

## Internship in Radioactive Ion Beam development

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### Development of proton-rich Fe-Co-Ni radioactive beams

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**Context:** The SPIRAL1 facility has been providing post-accelerated radioactive ion beams (RIBs) to GANIL users since 2001. In this facility, radioactive atoms are produced at rest by the interaction of a high energy stable ion beam with a thick target. The atoms are then guided from the target to an ions source, where they are ionized, hence forming a RIB, before being accelerated by a cyclotron. Owing to the wide variety of stable beams available in GANIL and the even wider variety of radioactive isotopes, many feasible RIBs remain to be produced. In particular, proton-rich RIBs of Fe-Co-Ni elements could bring great physics opportunities to GANIL. These beams have been requested multiple times in recent years and SPIRAL1 could produce them at an intensity unmatched by comparable facilities like ISOLDE-CERN and ISAC-TRIUMF. This internship aims at testing and improving the production of those beams.

**Master work:** An online production test is planned during the summer of 2024. The master student will participate to this test and be responsible for the data analysis to extract the RIB production rates and other information. He/she will then develop a multiphysics model using COMSOL or ANSYS to calculate the temperature distribution inside the irradiation target. Based on experiment and simulation results, the student will deduce ideal operation parameters (primary beam energy and intensity, electrical heating power of the target) to reduce the time delay between the production of an isotope in the target and its ionization in the source. If deemed necessary, he/she can even propose changes in the design of the graphite target and of the target oven to decrease further this time delay. Should the master student be interested, a PhD could follow this internship.

#### **Expected skills**

- General knowledge in engineering and applied physics (relevant fields are mechanical design, electricity, electromagnetism, heat transfer, radioactivity and basic chemistry)
- English, spoken and written
- Programming experience with at least one language or software relevant for data analysis (C/C++/Python/Matlab...)
- Interested in instrumentation and practical science. Experience with an engineering project from design to test (for school or personal project) will be greatly appreciated.
- Experience with modeling a physical phenomenon (numerical simulations, Monte Carlo methods, finite element calculation, etc) would be appreciated

This work can be pursued by [a PhD-thesis](#)

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