LIP
PAST, PRESENT *and* FUTURE
2013 - 2018 - 2022

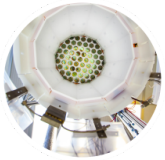
Lisboa, November 2018

WHAT

LIP IS

The reference institution for experimental particle physics in Portugal and the Portuguese reference partner of CERN as well as other international scientific infrastructures

Experimental particle and **astroparticle physics**



Development of **new instruments** and **methods**

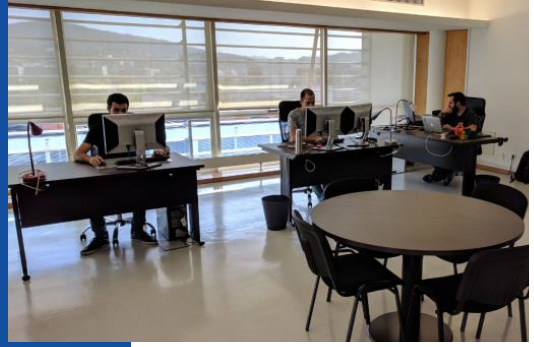
Scientific computing

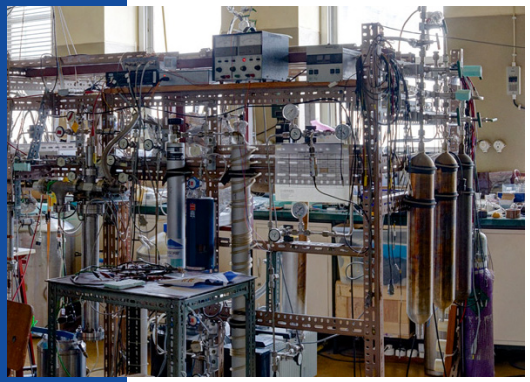
Knowledge transfer, education and **outreach**

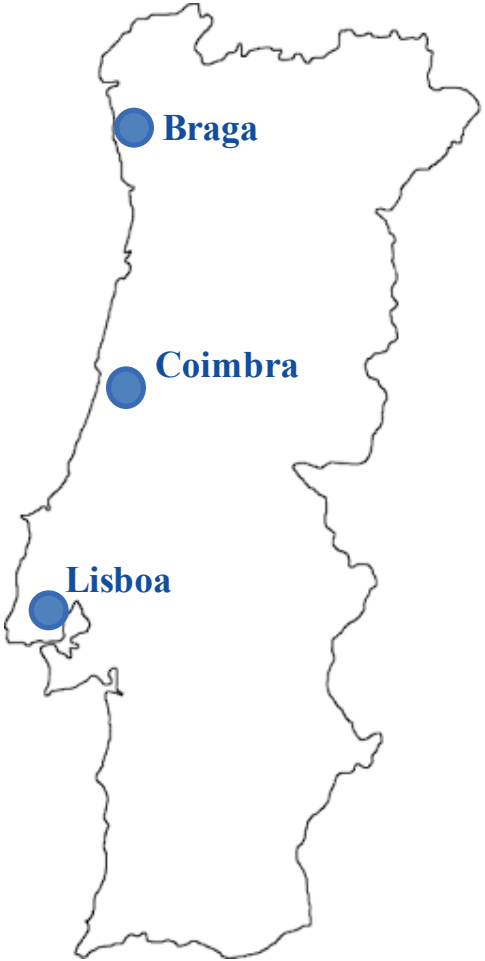
WHAT

WE ARE

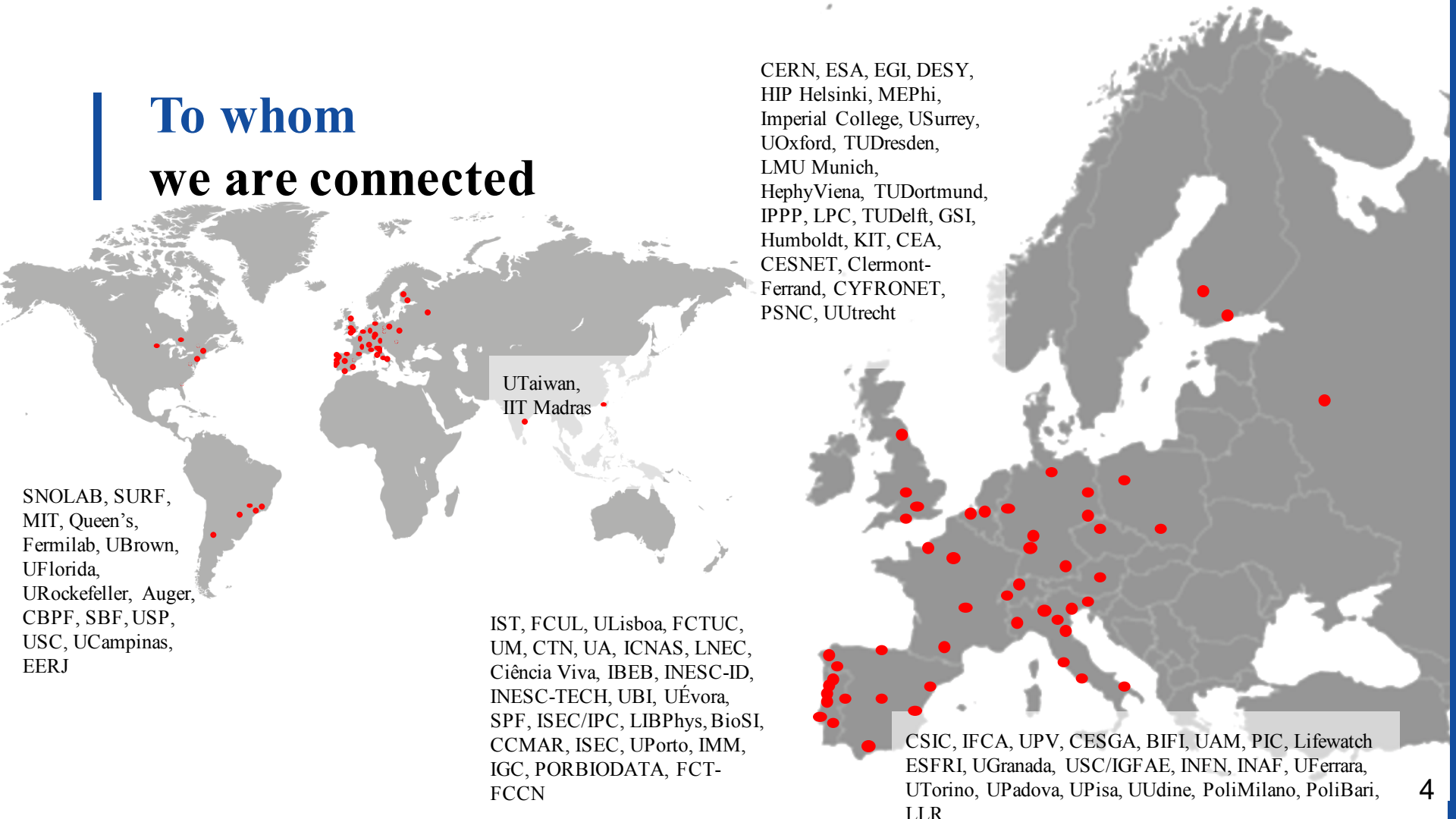
Nation-wide laboratory working in close collaboration with the local universities







To whom
we are connected



CERN, ESA, EGI, DESY, HIP Helsinki, MEPhi, Imperial College, USurrey, UOxford, TUDresden, LMU Munich, HephyViena, TUDortmund, IPPP, LPC, TUDelft, GSI, Humboldt, KIT, CEA, CESNET, Clermont-Ferrand, CYFRONET, PSNC, UUtrecht

UTaiwan, IIT Madras

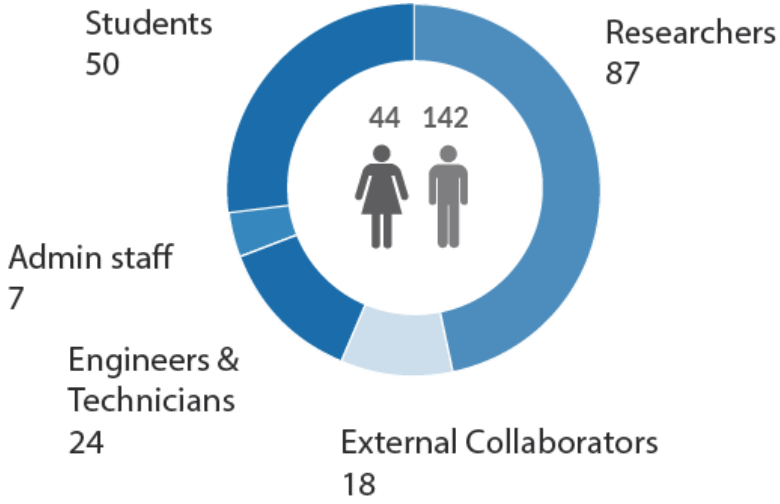
SNOLAB, SURF, MIT, Queen's, Fermilab, UBrown, UFlorida, URockefeller, Auger, CBPF, SBF, USP, USC, UCampinas, EERJ

IST, FCUL, ULisboa, FCTUC, UM, CTN, UA, ICNAS, LNEC, Ciência Viva, IBEB, INESC-ID, INESC-TECH, UBI, UÉvora, SPF, ISEC/IPC, LIBPhys, BioSI, CCMAR, ISEC, UPorto, IMM, IGC, PORBIODATA, FCT-FCCN

CSIC, IFCA, UPV, CESGA, BIFI, UAM, PIC, Lifewatch ESFRI, UGranada, USC/IGFAE, INFN, INAF, UFerrara, UTorino, UPadova, UPisa, UUdine, PoliMilano, PoliBari, LLR

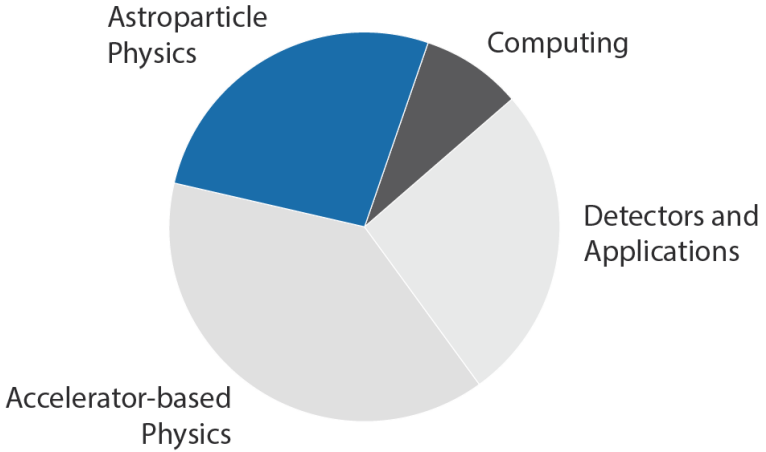
Who we are

MEMBERS

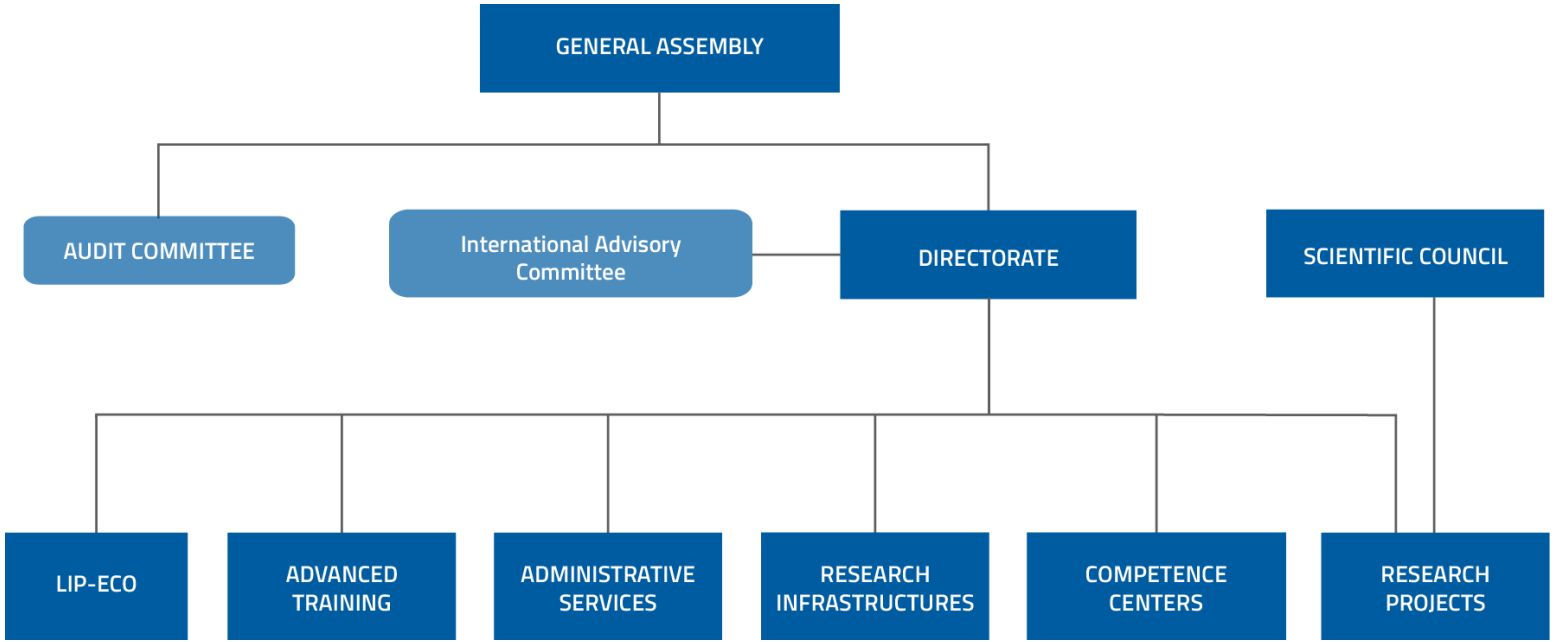


TOTAL = 186

ACTIVITIES

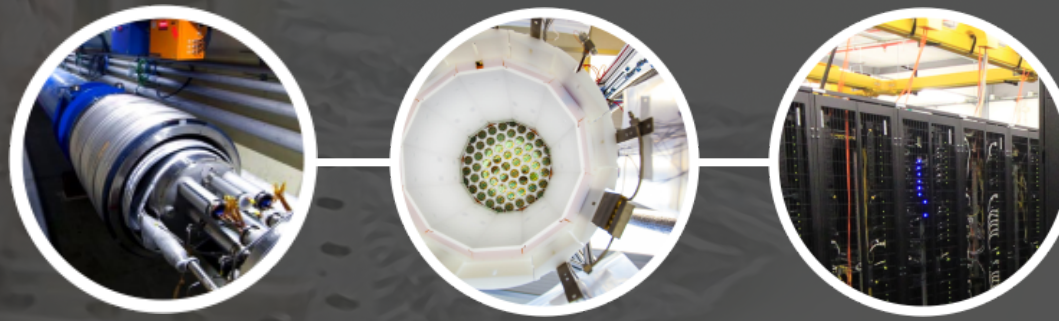


Structure and Governance



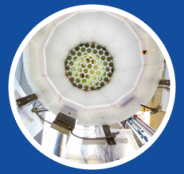
RESEARCH & DEVELOPMENT

AT LIP



Research Areas & Groups

Experimental particle and **astroparticle physics**



Development of **new instruments** and **methods**

Scientific computing

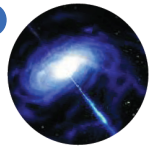
1. ATLAS - Portuguese participation in the ATLAS experiment
2. CMS - Portuguese participation in the CMS experiment
3. Phenomenology
4. PQCD - Partons and QCD
5. LERHI - Low Energy Reactions with Hadrons and Ions
6. Cosmic rays
7. Neutrino physics
8. Dark matter
9. Detector development for particle and nuclear physics
10. Health and biomedical applications
11. Applications for space exploration
12. Computing

Research Areas & Groups

Experimental particle physics

	Recent achievements	Resources
Involvement in the CERN Large Hadron Collider (LHC) program, contributing from the very beginning to the two largest LHC experiments, ATLAS and CMS	**First direct observation of Higgs couplings to bottom and top quarks** **Development of a new forward proton spectrometer**	Researchers: 30 Students: 25 **FTEs = 37.9**
Exploring new physics phenomenology	**Novel insights enhancing use of jets to probe Quark Gluon Plasma** **Innovative methods to study of CP in Higgs production using angular variables**	Researchers: 7 Students: 1 **FTEs = 5.2**
Probing the strong nuclear force and dense nuclear matter at CERN and GSI	**Most precise world results on gluon polarization** **Detector R&D and construction for GSI/FAIR experiments**	Researchers: 10 Students: 3 **FTEs = 9.5**

Research Areas & Groups



Astroparticle physics

	Recent achievements	Resources
Studying cosmic rays	**Novel methods for measuring e/μ components of Extensive Air Showers** **Design and construction of RPCs for outdoor operation in cosmic rays experiments**	Researchers: 31 Students: 6 **FTEs = 21.4**
Understanding neutrinos	**Final SNO results on solar neutrino oscillations** **Installation of the LIP-built calibration system in SNO+**	Researchers: 12 Students: 3 **FTEs = 8.2**
Direct searches for Dark Matter	**World-leading LUX results on direct Dark Matter searches** **Design and R&D of LUX and LZ control systems**	Researchers: 10 Students: 3 **FTEs = 9.3**

Research Areas & Groups

New instruments and applications

	Recent achievements	Resources
Innovative radiation detectors	**Standalone RPCs** **Neutron detectors based on 10B4C coated RPcs**	Researchers: 19 Students: 4 **FTEs = 14.0**
Imaging and in-vivo monitoring	**Animal PET – pre-commercial readiness level** **Orthogonal-CT Imaging prototype**	Researchers: 15 Students: 8 **FTEs = 9.8**
Radiation instrumentation in space	**Modeling of environment radiation in Mars** **RADEM monitor for the JUICE mission**	Researchers: 12 Students: 9 **FTEs = 13.7**

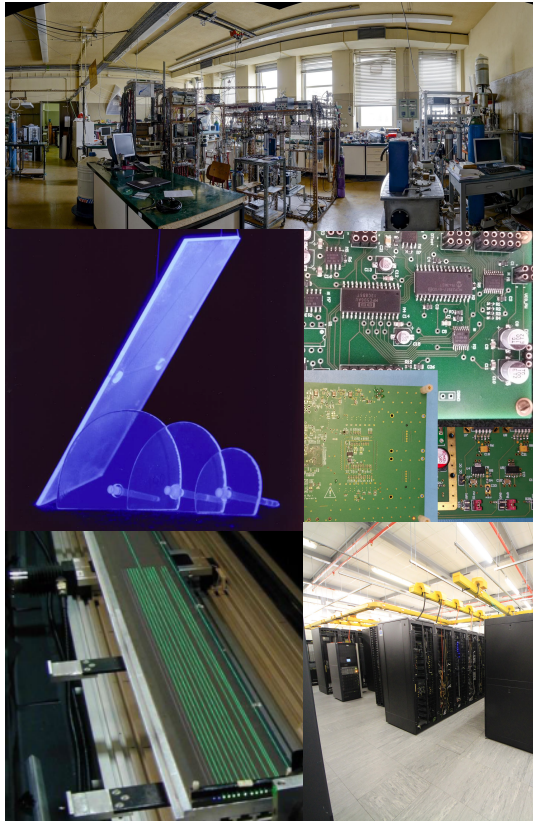
Research Areas & Groups

Scientific Computing

	Recent achievements	Resources
Focusing on Grid and Cloud computing technologies	**Worldwide LHC Computing Grid Tier-2 operation (ATLAS and CMS)** **Major partner in the European Open Science Cloud (EOSC), European Grid Infrastructure (EGI), and Iberian computing Infrastructure(IBERGRID)** **Collaborates with ESFRIs and international thematic infrastructures such as LifeWatch, GBIF, and Elixir.**	Researchers: 10 Technicians: 4 Students: 1 **FTEs = 12.6**
Supporting the Portuguese scientific community	**Co-leads the National Distributed Computing Infrastructure**	

SCIENTIFIC INFRASTRUCTURES & COMPETENCE CENTERS

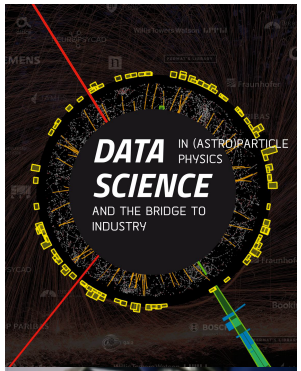
Scientific Infrastructures

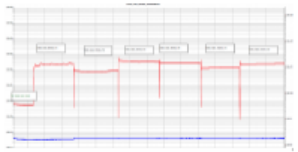


	Short description	Recent achievements
Detector laboratory and mechanical workshop in Coimbra	**Design, construction and testing of particle detectors, electronic circuits and vacuum systems; precision mechanical workshop**	60 m2 of RPCs for cosmic ray, nuclear physics, medicine, industry Umbilical Retrieval Mechanism for the SNO+ calibration system
Cosmic-ray electronic laboratory in Lisbon	**Acquisition electronics: from fast FPGA digital circuits to the design of complex boards, and simple prototypes**	Front-end electronics for MARTA engineering array Testing of radiation damage in electronics components for ESA
Laboratory for Optics and Scintillation Materials in Lisbon	**Characterization of optical fibres and scintillators; optical fibres aluminization;**	Aluminization and quality control of 6000 fibres for DUNE Prototype of Tilecal HV distribution system delivered to CERN for tests
National Distributed Computing Infrastructure (INCD)	**With FCT-FCCN, and LNEC, LIP leads INCD, a digital infrastructure supported by the FCT infrastructures roadmap**	Supplied 45 million CPU hours to Portuguese scientific community

Competence Centers

boost internal synergies and external collaborations with other scientific centres, academy and industry

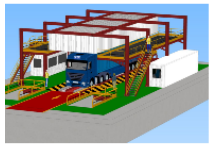




	Short description	Recent achievements
Simulation and Big Data	**Explore and enhance LIP competences in data analysis and simulation tools, from Monte Carlo generators and detector simulation to big-data handling and data mining.**	Data Science School and Symposium to bridge academy and industry Development of GEANT4 simulation models for teaching purposes
Monitoring and Control	**Facilitate the sharing of monitoring and control know-how and solutions in electronic and software design, both within LIP and with external partners.**	Projects exploring small computers (RaspberryPi, Beaglebone) Planning of environmental monitoring system for neuroscience centre

Technology transfer and Spin-offs

Knowledge-transfer across the spectrum of LIP's activities



Estágios tecnológicos no CERN, ESA e ESO

	Short description and achievements
Spin-off company – PETsys	**Created to commercialize the innovative electronics developed at LIP for Time-of-Flight PET systems**
Direct contracts or consortia with LIP – in the last 5 years	**EFACEC SA and EVOLEO SA – consortia to under ESA contracts** **HIDRONAV S.A. – muon tomography applications for shipping** **BOSCH – quality control applications for automotive industry**
Procurement contracts for CERN, ESO, ESRF	**Portuguese Industrial Liaison Officer is a member of LIP's staff developing activity within FCT** **Opportunities from LHC Phase II upgrade – e.g. fast ASICs and electronics for front-end readout, high-voltage and trigger systems of ATLAS and CMS**
Training	**LIP is directly involved in the selection of young engineers for FCT's Technology Internships programme at CERN, ESA and ESO**
INCD Computing and Data Services	**The National Infrastructure for Distributed Computing, delivers computing and data services to the Portuguese scientific community**

Advanced Training

	Short description	Recent activities
LIP hosts over 50 PhD and Master students	**Working within our research groups, in a truly international-level training and research environment**	LIP student workshops: every year, students present the status of their work in an informal atmosphere, with lectures on topics selected by the students PhD student survey: to improve the quality of support and spot problems
PhD networks and programmes	**Coordination of 2 doctoral programmes (~40 students): IDPASC and DAEPHYS** **Partner in EC-sponsored ITN and COST networks.**	The 8th edition of the IDPASC international school was held in Valencia, Spain, in May 2018 The yearly meeting of the MVA4 NewPhys ITN was held in Lisboa in May 2018 European HEP School 2018 in Évora, Portugal (public session with CERN DG)
Undergraduate student training programme	**Bring research closer to undergraduate students in schools, workshops and internships**	2018 Summer internship programme hosted over 60 students in Lisboa, Coimbra and Braga Every year, 4 to 5 schools and workshops

Education and Outreach

ECO activities are part of our social role and fundamental for the recognition of an institution's work

Recent activities

Support to education

a wide set of activities for both students and teachers

2018 CERN's Portuguese Language Teacher's programme (LIP and CERN, since 2007) attended by 20 Portuguese and 20 Brazilian teachers.

IPPOG's international Masterclasses in particle physics attended by over 1500 students every year

Summer internships for high-school students

Partnership with several schools across the country have been recently proposed, in the framework of the promotion of the experimental teaching of sciences and of modern physics in high-school

Other outreach activities

The exhibition "Particles: from the Higgs boson to dark matter", celebrating LIP's 30th anniversary, had over 40 000 visitors.

Present in the 2018 European Researchers' Night in Braga, Coimbra and Lisboa

Every year, over 50 outreach talks given by LIP scientists at schools and other settings

LIP is a close partner of both Agência Ciência Viva and the Portuguese Physics Society

Institutional Communication

Internal communication

considered a priority in 2016

External communication

Priority target audiences are our direct peer institutions (research centres, universities, FCT) and undergraduate Physics and Engineering students, but we reach may others

Recent activities

Survey on internal communication instruments

Monthly internal digital newsletter created (includes info on funding opportunities)

SciCom training for LIP members (2018: speaking in public workshop)

Soft skills training at PhD student workshop

LIP intranet fully reshuffled (more practical info for newcomers, agenda…)

Regular meetings with the research group ECO representatives

LIP annual report: visiting card of the institution

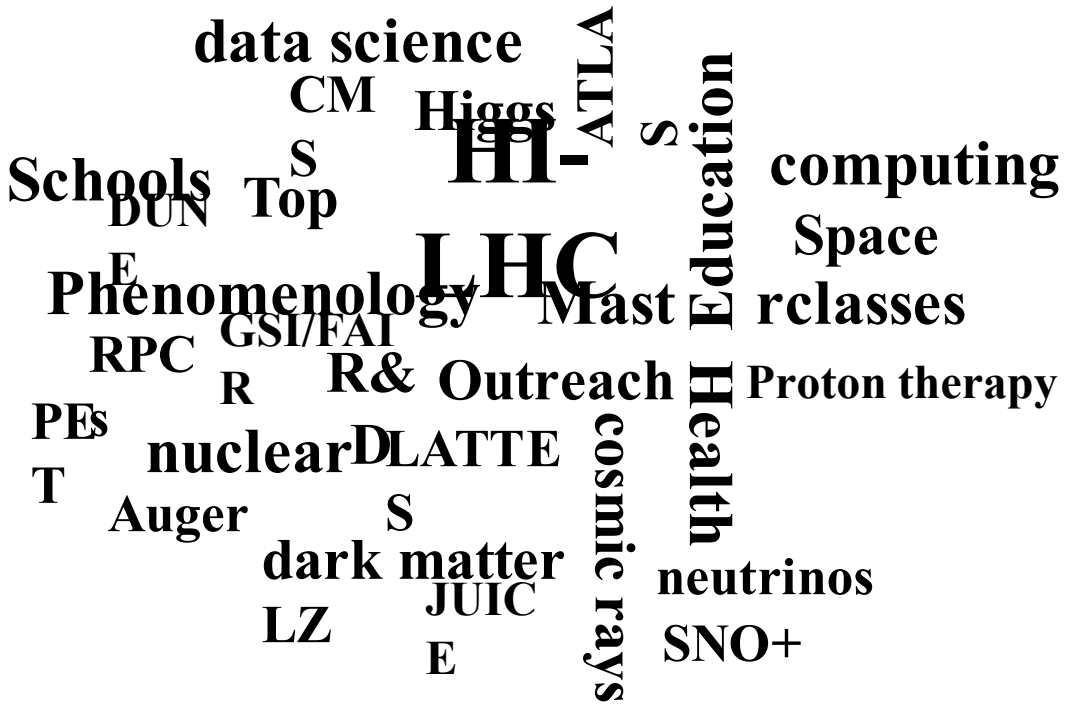
LIP-NEWS bulletin (three issues per year)

LIP public web site renewed + social media (fb, twitter, linkedin)

Several recent press appearances (Higgs, extragalactic cosmic rays, multi-messenger studies)

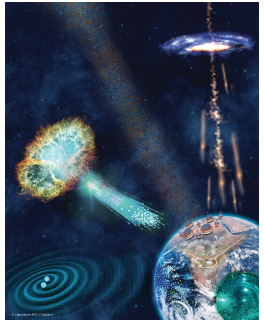
LIP is part of the EPPCN - European Particle Physics Communication Network

Keywords 2018-2023



2018-2023

LIP and its international partners develop strategies in the framework of the current great challenges in particle and astroparticle physics, taking into account the European and international roadmaps



Astroparticle Physics European Consortium (APPEC) roadmap
Multi-messenger approach | Neutrino physics | Dark matter and dark energy

Update of the European Strategy for Particle Physics ongoing
Developing a common vision for the future of particle physics in Europe, beyond HL-LHC

European Strategy Forum for Research Infrastructures in Europe (ESFRI)
Strategy Roadmap | Landscape analysis | Projects and landmarks

2018-2023

Physics challenges

The precision era, at the LHC and beyond

Searches for new physics, from accelerators to dark matter

Neutrino physics —possible clues to some of the great questions

The multi-messenger approach

Technology challenges

Detector R&D — ever more performant detectors, for the HL-LHC and beyond

Data acquisition and trigger — e.g. pile-up challenges

Big data — the challenges of high statistics

Applications to health care, space exploration and new fields

A consolidated management and internal communications plan
A wide education and advanced training program
A strong commitment with society

2018-2023

CERN	LHC high luminosity: detectors, data analysis, phenomenology – Higgs, heavy quarks, new physics Fixed target experiments: end present cycle prepare the next one
GSI/Fair	Contribution to the next generation experiments
Neutrinos	Double beta decay, in the future also CP and mass hierarchy
Cosmic rays	Charged particles, in the future also gammas
Dark matter	WIMP direct search with the largest double-phase xenon detector under construction
Detectors R&D	RPCs: timing, standalone and neutron monitoring
Health	Imaging and radiotherapy monitoring: future proton-therapy center – collaboration with CTN/ICNAS Participation in a national network for the survey of radon – collaboration with CTN and UBI
Muon tomography	Design, construction and running of a portable detector – collaboration with UE
Space	Short term contracts and participation in missions
Computing	Backbone of Portuguese scientific computing infrastructures; International and European projects and infrastructures — DEEP-Hybrid-DataCloud (H2020), EGI, WLCG, …
Advanced training	Hosting and training of graduate and undergraduate students in a truly international environment
ECO	A well-defined communication strategy, for better internal and external communications. A strong link to schools and to a wider community in support to education and outreach activities

Integrated PhD Researchers

too few permanent positions

too many fixed term positions

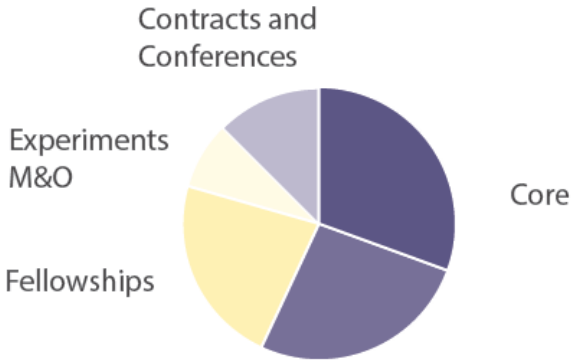
	2017	2022
Permanent positions @LIP	13	20
Permanent positions @University	25	29
Fixed term positions	20	36
Post-docs grants	21	7
Retired	6	6
Total	85	101

Funding 2017

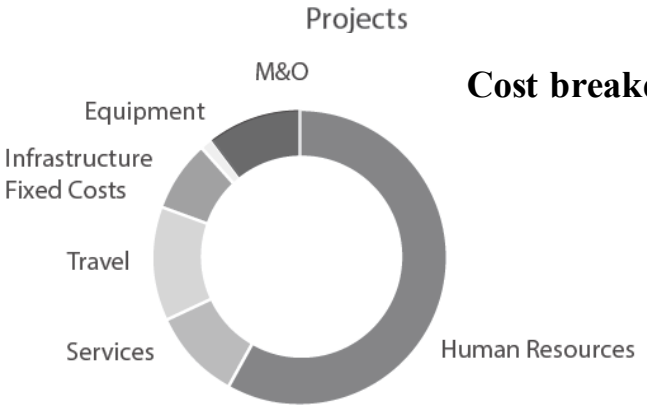
Total 4.9 M euros
Pluriannual 1.4 M euros

Human Resources:
2/3 Total
78% Pluriannual

General Funding

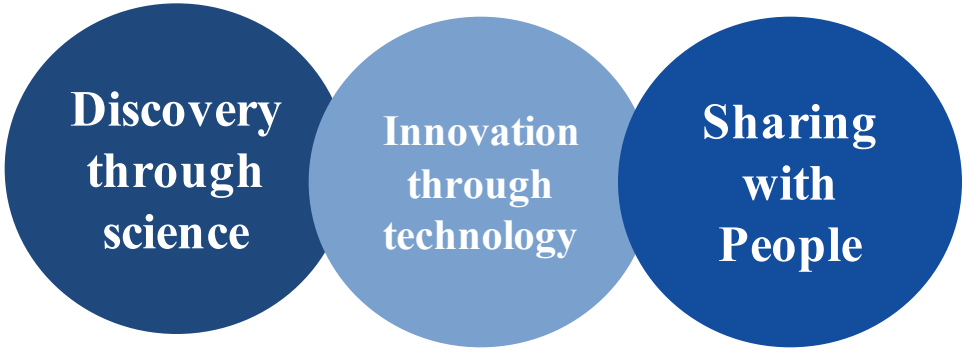


Cost breakdown



LABORATÓRIO DE INSTRUMENTAÇÃO
E FÍSICA EXPERIMENTAL DE PARTÍCULAS

"Our vision for the future is to make sure that LIP will be present in the next great scientific discoveries of humankind, leading science and innovation in Portugal in close connection with the academic and business communities".



PhD workshop


LIP
LABORATÓRIO DE INSTRUMENTAÇÃO
E FÍSICA EXPERIMENTAL DE PARTÍCULAS
partículas e tecnologia
Thanks!