Título puesto: RF Transient Beam Loading

Curso: 2023-24

División: Aceleradores

Descripción del proyecto:

- ALBA Light Source is working nowadays towards a 4th generation upgrade of its storage ring, aimed at achieving a much lower beam emittance. Such upgrade will include a double RF system, consisting of the main RF cavities, which will supply the beam with the energy loss by synchrotron radiation, and harmonic ones, which will change the voltage gradient around the synchronous particle to lengthen the bunches.

- To achieve the nominal bunch lengthening factors, the beam filling pattern has to be homogenous. Uniformities in the filling pattern such as ion-clearing gaps have a dramatic impact in the lengthening performance. Therefore, a mitigation strategy should be researched to maximize the performance of the harmonic system under the condition of a non-uniform filling pattern.

- Within this frame, the candidate will study as a first step the voltage build-up in a RF cavity and will calculate the voltage along the bunch train for an arbitrary filling pattern. Later, they will create an algorithm to optimally mitigate the transient beam loading by means of the generator power. Ultimately, their algorithm will be tested in a machine run and they will analyze the obtained results.

Perfil del estudiante:

Student profile: Physics student or similar engineering education.

Requirements:

• Knowledge of electromagnetism and circuit theory.

• Experience with programming languages like MATLAB or Python.

• Good level of spoken and written English.

Program:

• Introduction to RF for accelerators.

• Creation of an algorithm to compensate the transient beam loading in the RF cavities.

• Test in ALBA of the developed algorithm and analysis of the obtained results.

• Documentation of the project.

Tutor: Ignasi Bellafont

Responsable División: Francis Perez