Centro Nacional de Aceleradores-CNA
Applications, research, collaborations

Some studies, which are carried out at CNA, are shown below:

-Cultural Heritage: *Carambolo Treasure* composition study.
-Materials Science: Implantation of layers of different elements into new materials and determination of concentration profiles.
-Aerospace Technology: Electronic circuit behavior under irradiation.
-Instrumentation Development: Testing of detection systems for their use in large scientific facilities such as CERN, GSI, GANIL and ITER.
-Nuclear Physics: Half-life precise determination of ^{8}Li nuclei.
-Environment: ^{129}I distribution in marine environment.
-Environmental Impact: Plutonium determination in environmental samples.
-^{14}C Dating: Study of University of Seville Library Incunabula.
-Medicine: Radiopharmaceuticals production for PET imaging (Positron Emission Tomography)
-Preclinical Research: Determination of tumors evolution in animal models.

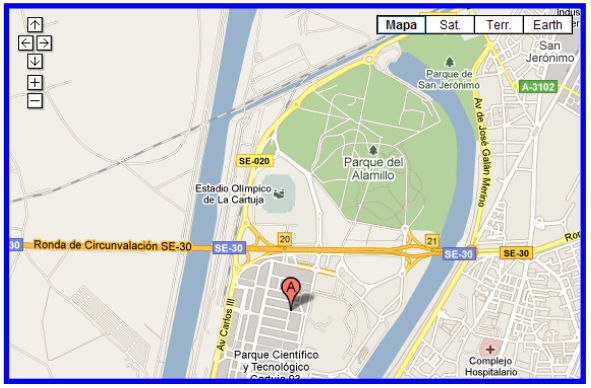
CNA has collaboration agreements with International Atomic Energy Agency (IAEA), Servicio Andaluz de Salud (SAS), CIEMAT (Public Research Agency for excellence in energy and environment) , as well as companies such as IBA Molecular and Enresa (Public entity responsible for the management of all the radioactive wastes generated in Spain).

Centro Nacional de Aceleradores-CNA
Presentation

Centro Nacional de Aceleradores, CNA, is a joint centre, Universidad de Sevilla, Junta de Andalucía and CSIC. It is a Singular Scientific and Technological Installation , ICTS, dedicated to interdisciplinary research with ion accelerators.

There are 3 accelerators: a 3 MV Tandem van der Graaff accelerator, a Cyclotron which provides protons of 18 MeV and deuterons of 9 MeV and a Tandem Cockcroft-Walton accelerator, so called 1 MV Tandetron, which is used as mass spectrometer. Recently, 3 new facilities have arrived at CNA, a human PET/CT scanner, a ^{60}Co irradiator and an ultracompact radiocarbon dating system, MiCaDaS.

The applications of CNA accelerators covers fields such as material sciences, environmental sciences, nuclear and particle physics and instrumentation and medical images treatment, biomedical research, among others.



Google Maps image

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Centro Nacional de Aceleradores
CNA
Accelerators


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"Una manera de hacer Europa"

Centro Nacional de Aceleradores-CNA
3 MV Tandem Accelerator

The first accelerator arrived at CAN (1998) was a Pelletron 3 MV Tandem, which is primarily focused on material characterization and modification by means of IBA techniques. 3 MV Tandem accelerates alpha particles, protons and other ions with a maximum terminal voltage of 3 MV.

Ions are produced by three ion sources. The first one is based on radiofrequency techniques (Alphatross) and generates negative ions from gases (H, He, N…). There is also a cesium sputtering source (SNICS) that produces negative ions from solid samples. The most recent one is a Duoplasmatron source, which is very reliable and provides a high-brightness beam. The beam line situated after the accelerator includes several instruments for focusing, steering and monitoring the beam. At the line end, the beam can pass directly to the 0° line or it can be deflected by the switcher magnet towards one of the seven beam lines.

Nowadays, there are six available beam lines to characterize and to modify materials, as well as for Nuclear Physics research.

The available techniques are:
-Rutherford Backscattering Spectrometry (RBS)
-Elastic Recoil Detection Analysis (ERDA)
-Nuclear Reaction Analysis (NRA)
-Particle Induced γ-Ray Emission (PIGE)
-Particle Induced X-Ray Emission (PIXE) Analysis

Centro Nacional de Aceleradores-CNA
18/9 MeV Cyclotron

Cyclotron was the second particle accelerator installed at CNA (2004). In this accelerator, ions are accelerated through the combined application of an electric and a magnetic field. It is able to produce 18 MeV protons and 9 MeV deuterons.

Cyclone allows the simultaneous bombardment with the same particle of one or two targets that are located in opposite positions (Dual Beam Mode). Seven of the eight targets are devoted to the production of positron emitters. Thus, CNA offers the possibility to produce the most frequent radioisotopes employed in the imaging modality Positron Emission Tomography (PET) for human studies and preclinical research.

Finally, there is an exit line (Experimental Beam Line). The CNA beam transport line has been installed in one of the target ports with two major purposes:

-to study the effects of 18 MeV proton irradiation on the behavior of electronic devices for space applications
-to complement studies of 3 MV Tandem with PIXE measurements at high energy (HEPIXE).

Centro Nacional de Aceleradores-CNA
1 MV Tandetron Accelerator (AMS)

Accelerator Mass Spectrometry (AMS) is a highly sensitive technique that combines mass spectrometry with particle accelerators. The use of high energies makes possible the detection of radioactive isotopes with long half-lives. Mass spectrometry (MS) uses the fact that a charged particle follows a trajectory that depends on its mass and its charge. The use of kinematic filters based on magnetic and electrostatic fields makes possible the selection of the desired particles. However, its sensitivity is limited due to the existence of interferences such as molecules or isobars.

CNA AMS facility utilizes a system based on a 1 MV Tandem Accelerator and it contains a carousel for 200 samples. This system is able to detect a wide spectrum of radioisotopes: ^{10}Be, ^{14}C, ^{26}Al, ^{129}I and Pu isotopes. This facility was installed in 2005. AMS facilities have two laboratories dedicated to sample preparations of radioisotopes such as ^{10}Be, ^{26}Al, ^{129}I and Pu isotopes. Also these laboratories are used to ^{14}C cleaning and preparation samples.

^{14}C is interesting in archaeological, artistic, historical samples because they can be dated by measuring their ^{14}C content .