Building LIP and Particle Physics in Portugal

A testimony by Rui F Marques

in

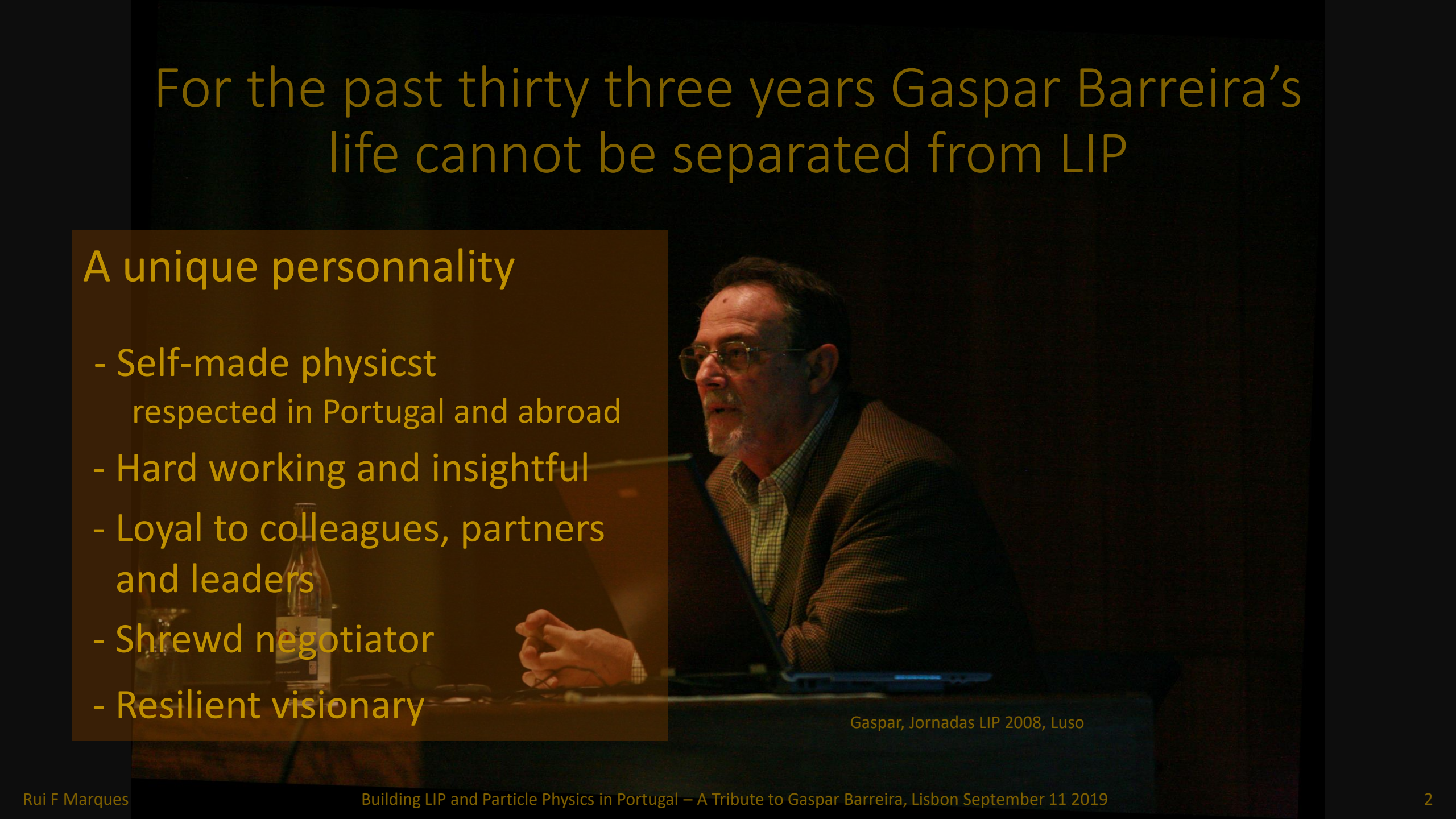
"Particle physics: from fundamental science to society"
A tribute to Gaspar Barreira

Lisbon, September 11th 2019

For the past thirty three years Gaspar Barreira's life cannot be separated from LIP

A unique personnality

- Self-made physicst
  respected in Portugal and abroad
- Hard working and insightful
- Loyal to colleagues, partners and leaders
- Shrewd negotiator
- Resilient visionary



Gaspar, Jornadas LIP 2008, Luso

For the past thirty three years Gaspar Barreira's life cannot be separated from LIP

Outline

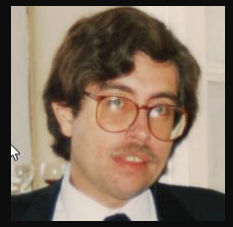
Highlights along three periods are reviewed:

- The eighties
- The nineties
- The twenty first century

Gaspar, Jornadas LIP 2008, Luso

The eighties – before LIP

When **the EPS High Energy Physics Conference 1981 took place in Lisbon**
just a small number of PhD physicists with links to CERN existed in Portugal



José Mariano Gago - OMEGA; the only experimental HEP with PhD at the time (IST)

Rui Vilela Mendes and

Jorge Dias de Deus – theoreticians (IST)

Armando Policarpo - Detector Physicist (U. Coimbra), with links to Charpak Group

The eighties – before LIP

1982/83 **Gaspar Barreira, electronics and microprocessors**
bridged CFN (Nuclear Physics Centre, FCUL, Lisbon) **to ICTP** (Trieste)

1985With the strong commitment of J. Mariano Gago and Jaime Gama (Minister for Foreign Affairs)
and the friendly support from **CERN's DG, Herwig Shopper**,

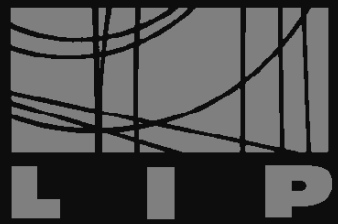
Portugal joins CERN

The first step towards the internationalization of Portuguese research

1985/86 **Involvement at CERN (NA38) strengthened** with young Portuguese researchers and the CAMAC interface to the CERN (proprietary) bus of the DacQ (Gaspar's design) which permitted reading out new detectors.

Creation of a national laboratory couldn't be stopped

1986 **LIP - Laboratório de Instrumentação e Física Experimental de Partículas was created on May 9**



The eighties – after LIP

1987 **Decision to join the DELPHI Experiment, at the** (then upcoming) **LEP e^+e^- collider**

LIP contibutions to DELPHI defined:

- **LTDs:** These large *fastbus* boards (CERN design) - would be produced in Portugal (by EFACEC) and fully tested at the LIP laboratories
- **Optical communications** - link between ground barrack and DELPHI pit was the thesis subject for a LIP PhD student (Paulo Gomes, with Gaspar's co-supervision)

Two due remarques:

- ***An eye witness is among us: Pier Giorgio Innocenti** , then Director of the CERN Electronics and Computing for Physics Division*

- ***The LTDs triggered the technological advanced training program for young engineers at CERN. Thanks to Gaspar Barreira, this still goes on nowadays, with extremely positive outcome***

The eighties – after LIP

Gaspar Barreira devoted much of his effort to improving computing and networking resources.

1987 – Gaspar was behind the istallation of **the first MicroVAX at LIP** (bought via CERN, it arrived in December 1986) – a MicroVAX II Q2: 5MB RAM, 71 MB disk, tape drive for 94MB cartridges, 0.9 VPU and Fortran compiler

A second mmachine was later added – MicroVAX II Q5: 16MB RAM, 4581 MB disk, tape drive for 94MB cartridges, two StorageTek tape drives 1/2 inch, 6250 BPI tapes and Fortran compiler –, the two communicating at 5 Mbits/s

The **first** (costly!) **connection to the outside world** was achieved via TELEPAC, **at a 9600 baud** synchronous modem. Four simultaneous logical connections were possible, which enabled mailing and login to CERN.

1988 - Terminal servers were added and the system upgraded with a VAX 6210 and a VAXstation 2000, all devices connected in a Local Area VAX Cluster (LAVC).

A **first UNIX machine** was also installed at LIP (electronics team) by that time.

1988/89 - **First CERN Network Connection was established with DECmet protocol in the framework of n international pilot project**

The eighties – after LIP

Gaspar Barreira was member of the Users Council of FCCN, Fundação para o Cálculo Científico Nacional, lead by Pedro Veiga. **Later (2002-2013) he would become member of FCCN's Executive Board**

1988 - LIP was integrated in the RCCN, Rede de Cálculo Científico Nacional (1Mb/s throughput)

Petite histoire

- *FCCN promoted the installation of a mini supercomputer, CONVEX C2, which run until 1993. The CERN Libraries never became usable on that machine and therefore, Gaspar opposed any future aquisition of a large computer by FCCN.*

  FCCN mainly foccused on the key role of running its national scientific network, RCCN.

Other progresses in computing power, storage space and networking deserved being mentioned …

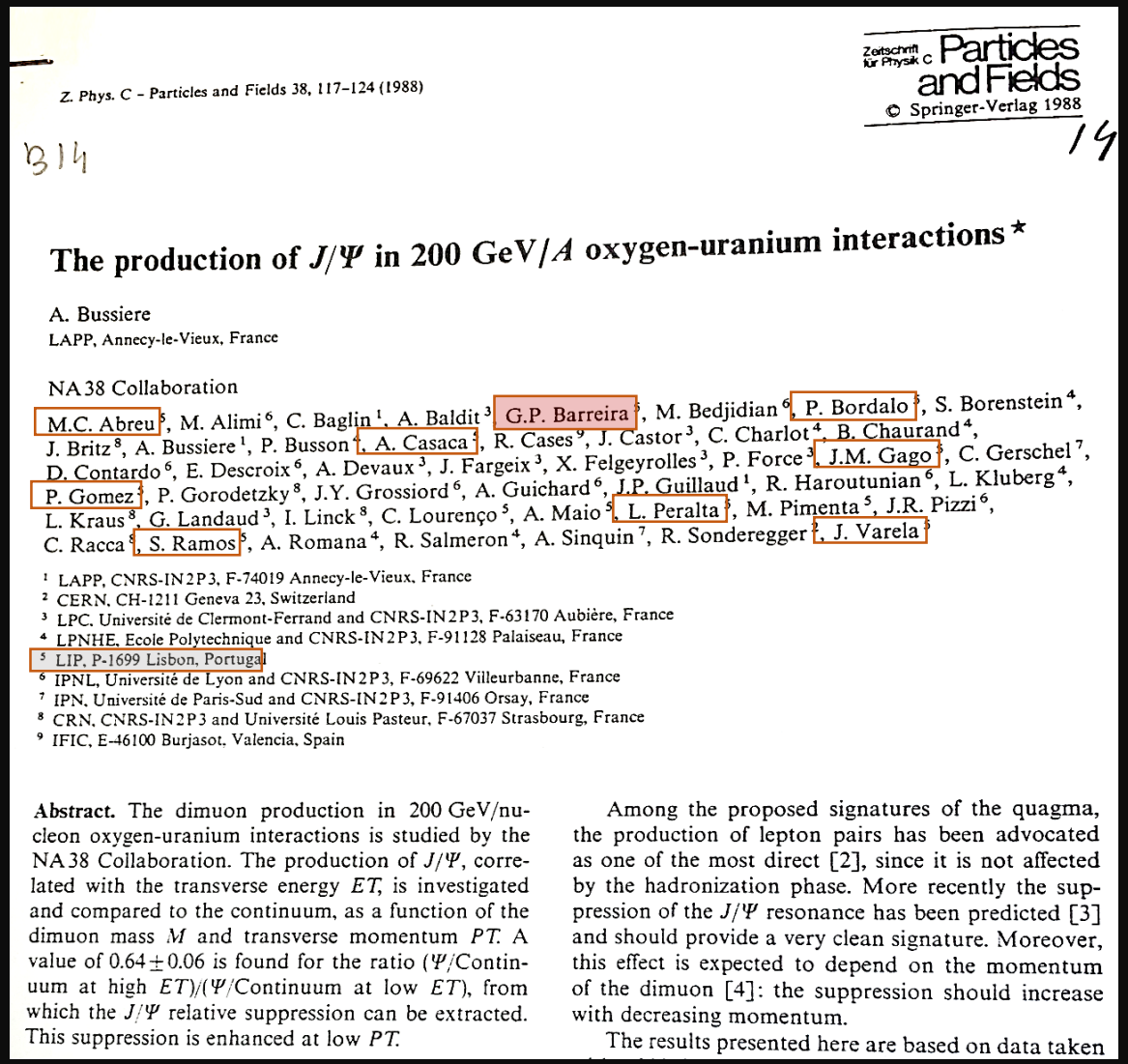
The eighties – after LIP

1988 - **The first LIP publication** appeared in the conference proceedings of **Quark Matter 87**.
A longer version would be published in Phys. Lett. B (1989)

Notice:

- **9 LIP members** of 46 author for NA38

- **Gaspar Barreira** had designed the CAMAC interface to the CERN-proprietary bus of the DAQ, allowing for the readout of new detectors



Z. Phys. C – Particles and Fields 38, 117–124 (1988)

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The production of J/Ψ in 200 GeV/A oxygen-uranium interactions *

A. Bussiere
LAPP, Annecy-le-Vieux, France

NA 38 Collaboration

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Abstract. The dimuon production in 200 GeV/nucleon oxygen-uranium interactions is studied by the NA 38 Collaboration. The production of J/Ψ, correlated with the transverse energy ET, is investigated and compared to the continuum, as a function of the dimuon mass M and transverse momentum PT. A value of 0.64 ± 0.06 is found for the ratio (Ψ/Continuum at high ET)/(Ψ/Continuum at low ET), from which the J/Ψ relative suppression can be extracted. This suppression is enhanced at low PT.

Among the proposed signatures of the quagma, the production of lepton pairs has been advocated as one of the most direct [2], since it is not affected by the hadronization phase. More recently the suppression of the J/Ψ resonance has been predicted [3] and should provide a very clean signature. Moreover, this effect is expected to depend on the momentum of the dimuon [4]: the suppression should increase with decreasing momentum.

The results presented here are based on data taken

The nineties

1990 – Gaspar Barreira participated with João Varela in the **Aachen LHC workshop, dedicated to the physics goals and experimental challenges of such a hadron collider**

LIP had to join LHC

Serious internal discussions followed, that led to the decision of joining the two major LHC experiments

Rational:
By exploiting the know-how acquired in two technologies, LIP maximizes the growth potential of he project

- **Optical fibres** – Amélia Maio – TeleCal (scint.tiles + fibres)
  (Following CERN's SPACAL, RD-1 and RD-34)

- **Fast electronics** – João Varela – ECAL ($PbWO_4$ crystals)
  (Following CERN's RD-11, RD-12 and RD-1)

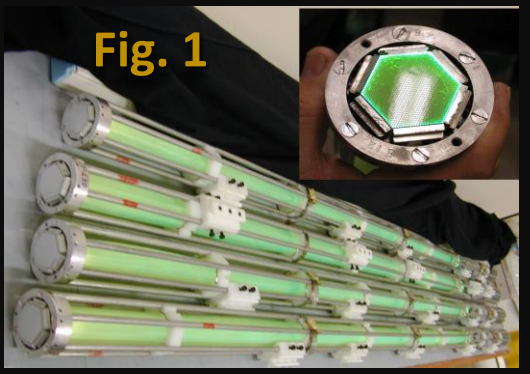
1993 – **LIP signs the Letters of Intent of ATLAS and CMS**

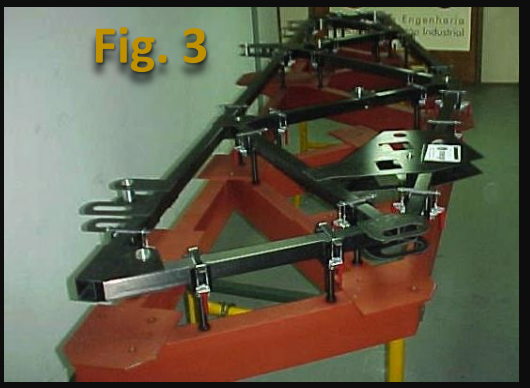
The nineties

Gaspar's role in the LHC endeavor

- Continued **support to Amélia Maio and her** (ATLAS) **team** in:
  - . Characterizing the **fibres for the ATLAS TileCal readout**
  - . **Preparing the fabrication of the fiber bundles in Portugal**: **aluminization** of the fibre ends (Manuel Maneira, UNL - **Fig.1**) **and robot for assembling the fiber bundles**

- **Seek for the participation of Portuguese industries:**
  - . **Silva Matos** (a constructor of metallic tanks for wine transport) would deliver the **helium tanks for the superconducting magnets cooling (Fig.2)**; **ISQ** involved in the welding techniques
  - . The **CMS support structures** MAB – prototype developed and tested at **INEGI**, Porto, and then delivered to CERN
  - . **Other firms** to reply to orders/tenders for the LHC machine project





The nineties

1998 CERN creates the **LHC Resources Review Board, LHC-RRB**, a committee of representatives from all countries participant of the LHC experiments intended to monitor the financial needs of the experiments

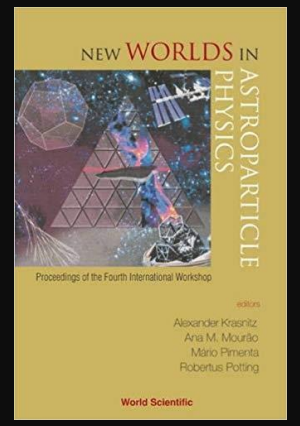
Gaspar Barreira was a member of the LHC-RRB since the beginning and for twenty years, always honoring the Portuguese financial commitments to the ATLAS and CMS experiments.

1996-2017 Besides of the participation in several other CERN committees, he will be the **Portuguese representative in ECFA for quite a long period**

The nineties / The twenty first century

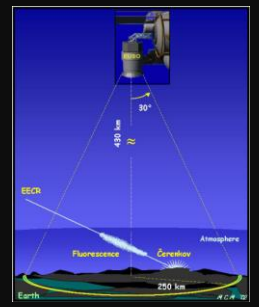
Around the turn of the century, Astroparticles start to "interact with" LIP

Pushed by Mário Pimenta, Dias de Deus and Peter Sonderegger, the biennial workshops "New worlds in Astroparticle Physics" take place in Faro (1996, 1998, 2000, 2002, 2005 and 2007).



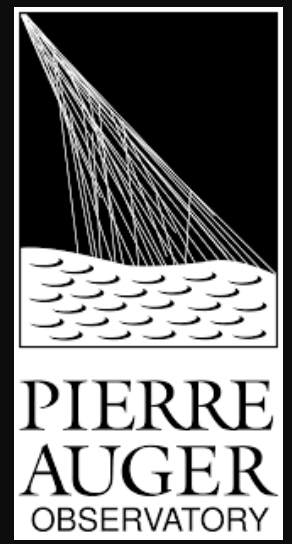
Gaspar Barreira firmly supported the LIP involvement in this new field:

- Joining Astroparticle experiments started to be considered: AMS (Sam Ting and CERN); EUSO (2000-2005)



- Gaspar was at Cape Canaveral in 1998 for the launch of the NASA's Space Shuttle with the AMS prototype.
- **AMS-02** would only be shipped with the very last shuttle mission (Atlantis, 2011)

- The same year (1998) Gaspar visits Malargue, as **LIP's future in Astroparticle Physics strarts to point to the Pierre Auger Observatory**



- **Joining AUGER would take place in 2005 –** EUSO had been abandoned
- **Neutrinos (SNO/SNO+) and Dark Matter (ZEPLIN/LUX) also became important commitments**

The twenty first century

2001-2003

Assembling the fiber bundles for TileCal, the hadronic calorimeter of the ATLAS Experiment at the LIP-Coimbra Workshops

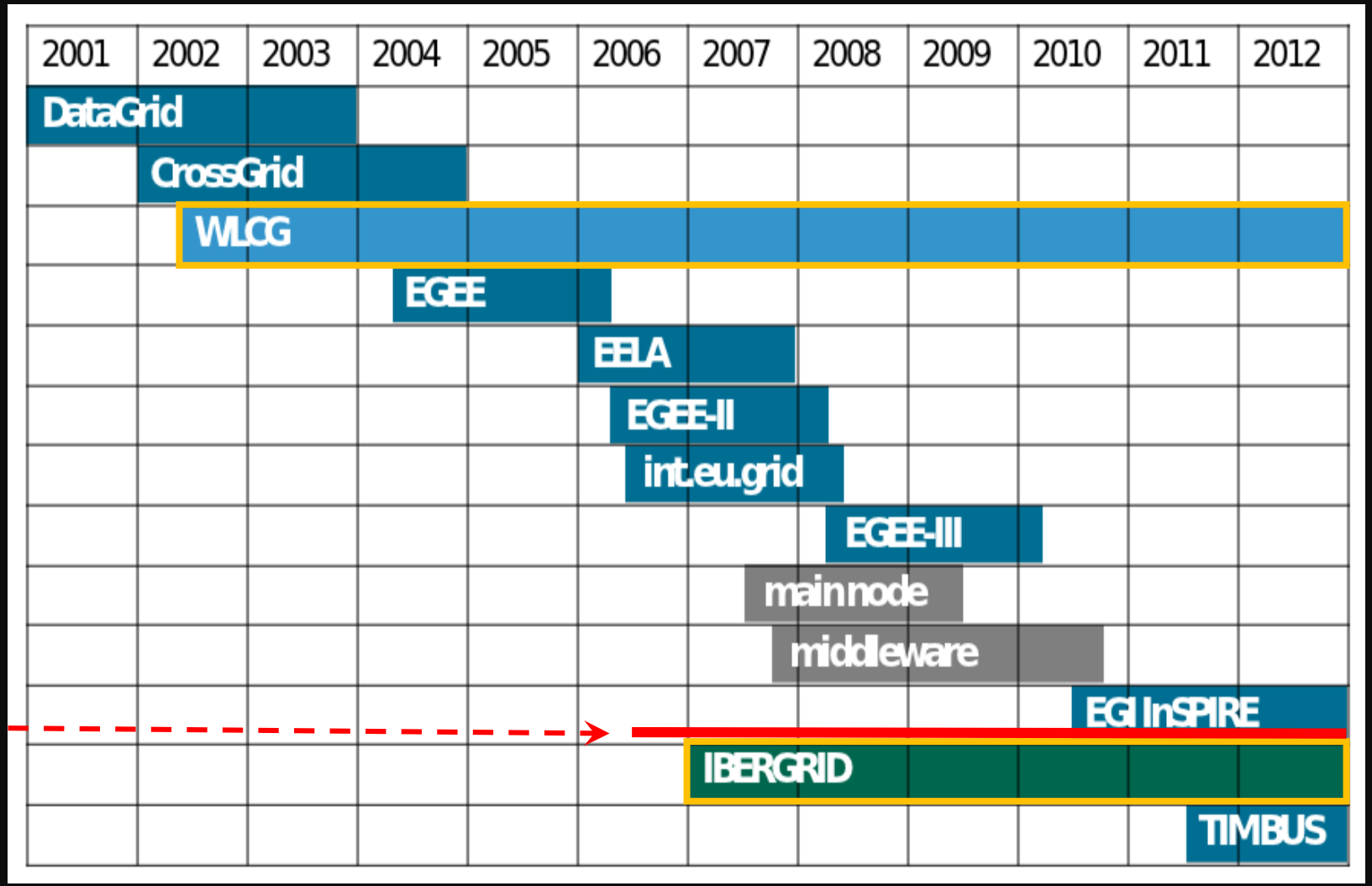
An industrial operation: over more than two years, 16h/day shift operation and weekly deliveries to the three assembly sites of the TileCal sectors: CERN, Barcelona and Fermilab

The twenty first century

Plenty of national and international projects on computing with LIP (and Gaspa's) strong participation

Especially relevant:
- GRID COMPUTING/WLCG e Tier-2 (next slide)
- IBERGRID (integration with Tier-1 and Tier-2s in Spain)

and national projects
- PORTUGUESE GRID INITIATIVE
- INCD (see below)



The twenty first century

Computing – from the WLCG to the Portuguese Tier-2

1988 Foster and Kesselman: proposal on **how to achieve capacity to address complex problems with geografically and administratively distibuted computing media**.

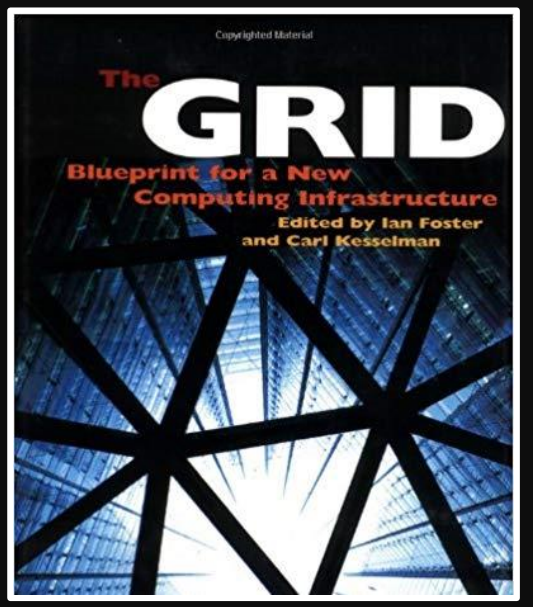
~ 2000 Lack of funding for computers at CERN force a **new approach for carrying out the LHC analysis: computing media in the participating countries**

2002 Worldwide **LHC Computing Grid (WLCG)** approved by CERN Council

2002–2005 Following Data Grid (2001), LIP participates in the european Crossgrid project; thanks to Gaspar's efforts, LIP participates as funded.
Projects EGEE, EGEE-II and EGEE-III and INT.EU.GRID follow (computing middleware and grid computing pilot infrastructures); collaboration with Spain is strengthened

2006 MoU for the WLCG is signed. Portugal agrees to install a Tier-2 node.
The space at Elias Garcia (where the pilot was aleady running, is not suficiente;

2009 Tier-2 is distributed by three poles: LIP-Lisbon, LIP-Coimbra and NCG (at LNEC)



The twenty first century

Milestones

2005 - 20th aniversary of Portugal-CERN agreement at Palácio das Laranjeiras - José Mariano Gago was then heading the Ministry for Science, Technology and Higher Education

Next to Gaspar, to the right, stand his friends Prof. Bragança Gil (Director of CFN in the seventies and eighties) and Prof. Herwig Schopper (CERN's General Director in 1985, when Portugal joined the organization)

The twenty first century

2006.06.06

Signature of the greement with the Univ. of Coimbra – Rector Seabra Santos – for installing part of the Tier-2 at Coimbra, in a room shared with CFC (Centre for Computational Physics – M. Fiolhais)

The twenty first century

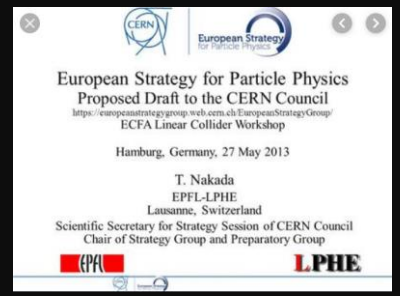
Grid and WLCG

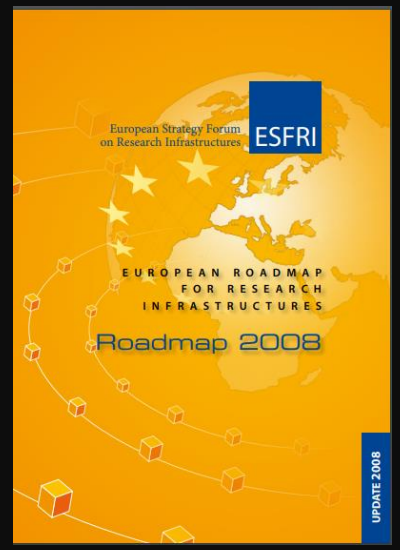
The image always seen on Gaspar Barreira´s computer screen ~2006-2010

The twenty first century

- As a **member of ECFA**, **Gaspar Barreira integrated the EUROPEAN STRATEGY GROUP (ESG) that proposed the European Strategy for Particle Physics issued in 2013** (presently under revision).
- Gaspar was the **Portuguese Delegate to the CERN Council (2006 to fall 2018)**. **His voice was among those taken in high consideration by many of the Council members.**
- In recent years his vision of Europe in his domains of expertise, rendered him a key collaborator of FCT and MCTES, influential in the definition of national and European Policies – e.g. **Portuguese Delegate** (together with Lígia Amâncio) **to the committee that proposed the European Strategy Forum on Research Infrastructures (ESFRI) revision of 2008.**

  Concerning the **PT-ES cooperation agreements**, he achieved the renovation of the Computing agreement, while the Particle Physics one still lacks the final OK from the Spanish side.





The twenty first century

Linking Brasil to CERN

September 2009.
Signature of an MoU regarding Brasilian activities at CERN
Brasilian Delegation: Ronald Shellard (head, CBPF), Sergio Novaes and diplomat Ademar Seabra Cruz.

Left to Right: Felicitas Pauss, Ademar Seabra Cruz, Sergio Bertolucci, Sergio Novaes, Gaspar Barreira , Rolf Heuer (CERN Director at the time), Ambassador Maria Nazareth Farani de Azevedo (Brasilian permanent representative in Geneva), Ronald Shellard, Jose Salicio Diaz.

The twenty first century

Minho Pole of LIP, in Braga

2010 – With his roots in Braga, it is with great pleasure that **Gaspar contributes to the creation of a LIP Pole at the University of Minho (UM)**, and the signs, wit Rector António Cunha the Collaboratio Agreement between between LIP and UM.

The Minho Pole grew from the minimal initial staff (1 professor + 1 post doc) to around thirty collaborators in the present day.

2016 – Opening the public exhibition "**Particles – from the Higgs boson to the dark matter**"- signalling the 30 years of LIP, with Minister Manuel Heitor, MCTES (Braga, February 17)

The twenty first century

Milestones

2011 - 25th aniversary of LIP

Formal session at the magnificent "Biblioteca Joanina" of the University of Coimbra.
Gaspar Barreira(LIP President), with Mariano Gago (MCTES), João Gabriel Silva (UC Rector), Jaime Gama (ex-Minister of Foreign Affairs who fought for the agreement with CERN), Herwig Shopper (former CERN Director Geneal) and Armando Policarpo (another LIP founder and Director)

The twenty first century

2016 **Gaspar Barreira had a central role in the creation of the Portuguese National Distributed Computing Infrastructure, INCD, an association of FCT-FCCN, LIP and LNEC.**
He served as the **first president of the association's General Assembly**

With services operated by LIP, INCD provides nowadays high throughput computing, high performance computing, cloud computing and data oriented services to the whole Portuguese research community.

Currently, the infrastructure has sites in Lisbon (LNEC) and Minho (REN datacenter).

The twenty first century

Milestones **2016 - 30th aniversary of LIP**

Formal session at the "Anfiteatro Pombalino", Colégio de Jesus, Universidade de Coimbra (former Physics Department), at the opening of the public exhibition "Particles: from the Higgs boson to Dark Matter" (April, 5)

The twenty first century

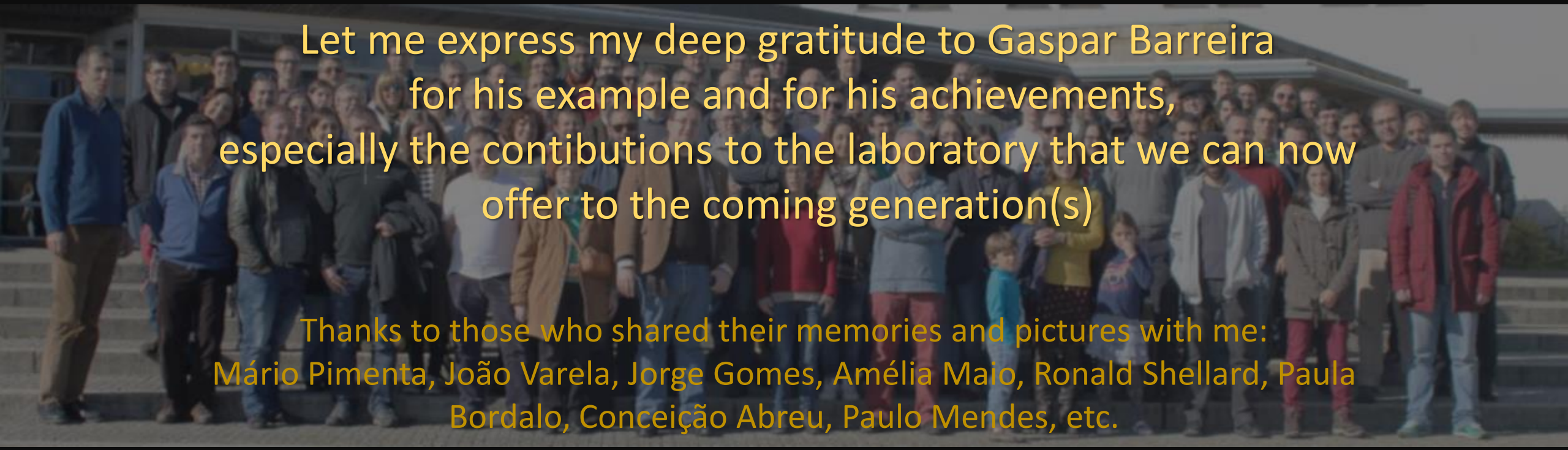
2017 Last assignement:
coordination of the Working Group for the installation of Proton Therapy Centre at C2TN - IST.

Gaspar started by congregating the interest of key experts for a center meant to be both a health unit and a national research infrastructure.

LIP gives central attention since many years, particularly developing techniques for the optimization of beam monitoring.

Images of a meeting of an informal IST-LIP-ICNAS discussion group (Ereira, November 2018) - the last attended by Gaspar.

For the past thirty three years Gaspar Barreira's life cannot be separated from LIP



Let me express my deep gratitude to Gaspar Barreira
for his example and for his achievements,
especially the contibutions to the laboratory that we can now offer to the coming generation(s)

Thanks to those who shared their memories and pictures with me:
Mário Pimenta, João Varela, Jorge Gomes, Amélia Maio, Ronald Shellard, Paula Bordalo, Conceição Abreu, Paulo Mendes, etc.