

# LIP – Laboratory for Instrumentation and Experimental Particle Physics

From Fundamental Physics to the Space Frontier

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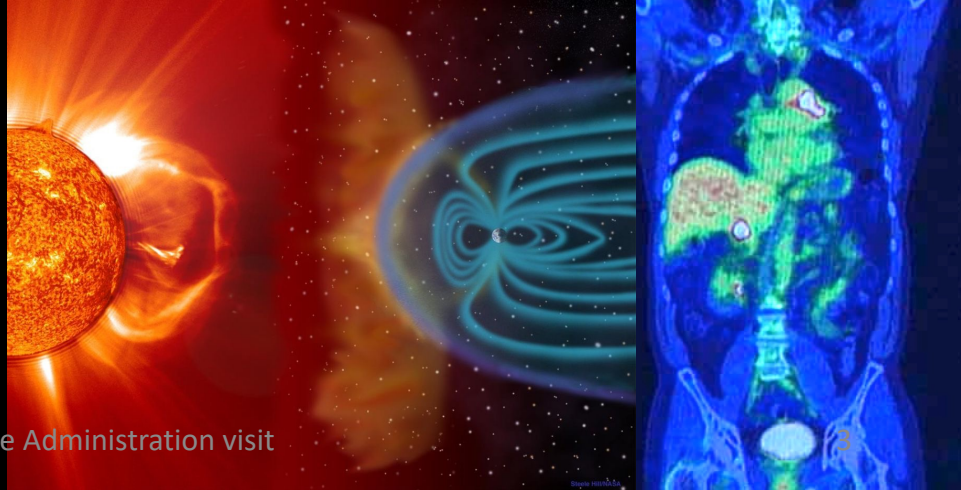
**FCT**

Fundação  
para a Ci4ncia  
e a Tecnologia



# Particle Physics Technologies

- Radiation Detectors
- Particle Accelerators
- Electronics and Instrumentation
- Software:
  - Large-scale data analysis
  - Large experimental control systems
  - Detector/radiation simulation



DETECTOR  
LABORATORY  
RADIATION  
DETECTORS  
DARK  
MATTER  
NEUTRINOS  
HEALTH  
CERN

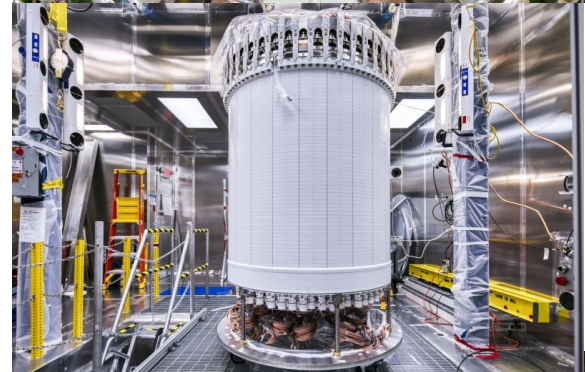
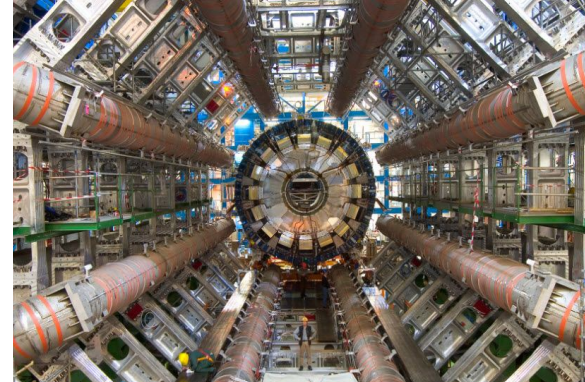
MUONS  
AND CONTROL  
AUTOMATION

SPACE

THERMAL  
NEUTRONS  
PRECISION  
MECHANICAL  
WORKSHOP

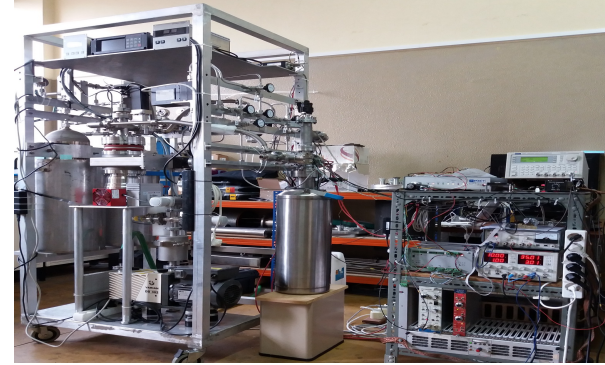
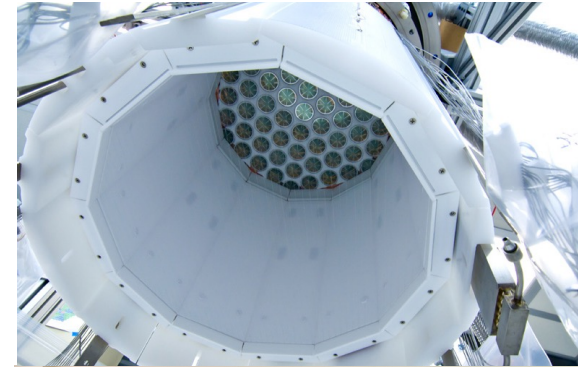
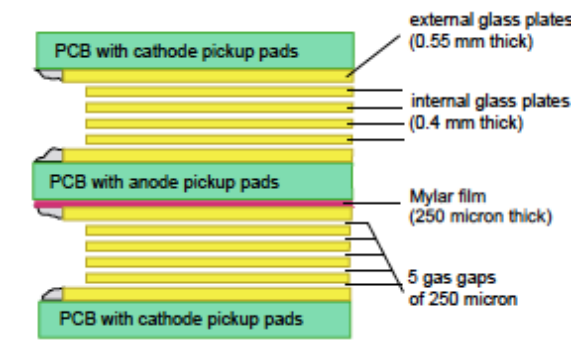
# Particle and Astroparticle Physics

- LHC (CERN) – ATLAS experiment
  - Higgs boson, top quark, exotics, etc
- Lux and LZ experiments (US):
  - Dark Matter direct search
- DUNE experimente (US):
  - Next generation neutrino oscillation experiment



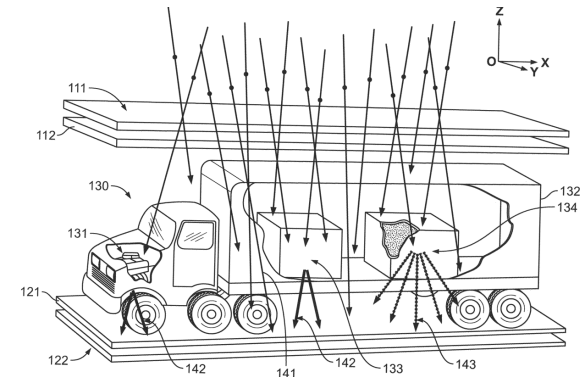
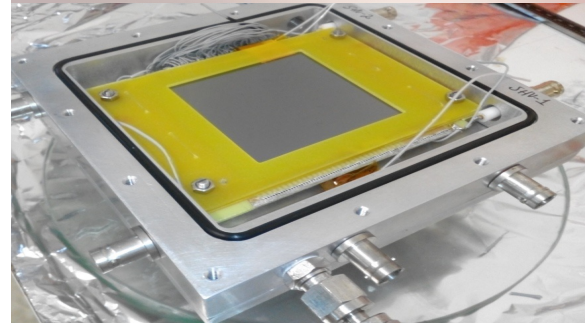
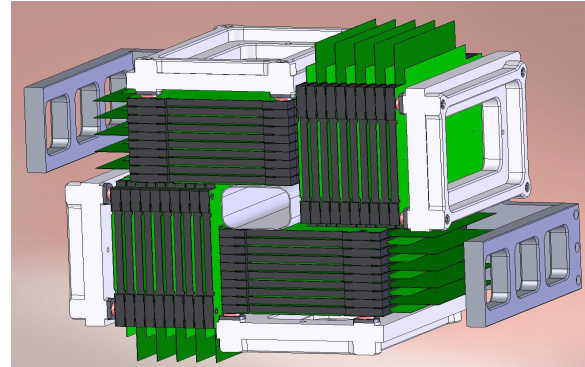
# Particle Detector development

- Resistive Plate Chambers
  - Intrinsically fast, excellent spatial resolution
- Noble liquid detectors
  - Neutrino and Dark Matter experiments
- Gaseous detectors
  - Study of electron and ion mobility in gases



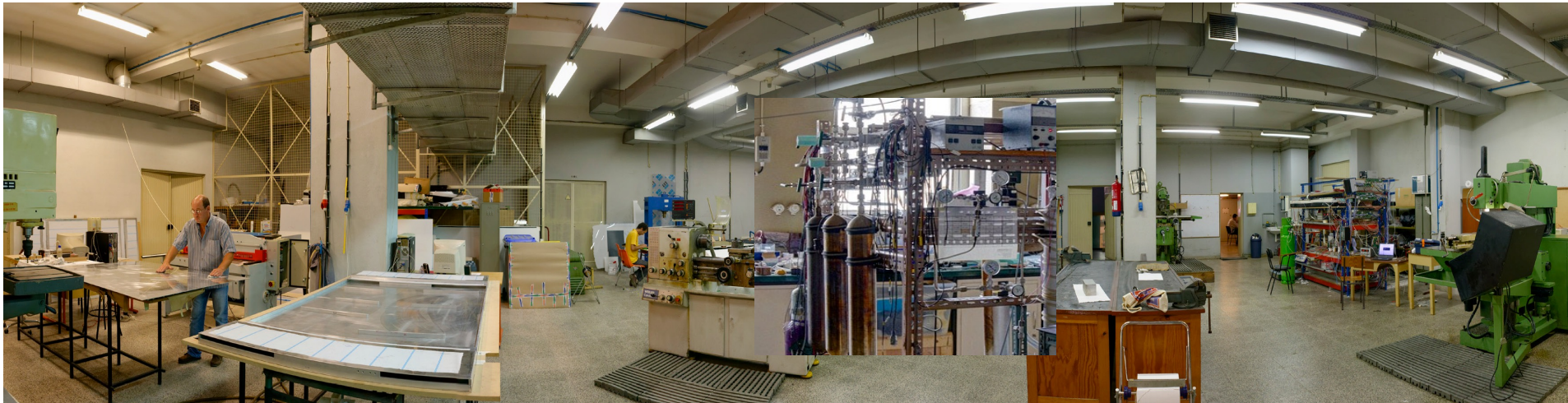
# Some Applications

- Brain-PET prototype with sub-mm resolution
  - Under tests in radiation therapy centre (ICNAS)
- Radio- and proto-therapy instrumentation
- Thermal neutron detectors
  - European Spallation Source
- Muography for National Security
- Tecnologia para o Astrofísica e Espaço
  - CdZnTe sensors for X-ray polarimetry



# Infrastructures in Coimbra

- **Detector Development Laboratory:**
  - Design and construction of radiation detector systems
- **Monitoring and Control Competence Centre:**
  - Experimental control and safety systems
- **Precision Mechanical Workshop:**
  - Design and execution of precision mechanics; ideal for prototypes and small series





# Radiation technology in the space frontier

## Missão JUICE (ESA, EFACEC, PSI, IDEAS)

- RADEM – Rad. Hard Electron Mon.
- EEE component testing for the Jupiter radiation environment

## Projeto MarsREM – Mars Energetic Radiation Environment Models (ESA)

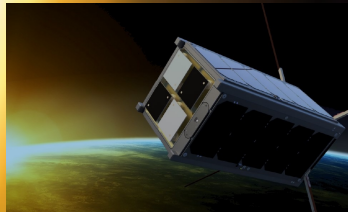
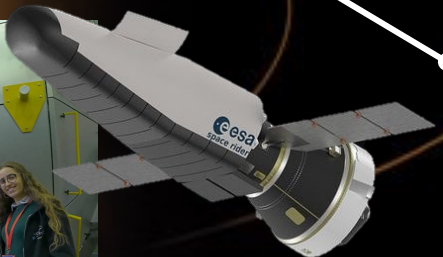
## Projeto BERM (ESA/JAXA) Radiation monitor de for Bepi-Colombo mission (Mercury)

## Efeitos da radiação espacial:

- EEE component testing (Technology Test Bed)
- CdZnTe sensor ageing for space (GLOSS, ESA/CNES)

## Gamma ray polarimetry, Earth observation:

- COMcube (ESA); AMEGO (NASA)
- STRATOSPOLCA (ESA)
- THOR - Space Rider: Terrestrial Gamma Flashes (Active Space, Advacam, ESA)



# Partners

- ESA
- NASA
- Active Space
- EFACEC
- Advacam (Chzechia)
- Ideas (Norway)
- PSI (Switzerland)
- ...



<http://www.lip.pt/>

China National Space Administration visit



<http://www.lip.pt/>