

Título puesto: Longitudinal particle tracking simulations for ALBA II.

Curso: 2025/26

División: Aceleradores

### Descripción del proyecto:

ALBA Light Source is currently working on a 4<sup>th</sup> generation upgrade of its storage ring, aimed at achieving a significantly lower beam emittance. This upgrade will include a double RF system, consisting of the main RF cavities, which will compensate for the energy lost due to synchrotron radiation, and harmonic RF cavities, which will modify the voltage gradient around the synchronous particle, lengthening the particle bunches and thereby improving beam lifetime.

However, double RF systems are inherently susceptible to beam loading instabilities, which can limit the system's performance. To mitigate these effects, feedback systems play a crucial role.

In this context, the student will develop a Direct RF Feedback (DRFF) module within the particle tracking simulation software elegant, drawing on existing literature. After implementing this module, the student will run simulations on ALBA's high-performance computing cluster to evaluate the DRFF's effectiveness in reducing beam loading instabilities and estimate the resulting improvement in beam lifetime.

#### Program:

- Theoretical introduction to RF systems for particle accelerators and feedback mechanisms.
- Implementation of a Direct RF Feedback (DRFF) module in elegant.
- Conducting particle tracking simulations to evaluate the efficacy of DRFF in the ALBA II storage ring and predict its impact on the beam lifetime.
- Analysis of results and final presentation of the project's conclusions.

## Perfil del estudiante:

Student profile: Background in physics, mathematics or a related engineering field.

Requirements:

- Knowledge of electromagnetism and circuit theory.
- Proficiency in programming (C and Python preferred).
- Good command of both spoken and written English.

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Responsable Divisi3n: Francis P3rez

