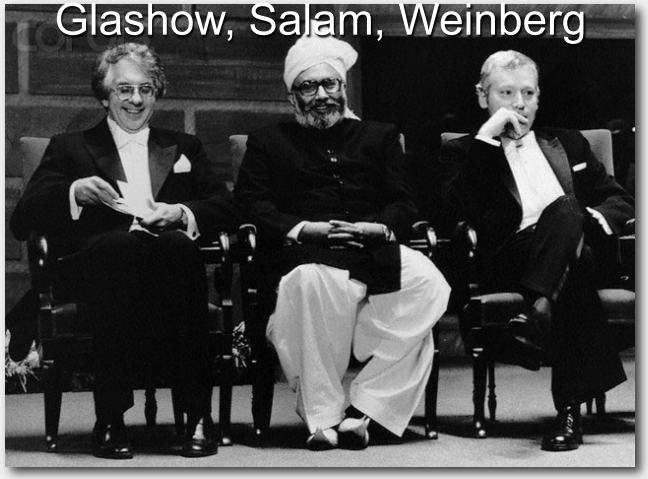
Constantly evolving interchange of theory and experiment for over 40 years and CERN has been at the heart of this process

The Standard Model

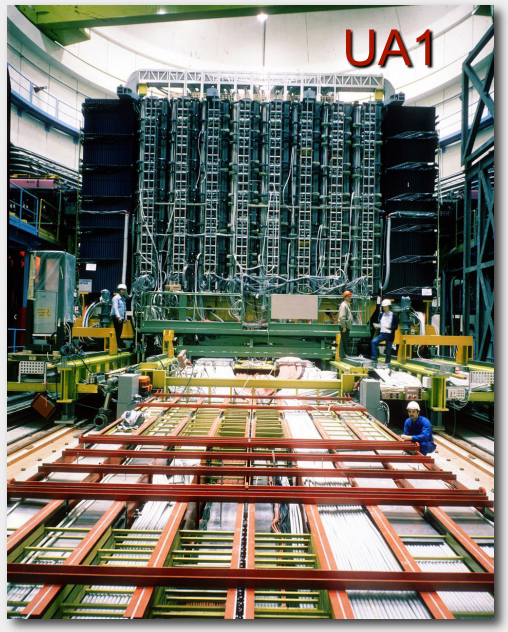
From the **first hints** that the **electroweak theory** was right in 1973 ……



…. to the **NP** for the **electroweak theory** in 1979….

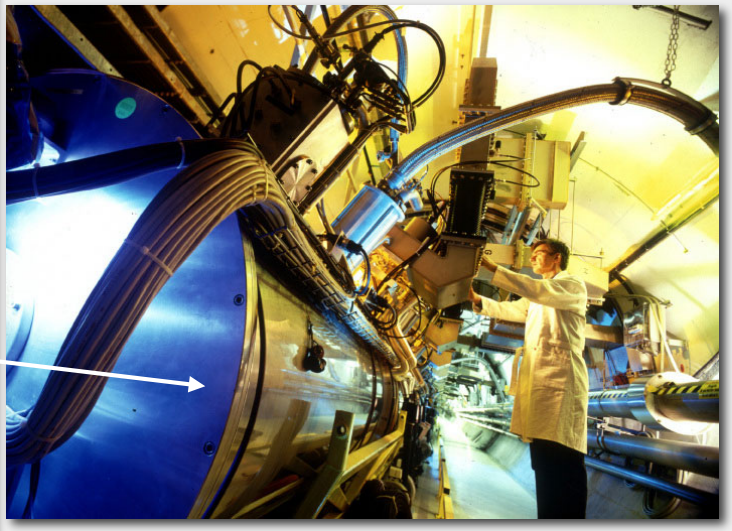


… to the **discovery of the carrier (W, Z)** of the **weak force** with the UA1 and UA2 experiments at CERN in 1983 (**NP in 1984**) …



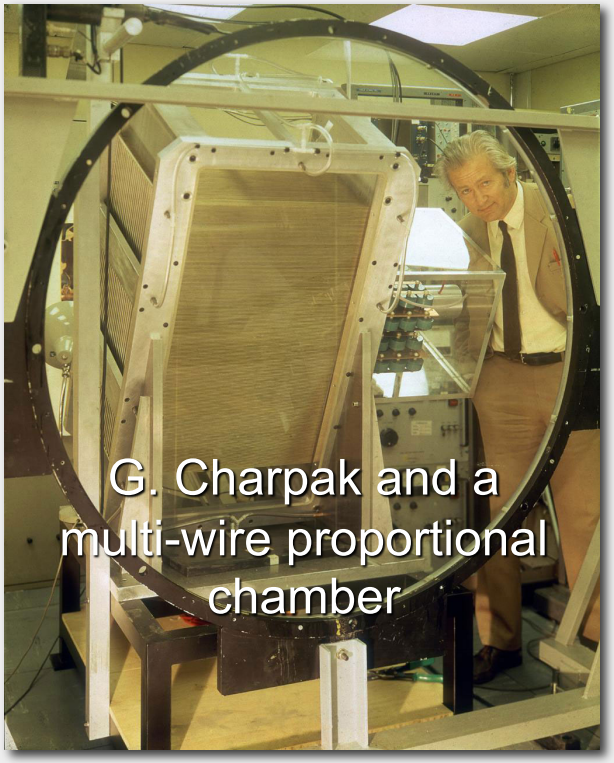
The Standard Model

…… to CERN's flagship research facility in the 1990s:
the **Large Electron Position (LEP)** collider, putting the
electroweak theory on extremely solid experimental foundations



Inside the LEP tunnel

Particle Detection Techniques


G. Charpak and a multi-wire proportional chamber

Georges Charpak transforming particle detection techniques from optical to electronic in the 1960s
Revolutionising many other areas as well

1992: NP in Physics

Walter Le Croy: *"Charpak's invention had transformed the world of the electronics developer"*


2006: IEEE Milestone Award

G. Charpak and W. Cleon Anderson

The LHC: CERN's New Flagship

The new generation of detectors will record **proton-proton collisions** at an **unprecedented energy**: Detectors with 100 million individual electronics readout channels sample data at a rate of 40 MHz

Data will be analyses on a vast **worldwide spanning grid** of computers linked by dedicated fibres and the Internet.

The Need for Standards

IEEE's work on standards is vital for complex scientific instruments

A current **hot topic** at the particle accelerator conferences – sponsored by IEEE – is **electromagnetic compatibility**. LHC scientists are working with IEEE on **extending the range beyond** the frequency range covered by **current standards**.

Engineering the Future

Which way should we go to **engineer the future for the benefit of humanity?**

- Basic science as carried out at CERN provides the foundations for future knowledge and innovation.
- Basic science rests on a solid foundation of good practise in engineering, as exemplified by the IEEE.
- That is why the histories of our two organisations are so closely intertwined, and why I believe that is the way to continue.

Happy Anniversary !!