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Título puesto: Longitudinal beam dynamics studies for ALBA II

Curso: 2026/27

División: Aceleradores

Descripción del proyecto:

ALBA Light Source is currently working on a 4th 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 which will modify the voltage gradient around the synchronous particle, lengthening the particle bunches and improving beam lifetime.

However, double RF systems might arise beam instabilities and are particularly sensitive to transient beam loading effects, which can limit overall system's performance. To mitigate these effects, appropriate compensation and feedback strategies must be implemented.

In this context, the student will study the beam instabilities and transient beam loading effects that might take place in the ALBA II drawing on existing literature. Later, the student will run tracking simulations on ALBA's high-performance computing cluster with mbtrack2, to evaluate the effectiveness of the different proposed solutions in enhancing the double RF system performance and estimate the resulting improvement in beam lifetime.

Program:

- Theoretical introduction to RF systems for particle accelerators.
- Calculation of longitudinal beam parameters based on RF settings.
- Perform particle tracking simulations to assess the effectiveness of the proposed solutions in enhancing the performance of the double RF system in ALBA II.
- Analysis of results and final presentation of the project conclusions.

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Perfil del estudiante:

Student background: Physics, mathematics or a related engineering field.
Requirements:
- Knowledge of electromagnetism and circuit theory.
- Proficiency in programming with Python.
- Good command of both spoken and written English.

Desirable:
- Knowledge of particle accelerator physics.
- Knowledge of control theory.

Tutor: Ignasi Bellafont
Responsable División: Francis Pérez