

# PHYSICS SECTOR

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The Physics Sector houses three large infrastructures which are unique in Portugal:

1. **The Ion Beam Laboratory** with a 3.1 MeV Van de Graaff Accelerator and the 210 keV high fluence ion implantor. The accelerator replaced, in 1992, the old 2 MeV van de Graaff, which had been installed in 1958, in this Campus.

The strategy adopted a few years ago (in fact, since 1981) to open the infrastructure to the University and other research institutions in order to be fully used for training and education of students and young researchers, originated a strong collaboration between the Nuclear Physics Centre of the University of Lisbon (CFNUL) and ITN. With this collaboration it was possible to prepare and present a proposal for the acquisition of the **implantor** and later on of the **ion microprobe** and in this way to install the Ion Beam Laboratory as it is today.

This infrastructure is used in the fields of material sciences, environmental health, atomic and nuclear physics (cross section measurements). This last subject is carried out by a research group formed with staff from the Universities of Lisbon. Most of the activity of the Ion Beam Laboratory is presented in the following pages under the name **Nuclear Solid State Physics using ion beams** and **Health and Environmental studies using ion beams**.

2. **The High Temperature Materials Laboratory** became operational in the fall of 1999. The main instrument is the Hotbird, a high-temperature high-resolution X-ray diffractometer. This instrument was projected and constructed at ITN, including the development of all the software for the remote control of the hardware components, for data acquisition and for data analysis.

The major particularity of the Hotbird is its versatility since it can be used as a double-crystal diffractometer and - a recent development - also

as a triple-axis diffractometer to perform in-situ experiments up to 1400°C in both single and polycrystalline samples. The X-ray source is a powerful 18kW rotating-anode generator and the sample goniometer has 7 degrees of freedom.

During the year 2000 the Hotbird was used to study several single crystalline semiconductors, the formation of nanocrystals in implanted metals and semiconductors, the study of powder samples, very fine magnetic multilayers used for IC devices, metallic aeronautical overlay coatings, and others.

Most of the activity developed in this Laboratory is presented under the title **Condensed Matter Physics**. Also under this name is presented the research work related with the neutron scattering work carried out with national and international collaborations as well as the development for the installation of two neutron instruments at the Reactor.

3. **The Gamma Radiation facility (UTR)** is a Cobalt-60 facility with a semi-industrial dimension, which was constructed in collaboration with the International Atomic Energy Agency (IAEA), as a demonstration unit for the national industry.

For logistical reasons the unit is under the Physics Sector coordination. Its operation started in Nov.1988 with an activity of approximately 300 kCi. Today the irradiations are carried out with an activity about 60kCi.

The main activity developed around this infrastructure relates with the radioesterilisation of medical devices and pharmaceuticals from national industries. The research carried out is presented under the title **Radiation Technologies Processes and Products**. This activity, together with the work carried out by the **Nuclear Instruments and Methods Group**, is presented under the umbrella Industrial Technologies.

**Summary of the research groups in the Physics Sector:**

- Nuclear Solid State Physics using Ion Beams
- Health and Environmental Studies Using Ion Beams
- Condensed Matter Physics
- Nuclear Instruments and Methods
- Radiation Technologies: Processes and Products

The composition of these groups is presented in the following pages.

**Administrative and Technical staff:**

- Ana Faria
- Diamantina Venâncio
- José António Cristina
- José Vieira Henriques
- Manuel Cabaça
- Maria Luisa Oliveira
- Maria Teresa Pires