

Título puesto: Electromagnetic simulations for ALBA II RF cavities

Curso: 2024/25

División: Aceleradores

### Descripción del proyecto:

Radiofrequency system is used at ALBA to keep the energy of the electrons constant as they emit synchrotron radiation. An electric field parallel to the direction of the particles is generated into a resonant cavity with an external high-power source for that purpose. A control loop is implemented to keep the voltage and the phase inside the cavity constant and synchronized with the electron beam.

The cavities are cylinder-like conductor structures, made out of copper, with holes in the axial direction in order to allow the electrons to enter and leave. These holes have different diameter than the vacuum chamber where the cavity is connected to, so a taper must be used. This element is a pipe with different diameters at its ends that assures a smooth transition. Nevertheless, the taper is able to store some energy and therefore to generate unwanted electromagnetic fields, that might perturb the electron beam as it passes through.

For the ALBA-II upgrade is planned in 2026 to install harmonic RF cavities with larger aperture diameters in the actual ALBA beam pipe. Later, in 2030, the new ALBA-II beam pipe with smaller diameter will be installed. In both cases, new tappers are to be used.

Here the candidate will use the finite element simulation software CST in order to simulate the fields inside the new tappers. Both eigenmode and particle tracking modules should be used for this purpose and a mitigation strategy should be proposed in case it would be needed.



## Perfil del estudiante:

Student profile: Physics student or similar engineering education.

Requirements:

- Knowledge of electromagnetic and high frequency theory.
- Experience with programming languages like MATLAB or Python.
- Good level of spoken and written English.

Program:

- Introduction to RF for accelerators.
- CST introduction and simulation
  - Tapper for ALBA with harmonic cavity
  - Tapper for ALBA-II with
    - Main cavity
    - Harmonic cavity
- Documentation of the project.

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