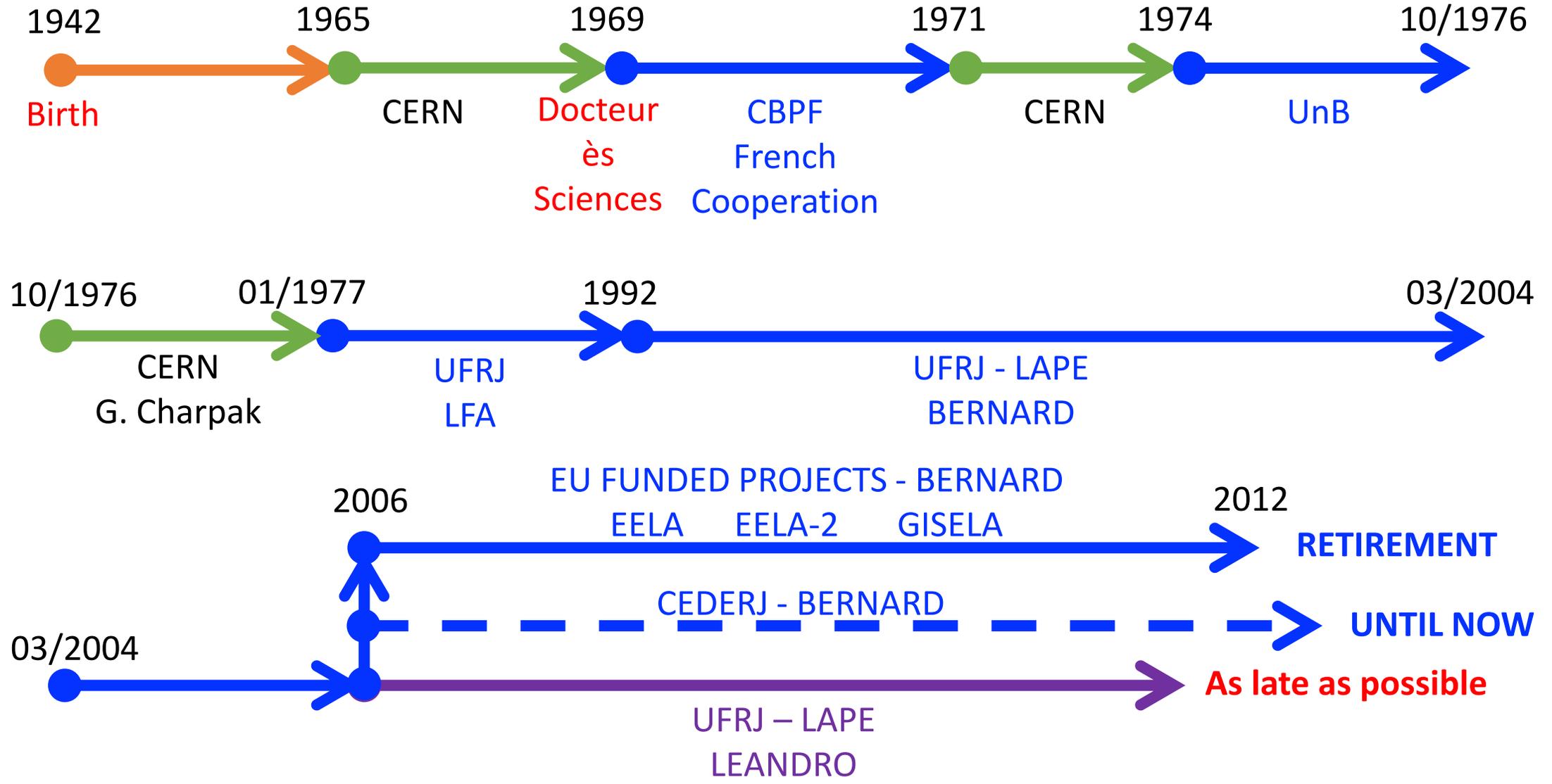




Laboratório de Partículas Elementares: from its genesis to the LHC era

Presented by Bernard Marechal
LAPE 30 years workshop – Rio de Janeiro , Octobre, 25, 2022

From 1942 to 21th century...



Once upon a time... in the late 60s



- At CERN, in L. Montanet's Bubble Chamber Group:
 - Prof. Roberto Salmeron (UnB) visiting professor (had left Brazil in 1966 due to the political situation)
 - A couple of Grenoble + Paris University students preparing their PhD before their military service
- In Latin America:
 - President Charles de Gaulle, promoting cooperation "la mano en la mano" to each Latin America country, all along an historical trip
 - Prof. José Leite Lopes, Director of CBPF welcoming warmly (young) scientists in his institute
- As a result, a Brazil-French connection was established under the French Cooperation scheme
 - Half a dozen of "coopérants" spent 18 months at CBPF participating in research activities and giving lectures
 - In several cases durable successful relations were established (even outside HEP)

But the 1969 political situation largely contributed to a 20-year blackout in HEP collaboration



- Several Brazilian scientists were fired and had to emigrate (e.g., Prof. José Leite Lopes)
- Several Brazilian students emigrated to make their PhD outside
- The Brazil-French HEP Cooperation exchanges ended up
- A few groups could survive, e.g. HEP Groups collaborating with Fermilab (L. Lederman)
- A few physicists made their best to maintain research activities

The creation of the Laboratório de Física Aplicada (LFA) (1/2)



- Coming back to Brazil in 1974, I was one of these “resistants”
- In 1976, with the support of the IF/UFRJ Director, Eugênio Lerner and of Profs. Fernando de Souza Barros and Solange May Cuiabano Barros, I created the LFA whose mandate was to develop new detectors based on modern wire chamber technologies, but for various applications other than HEP
- To fulfil his ambitious mission the LFA included progressively skilled mechanical and electronical technicians and young physicists

The creation of the Laboratório de Física Aplicada (LFA) (2/2)



- Collaborations with frequent exchanges were established with:
 - The Georges Charpak Group at CERN, one of the most advanced in the MWPC field
 - The Laboratoire de Physique Corpusculaire (Marcel Froissart - Collège de France)
 - The Laboratoire de l'Accélérateur Linéaire (LAL – Université d'Orsay)
- This resulted in fruitful joint realizations such as a detector for Mössbauer instrumentation and a device for two-dimensional localization of events that generate current on a resistive surface (Patent with R. Bruère-Dawson and Profs. M. Froissart and Marcio Nogueira de Souza)

Renaissance of the Brazil - CERN collaboration

LFA becomes LAPE (1/5)



- End 80s, at pre-LEP time, a few Brazil-CERN exchanges were occurring (e.g. with COPPE) but Brazil was going to miss the opportunity to join the LEP program
- In 1989 thanks to the UFRJ Rector (Nelson Maculan), a sustained CERN-UFRJ cooperation was established in the DELPHI experiment under my leadership. In 1992, due to this new major orientation to HEP physics, the LFA became the LAPE (Laboratório de Partículas Elementares)

The LAPE – DELPHI Collaboration at LEP (1/3)

- In 1993 an EU Project (UFRJ - CERN Collaboration in the DELPHI Experiment at LEP and in the R & D Programme for the LHC) was submitted successfully to the EC with the full support of Prof. Carlo Rubbia (CERN DG) and of his advisor Dr. Juan Antonio Rubio
- Several new physicists joined to form the official DELPHI-UFRJ Team supported at CERN by DELPHI Spokesmen [Ugo Amaldi (1981-1994), Jean-Eudes Augustin (1995-1996), Daniel Treille (1997-1998), Walter (Wilbur) Venus (1998-1999), Tiziano Camporesi (2000-2001) and Jan Timmermans (2002)]

Renaissance of the Brazil - CERN collaboration

LFA becomes LAPE (2/5)



The LAPE – DELPHI Collaboration at LEP (2/3)

- Major outcomes of the Joint Project in DELPHI:
 - Physics (L. de Paula, S. Amato, J. H. Lopes, D. Reid et al.):
 - ❖ Tau physics: Accurate measurements of physical constants (polarization, branching ratio, mixing angle)
 - ❖ Search for new particles: Precise limits on the masses of super-symmetric leptons determined
 - Detector development (M. Barbi, M. Gaspar, B. Marechal, P. Siegrist et al):
 - ❖ Fast-response electronics Silicon Radiation Detector (SRD) sensitive to low-energy photons built in collaboration with CEN-Saclay. Since 1997 it has played a key role in protecting the DELPHI detector against high-level synchrotron radiations
 - Data processing (S. Amato, L. de Paula, D. Carvalho):
 - ❖ New computer architecture, based on two HP712 Workstations implemented in 1996 at LAPE. All the DELPHI software installed, providing a modern and well-supported computing environment for its activities in DELPHI

Renaissance of the Brazil - CERN collaboration

LFA becomes LAPE (3/5)



The LAPE – DELPHI Collaboration at LEP (3/3)

- Major outcomes of the Joint Project in DELPHI:
 - Online computing (See D. Carvalho talk):
 - ❖ By the end of 1993, D. Carvalho took the responsibility of the Distributed Computer Control System (DCCS) of the Delphi Online computing cluster. He developed two important online applications:
 - GIN: a General Information moNitor allowing to monitor efficiently the complete activity of large Distributed Computer Control Systems (DCCS)
 - Buffer Manager (Alpha VMS version): re-engineering for Alpha VMS platform of the Buffer Manager software task, controlling the data acquisition
 - ❖ In 1995 S. Amato took charge of the Data Quality Control of the experiment. She developed a very useful application allowing to verify quasi-online the stability of the physical quantities extracted from the data freshly taken by the detector

Renaissance of the Brazil - CERN collaboration

LFA becomes LAPE (4/5)



The LAPE – LHC R&D Cooperation

- Besides its participation in DELPHI, LAPE supported several R&D activities for the LHC in particular the forthcoming participation in LHCb such as:
 - Micro-strip detector development started for the DELPHI upgrade and extended in the LHCb Vertex detector project (Miriam Gandelman, Kazu Akiba)
 - Involvement of the whole LAPE Group in the LHCb Muon chamber detector project including:
 - ❖ Development of the CERN/RIO Current Amplifier – CARIOCA (part of the Danielle Moraes PhD thesis)
 - ❖ Investigations of Muon Chamber technologies (part of the Erica Polycarpo PhD thesis))
 - ❖ Implementation of the zero-level muon trigger (part of the Tatiana da Silva PhD thesis)

Renaissance of the Brazil - CERN collaboration

LFA becomes LAPE (5/5)



LAPE - CPPM collaboration under the umbrella of a CNPq – CNRS agreement

- From 2000 to 2003, the “Colaboração LAPE-CPPM para o Desenvolvimento do Sistema de Muons do Experimento LHCb” enabled several fruitful exchanges between Rio de Janeiro and Marseille (J.H. Lopes, J.R.T. de Mello Neto, L. de Paula, T. da Silva, R. Le Gac, O. Leroy, B. Viaud)

LAPE - Pierre Auger Observatory Collaboration

- In 1998 and 1999, short (E. Polycarpo and B. Marechal) participation in the Surface Detector Development
- Still ongoing involvement of Joao Ramos Torres de Mello Neto in physics studies of very high energy cosmic rays

Organization of workshops, collaboration weeks and schools



- During the LEP and pre-LHC eras, several cooperation and dissemination events were organized under the responsibility or with major engagement of LAPE
 - DELPHI schools, workshops in Rio
 - Winter students HEP schools at CERN
 - DELPHI, LHCb weeks in Rio
 - ICFA workshop, CERN-CLAF schools in Rio
 - Invitation of renowned scientists (C. Rubbia, G. Charpak, D. Treille)
- I do believe that they were rather cost effective for the LAPE ongoing work and helped to raise its excellent reputation

LAPE – CERN Cooperation framework(1/2)



- The first 3-5 years of LAPE – CERN collaboration in LEP could be supported by the EU Joint Project
- Then LHC R&D activities were naturally growing and additional financial and manpower support had to be requested to CNPq and CERN:
 - In Brazil the funding agencies were FAPERJ and CNPq
 - At CERN were allocated:
 - ❖ An annual “Non Member State” budget for travel, short-term visits
 - ❖ Occasionally fellow, doctorate, technical or summer students’ positions

LAPE – CERN Cooperation framework(2/2)



- In 2005, the creation of the LA-European Academic Network HELEN with 22 LA and 16 European Institutions (L.Maiani, ex CERN DG, Dr. Juan Antonio Rubio CIEMAT DG) dedicated to the “Training of young generations in High Energy Physics to promote Fundamental Physics” was most helpful to the various collaborations
- Progressively, in the early 2000s, while LEP analysis was still going on and LHC preparation requiring all possible resources, it became clear that a change of scale in the Brazil-CERN cooperation form was most suited to secure the future
- This was achieved by the renewal of the Brazil-CERN Cooperation agreement (See Ph. Gavillet talk)

Coordination of 3 EU funded Projects during almost 10 years



Surfing the GRID with my “compagnons de route” Ph. Gavillet and D. Carvalho

- **E-INFRASTRUCTURE SHARED BETWEEN EUROPE AND LATIN AMERICA (EELA)**
 - <https://www-eela.ceta-ciemat.es/first-phase.php>
 - **21 Institutions in Europe and Latin America**
- **E-SCIENCE GRID FACILITY FOR EUROPE AND LATIN AMERICA (EELA-2)**
 - https://cordis.europa.eu/project/rcn/86622_en.html
 - **78 Institutions in Europe, Latin America and Caribbean**
- **GRID INITIATIVES FOR E-SCIENCE VIRTUAL COMMUNITIES IN EUROPE AND LATIN AMERICA (GISELA)**
 - <https://www.gisela-grid.eu/>
 - https://cordis.europa.eu/project/rcn/95836_en.html
 - **19 Partners + 12 Third Parties in Europa and Latin America**

Just to remember that physics is not only equations



**Thank you,
hoping to see you
soon ...
to celebrate the
"LAPE 40 years"**