

Post-doctoral Position – (m/f)

Accelerator Division

Position: Available since February 2022 and shall be open until filled.

1. Introduction

Synchrotron SOLEIL is the French national synchrotron facility, located on the Saclay Plateau near Paris. It is a multi-disciplinary research laboratory based on a state-of-the-art synchrotron source, whose mission is to run research programs using synchrotron radiation, to develop state-of-the-art instrumentation on the beamlines and make those available to the scientific community.

The 354 m circumference storage ring that generates synchrotron radiation stores a 2.75 GeV electron beam and runs continuously 24 hours a day, 7 days a week, with uninterrupted periods up to 10 weeks. It consists of an extended DB (Double Bend) lattice, which is fully optimized in terms of straight section lengths for insertion devices, beam sizes and divergences at source points, and of beam lifetime. It provides a low beam emittance of 4 nm-rad horizontally and 40 pm-rad vertically with excellent stability at the nominal beam current of 500 mA. Top-up injection as well as several feedback systems are running at all times. Besides, it can run in 5 modes of operation, differing in filling and intensity of the stored bunches, to fulfill the demands of a wide range of experiments, carried out in the beamlines.

Current studies for a major upgrade of the SOLEIL ring are underway in phase with an explosive wave of constructing a new generation of LS rings, called Diffraction Limited Storage Rings (DLSR), thanks to a marked progress of the technology over the last decade in the international light source (LS) community. To be able to continue serving as a top-class light source in future, SOLEIL has officially launched R&D studies for its upgrade since beginning of 2019 and a CDR (Conceptual Design Report) was compiled at the end of 2020. The project is presently in the TDR (Technical Design Report) phase with the goal of delivering a TDR by the end of the year 2023.

Background situation linked to this postdoc position:

- 1) Achieving the desired ultra-low horizontal emittance usually requires very high magnetic fields to strongly focus the electron beam transversely, which in turn forces the vacuum chamber openings to be greatly reduced to have a small distance between the magnetic poles. Consequently, the so-called wake fields or the coupling impedance of the machine increase, which enhances the collective effects of the beam. The presence of ions in the vacuum chamber could also increase the risk of significantly spoiling the size and stability of the electron beam.
- 2) It is known that to remedy the problems of particle scattering known as Touschek and Intra-Beam Scattering (IBS), it is effective to lengthen the electron bunches by introducing additional RF cavities operating at a harmonic frequency ($n = 3, 4, \dots$) of the fundamental RF frequency, which is envisaged in most next generation LSs. Unfortunately, a complex RF system combining fundamental and harmonic cavities is apt to induce some undesirable beam collective effects such as Robinson instability (AC or DC) and strong sensitivity to transient beam loading. Today for the SOLEIL Project these studies must be carried out quickly over sets of possible scenarios for the fundamental and harmonic cavities (passive or active, normal or super-conducting, different harmonic number, ...) against foreseen different beam operation modes to be able to make the right choice for the technology of the upgraded RF system.

2. Mission

The successful candidate shall be engaged in:

- Studying the collective effects of an electron beam due to their interactions with ions in the upgraded storage ring and the new booster
- Contributing to completion of ongoing studies on the evaluation of impedances and the collective effects of an electron beam due to the former of the storage ring as well as the booster
- Assisting ongoing studies related to harmonic cavities in the storage ring
- Using the existing numerical tools to simulate the collective effects of the beam and to evaluate machine impedances, as well as in developing new tools (simulation codes) upon needs and contributing to maintenance of the codes.

The successful candidate is expected to be a member of the accelerator physics group of SOLEIL in the Accelerator and Engineering Division. The group currently consists of 6 physicists and 1 postdoc and 2 doctoral students. He (or she) shall work principally on the missions described above under the supervision of the experts of the beam collective effects in the group, as well as of the experts of the RF technology from the RF and LINAC group. He (or she) shall also participate in the beam-based experimental studies which may be organized either at SOLEIL or other machines. In addition, he (or she) shall likely interact with colleagues in his (or her) group and from various engineering groups to study the inter-disciplinary aspects of his (or her) studies.

He (or she) shall be regularly given opportunities to participate in conferences and workshops and present his (or her) works, as well as making publications of the outcomes in appropriate journals.

3. Qualifications & Experience

The candidate is expected to possess a PhD degree in physics or equivalent competence. We are looking for a motivated candidate with a very strong university background in physics (classical physics and electrodynamics), mathematics (linear algebra, numeric methods, statistics), as well as in computer science (programming in MATLAB, python, C, C++, FORTRAN etc., as well as knowledge of numerical codes for accelerators). Experience with synchrotron radiation, accelerator physics, high energy physics or relevant engineering fields would be a particularly important asset. The working language is English. Ability to speak French shall be an added value.

4. General conditions

The offer concerns a post-doctoral contract for 12 months-period with the possibility of one year renewal.

The working place shall be at Synchrotron SOLEIL, which is located in the Paris suburbs (Saint-Aubin in the Prefecture of Essonne).

Applications should include a motivation letter and Curriculum Vitae with the addresses of three references. Applications should be preferably registered directly on the SOLEIL website (via the button on the site "*You can also submit an unsolicited application [here](#)*"):

<https://candidature.synchrotron-soleil.fr/YourApplication/Candidatures.php?ref=>

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