

ACCELERATOR PHYSICIST

Collective effects studies for the high energy booster of the electron-positron Future Circular Collider

Project description

The Future Circular Collider (FCC) is an international design study with emphasis on a hadron collider with a centre-of-mass energy of the order of 100 TeV in a new 80-100 km tunnel as a long-term goal. As a first stage, an electron-positron Higgs and electroweak factory (FCC-ee) operating at centre-of-mass energies from 91 GeV (the Z mass) to a maximum of 365 GeV (above the tt production threshold). The same tunnel is then planned to host a hadron collider (FCC-hh) operating at the highest possible energies..

Affiliation

GANIL, National Large Heavy Ion Accelerator, is a very large equipment at the service of French, European and international research. Today, GANIL is one of the world's leading laboratories for ion beam research. As a national laboratory located in Caen, its scientific community includes 700 researchers from laboratories around the world, who regularly come to GANIL to conduct experiments.

Job description

GANIL, in the frame of the FCC (Future Circular Collider) project, invites applicants for a post-doctoral position to study collective effects for the high energy booster of the electron-positron Future Circular Collider [1].

One of the provocative questions in particle physics is the understanding of the origin of the particle mass, by exploring the Higgs boson properties, and more particularly its self-interaction. In order to probe the Higgs properties, the electron-positron collider is a powerful tool for precision physics. In this framework, the « Future Circular Collider » studies aim to deliver a detailed conceptual design and to give a sustainable long-term implementation plan of an electron-positron 100-kilometer-long collider with the highest luminosity (value linked to the number of collisions per second) at CERN. The candidate will join an international collaboration grouping top-level laboratories like CERN, DESY, INFN, or KEK. The candidate will focus on the booster, the ring accelerating the electrons and positrons up to the nominal energy before injection into the collider. The booster has numerous challenges. One of the challenges is the collective effects interplay and roles in the booster design optimisation process. Such effects can be the root of important instabilities that could limit the ability of the booster ring to accelerate leptons up to the required energies. In addition, several design parameters (including overall lattice design and components design) as well as operation and energy ramp-up strategies can be linked to collective effects such as intra-beam scattering, wake-fields or space charge.

In order to better understand these phenomena, the candidate will be in charge of impedance budget studies linked to components design like beam-pipes and radio frequency cavities. The candidate will also be involved in

GANIL is also involved in a number of critical R&D studies including those for the Future Circular Collider whose outcome can shape the future of particle and nuclear physics research in Europe and worldwide for the years to come.

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instabilities studies with experts from CEA, CERN, DESY, INFN and GANIL..

The candidate will use specific codes like XSuite [2], pyHEADTAIL [3], IW2D [4] and PyWit [5] as well as the Python programming language.

References

[1] Abada, A. E. A., et al. "FCC-ee: The lepton collider: Future circular collider conceptual design report volume 2." *The European Physical Journal Special Topics* 228 (2019): 261-623.

[2] Iadarola, G., et al. "Xsuite: An integrated beam physics simulation framework." *arXiv preprint arXiv:2310.00317* (2023).

[3] Oeftiger, Adrian. "An overview of PyHEADTAIL." (2019).

[4] <https://gitlab.cern.ch/IRIS/IW2D>

[5] <https://gitlab.cern.ch/IRIS/pywit>