



Internship in accelerator physics

Analysis of a new simulation model for SPIRAL2 BPM diagnostics Development of a program for calculating BPM signal amplitudes Comparison with BPM measurements of SPIRAL2 beams

General overview

This internship is part of the study and optimization of measurement chains of beam position monitor (BPM), sensors installed on the SPIRAL2 accelerator, a new facility that produces ion beams 100 to 1000 times more intense than the existing GANIL facility.

The electric field generated by the ion bunches produces signals on the four electrodes of a BPM.

The four signals from the BPMs are digitized by electronic cards at a frequency close to that of the accelerator (88 MHz). Digital processing performed by an FPGA calculates the position, ellipticity, phase, and energy of the ion beam with precision.

Internship objectives

This internship focuses on a new BPM diagnostic simulation model developed for SPIRAL2 beams. The amplitudes of the signals from the four BPM electrodes at different harmonics depend on the mechanical dimensions of the BPMs and the beam characteristics.

The objectives of the internship are as follows:

- Understand the characteristics of ion beams, including those of SPIRAL2.
- Analyse the behaviour of the electric field generated by ion bunches on BPM electrodes as a function of beam energy.
- Compare different simulation models of electric field extension.
- Understand frequency signal processing and amplitude measurement of the harmonics of BPM signals performed by the measurement electronics
- Formalize the new BPM simulation model, the calculations of amplitudes and sensitivity coefficients in positions and ellipticities
- Develop a program to calculate the amplitudes of the frequency spectrum of BPM signals (4 electrodes and the vector sum) based on mechanical dimensions (diameter, electrode length), beam characteristics (intensity, energy, packet length, position, ellipticity)
- Use the Tracewin beam parameters and implement bunch length calculations. Calculate the expected BPM amplitudes from the Tracewin parameters
- Compare these results with the beam measurements performed on SPIRAL2

This internship is aimed at physics students interested in accelerator physics, the study of electromagnetic fields produced by beams, and modelling the behaviour of sensors in particle accelerators.

This work does not lead to a PhD-thesis.

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