Le LAL et le CERN

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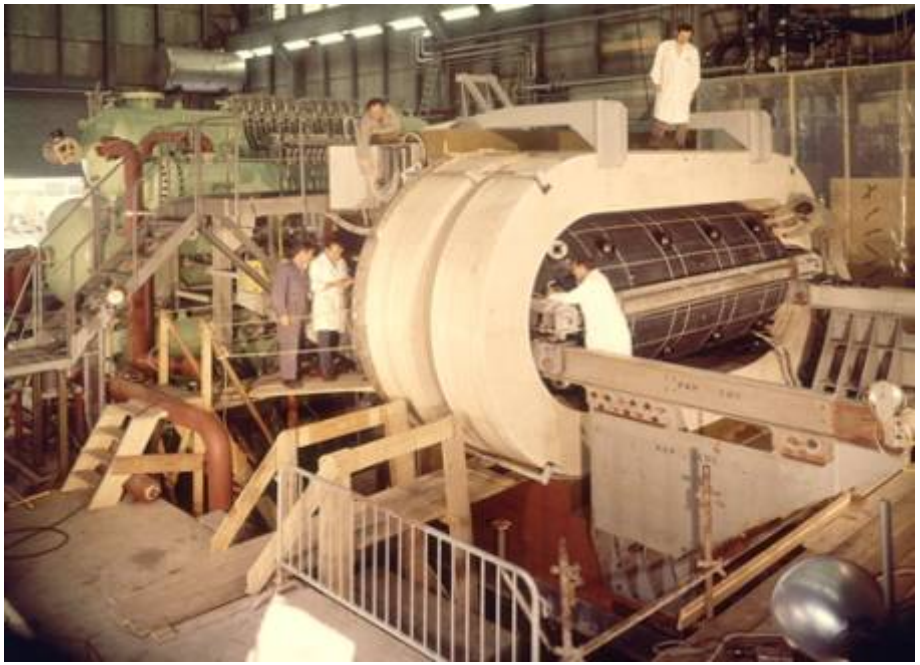
8 juin 2006

Le LAL et le CERN

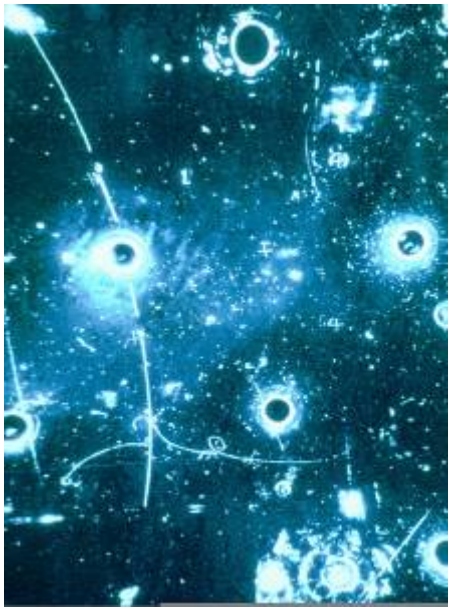
- 1954-2004 : 50 years of CERN
- 1956-2006 : 50 years of LAL
- Over the past 50 years our two laboratories have grown together
- 24 December 1958 : first operation of LAL's electron linac at 3 MeV
- 24 November 1959 : first operation of CERN's Proton Synchrotron at 24 GeV
- 2006
  - preparations together for the LHC, a 7 TeV proton collider
  - and for the future with CLIC, a multi-TeV electron linear collider

Gargamelle

Lagarrigue (LAL) et Rousset (CERN)



Gargamelle au CERN



1973: Courants neutres

Gargamelle

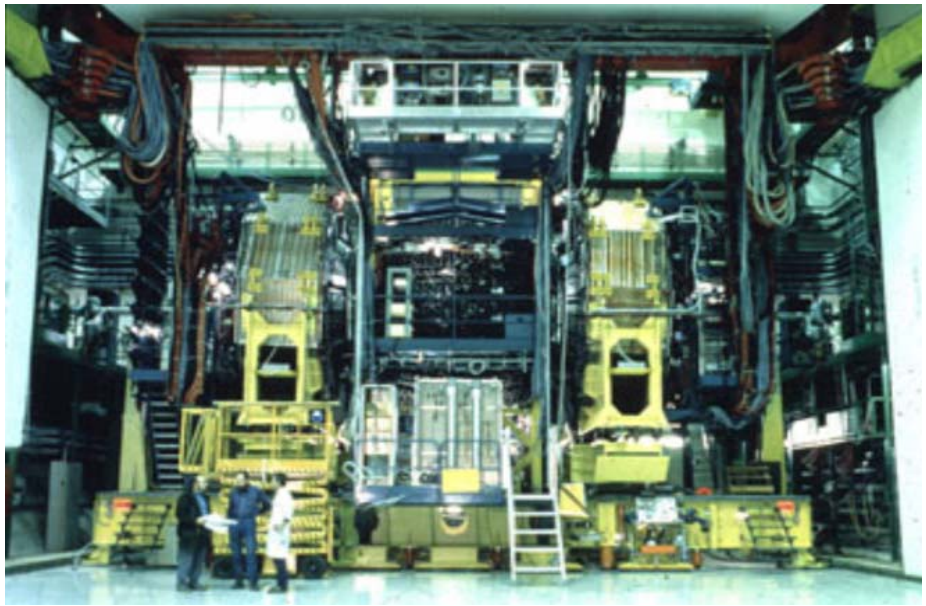
- 1970 - The big bubble chamber, Gargamelle, comes to the PS at CERN
- 2 m diameter, 4 m long, filled with Freon, with a magnetic field of almost 2 T
- 1973 - discovery of neutral currents
- André Lagarrigue, the “father” of Gargamelle, director of LAL from 1969 until his untimely death in 1975

L’ère du SPS

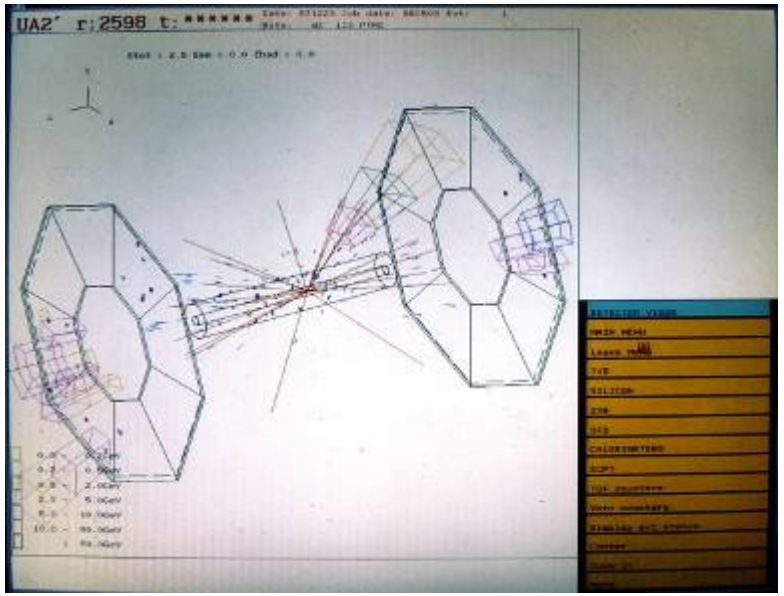
L'ère du SPS

- 1976 – start up of the SPS
- Notable contributions from LAL
  - WA2 : study of hyperons
  - WA4 : photoproduction
  - NA3 : hadronic production of high p_T leptons and hadrons
  - NA14 : photoproduction, photon hard scattering, tests of QCD

Bosons W et Z



Le détecteur UA2



Le désintégration d'une particule Z
dans le détecteur UA2

Bosons W et Z

- 1981 - CERN converts SPS into a proton-antiproton collider with the aim of discovering the W and Z bosons
- LAL contributed to UA2 with tracking detectors
- 1983 – discovery of W and Z bosons
- 1984 – Nobel prize for Carlo Rubbia and Simon van der Meer
- Later studies included searches for the top quark and supersymmetry

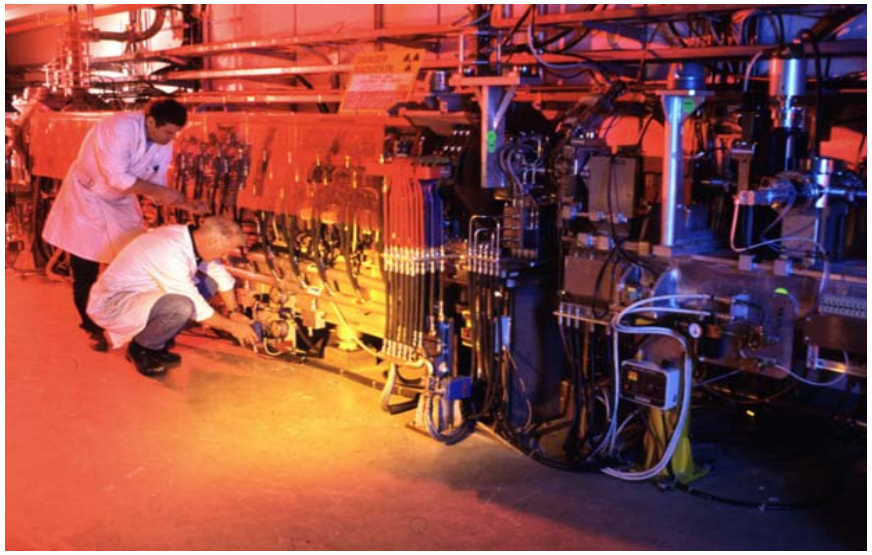
L'ère du LEP

L'ère du LEP

- 1989 – start up the Large Electron-Positron collider
- With electrons and positrons colliding head on at an energy equivalent to the mass of the Z boson, it was, in its first phase, a Z factory
- Later, upgraded to more than the double the energy, it provided large numbers of W^+W^- pairs

LAL et LIL

Convention entre le CERN et l'IN2P3 agissant pour le compte du LAL, signé le 31 mars 1982 par H. Schopper, du CERN, J. Yoccoz, Directeur de l'IN2P3 and J. Perez-y-Jorba, LAL.



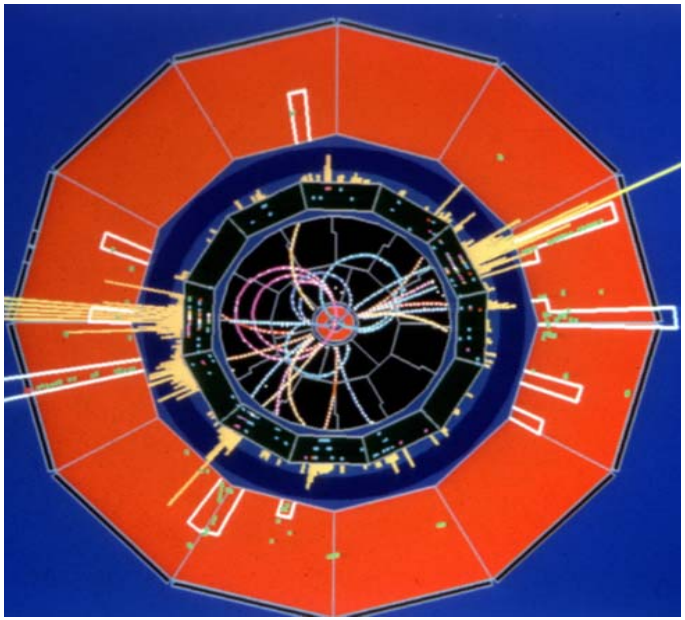
LIL : le LINAC à électrons et positons d'une énergie de 600 MeV

LAL et LIL

- 1982: convention signed between CERN and LAL, providing for collaboration on the design and construction of the LEP Injector Linacs, LIL
- Together with the Electron-Positron Accumulator (EPA), the two linacs formed the LEP Pre-Injector
- Electrons accelerated to 200 MeV in the first, “upstream”, linac hit a target to create positrons
- Positrons (or electrons) then accelerated to 600 MeV in the second, “downstream” linac, before entering EPA

ALEPH

d. à g. Jacques Lefrançois, Jack Steinberger, Lorenzo Foa et Pierre Lazeyras



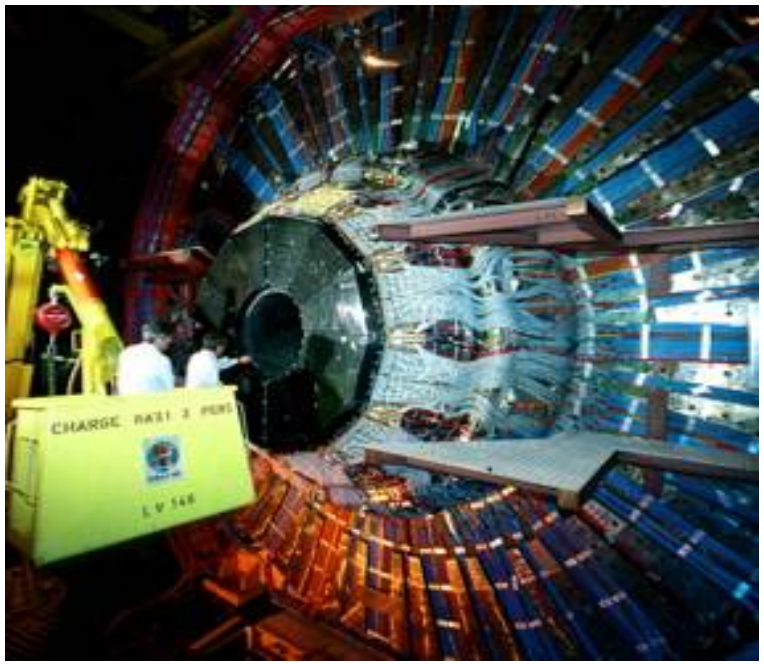
Le désintégration d'une particule Z

ALEPH

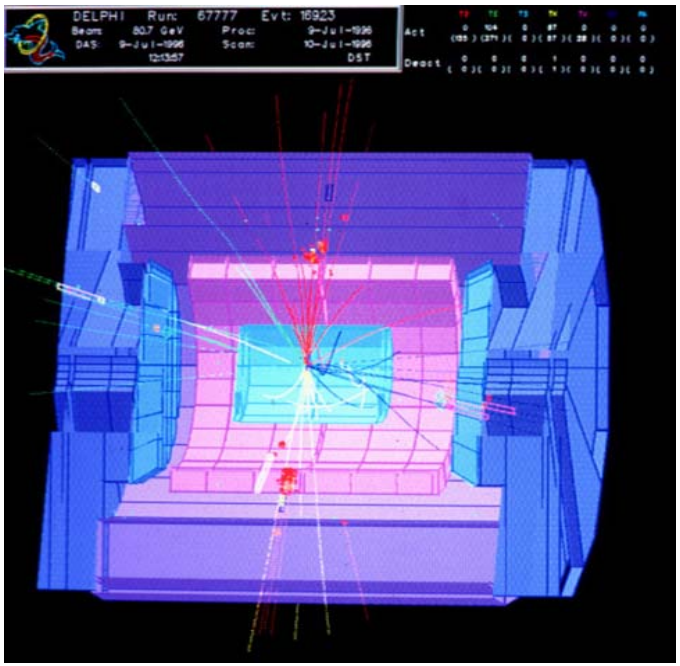
- LAL's contributions to the ALEPH detector centred on the electromagnetic calorimeter barrel

- Analysis highlights have included physics of B mesons and the tau lepton, searches for supersymmetry and the Higgs

DELPHI



DELPHI



1996: premières paires de particules W

DELPHI

- Major participation from LAL to the TPC and RICH

- Analysis highlights have included measurements of B mesons and the unitarity triangle, and searches for technicolour, supersymmetry, and the Higgs

NA48

NA48

- Study of CP-violation pursued in the NA48 experiment and its predecessor NA31 – again with contributions from LAL

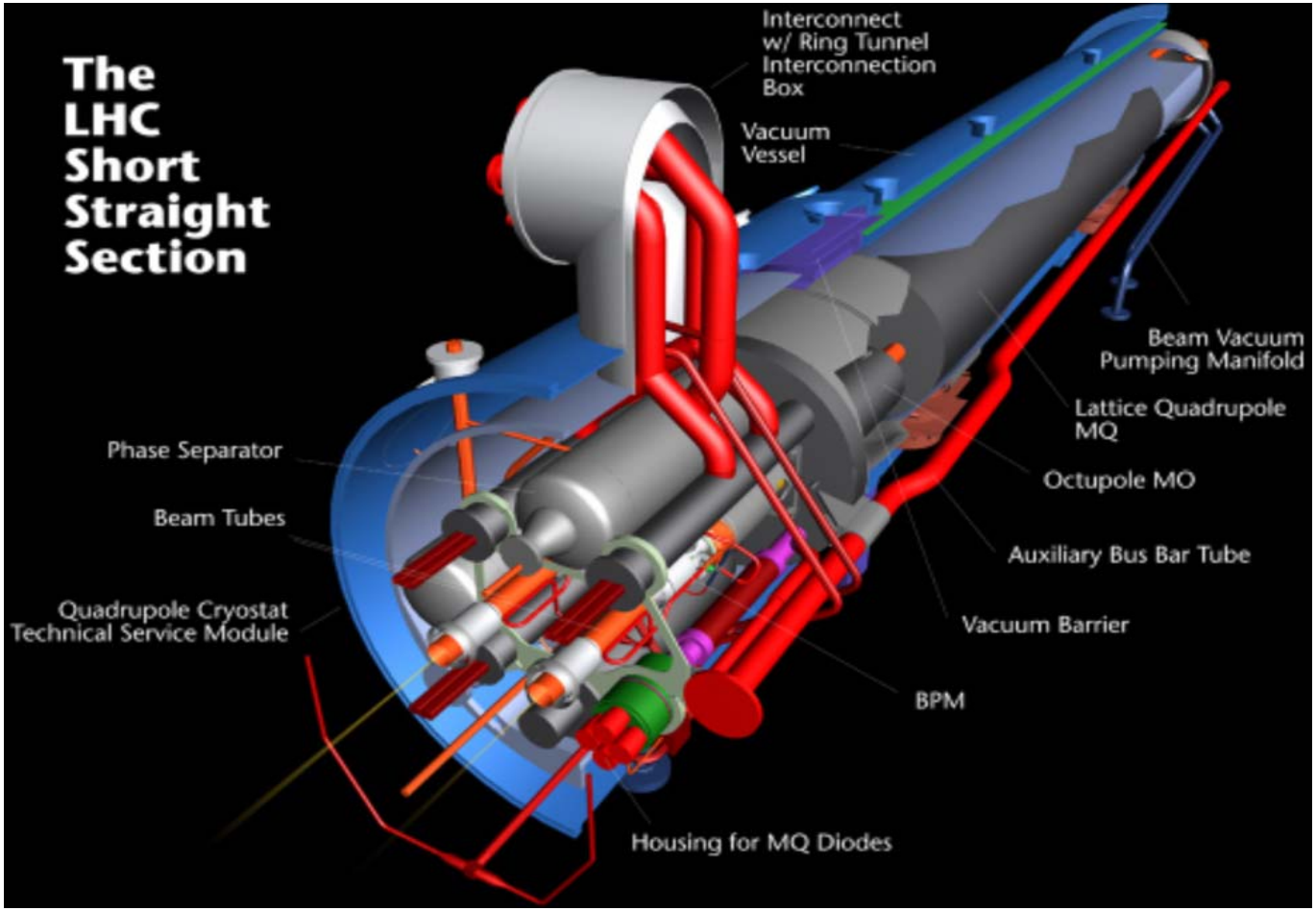
- 1999 - data from NA48 on ‘direct’ CP-violation, confirm earlier results of NA31 and show once and for all that this phenomenon exists

Le LHC

Le LHC

- Now LAL and CERN are embarking on a new adventure, to new frontiers with the Large Hadron Collider – and with collaboration as strong as ever
- LAL is making important contributions to two of the experiments, as well as to the machine
- LAL is also participating in Grid activities with CERN
  - Tier 2 centre for the LHC Grid
  - principle partner in DATAGRID, EGEE-I and EGEE-II

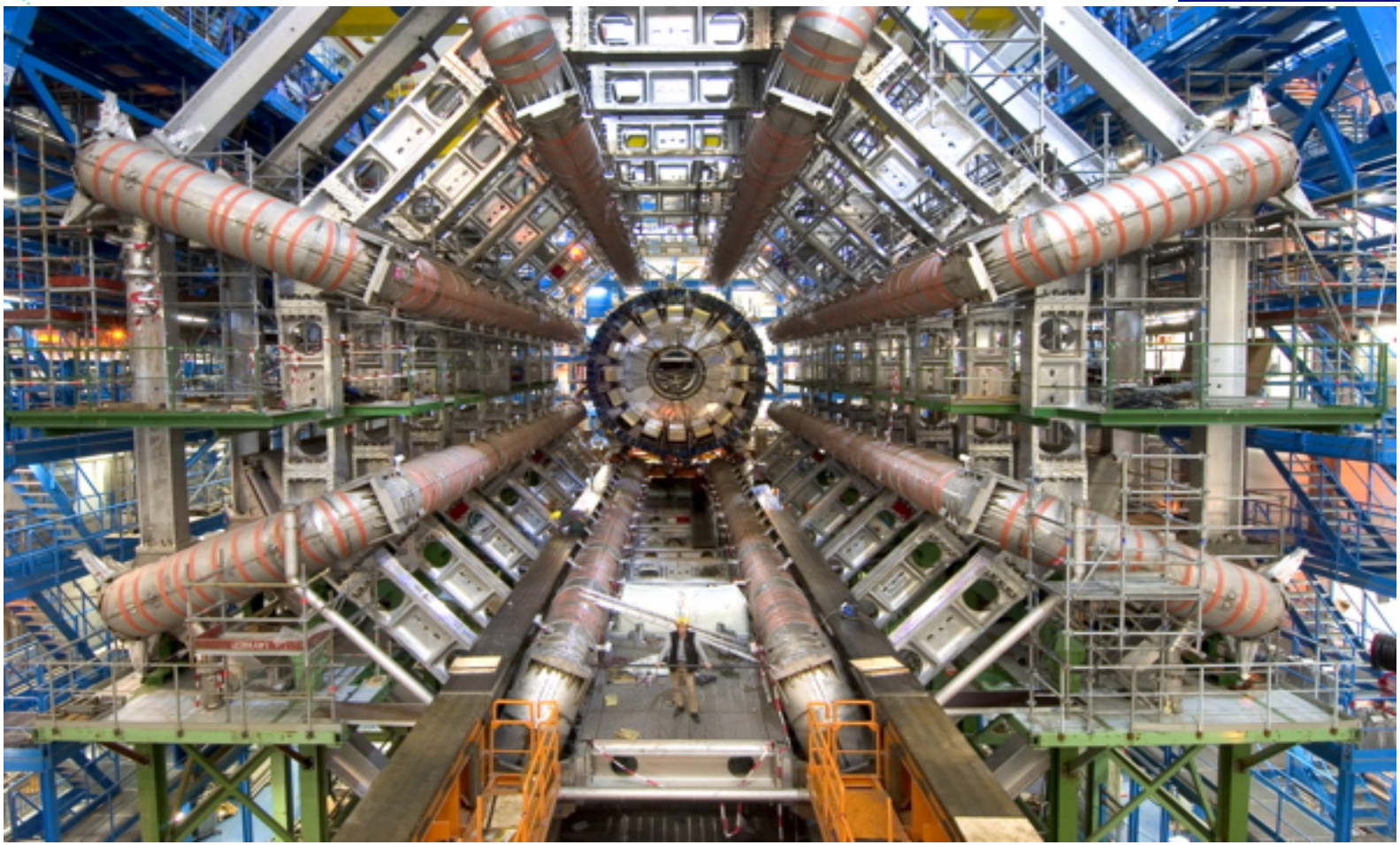
Short straight sections



Short straight sections

- LHC contributions from LAL:
  - Integration of the main quadupoles into the short straight sections
  - Calibration of some 8000 thermometers

ATLAS



ATLAS

- ATLAS is a general purpose detector
- LAL physicists and engineers in from the start in the 1990s
- Major involvement in particular with the liquid argon calorimeter:
  - accordion-like absorbers for the barrel calorimeter
  - cryostats for the end-caps calorimeters
  - front-end electronics
  - cabling
  - controls for the cryogenic systems

LHCb

Le mur du calorimètre électromagnétique de LHCb

LHCb

- LHCb takes over the cavern previously occupied by DELPHI
- It will continue the exploration of CP-violation by investigating B mesons
- LAL has major role in readout electronics for the calorimeters

CNGS

Vue du tube à vide avant fermeture

Mise en place de la corne CNGS

CNGS

- CERN Neutrinos to Gran Sasso
- Aim to see appearance at Gran Sasso of tau neutrinos in a beam of muon neutrinos created 730 km away at CERN
- LAL - horn and reflector to focus pions and kaons produced when protons from SPS strike a graphite target
- LAL participates in the OPERA experiment at Gran Sasso

L’avenir: CLIC

Le canon de CTF3 au LAL

CTF3 au CERN

L'avenir: CLIC

- The Compact Linear Collider project, CLIC, involves several laboratories in a design study for a future multi-TeV electron-positron collider
- LAL's participation is part of a tri-partite collaboration between CERN, LAL and SLAC
- LAL has provided the electron gun for the CLIC test facility, CTF3

Sommaire

Le LAL et le CERN…

… un partenariat en accélérateurs

… un partenariat en recherche