Annex. VACANCIES

1. Center: LIPAc site - QST Rokkasho Fusion Institute (Rokkasho, Japan)

Overall purpose

LIPAc, the Linear IFMIF Prototype Accelerator, is an accelerator using superconducting linac presently under installation and commissioning in Rokkasho Fusion Research Institute in Japan in the framework of the IFMIF/EVEDA project. The goal of the IFMIF/EVEDA project is to validate the technological concept of a Li(d,n) fusion relevant neutron source for materials testing. It is being implemented under the Broader Approach Agreement between Japan and EURATOM in the field of Fusion Energy Research running until December 2019.
LIPAc aims at running a deuterons beam of 9 MeV at 125 mA in Continuous Wave mode; this performance will break through present accelerator technologies frontiers. LIPAc will validate the technological concept of the 40 MeV accelerator of IFMIF-DONES.
We are looking for people interested to join the Integrated LIPAc Unit in Rokkasho to reinforce the international team in accelerator technologies and to support the team onsite technically, ensuring the safe and efficient execution of the experimental campaigns.

1.a. 3 positions for Accelerator Physicist

Task descriptions

- To carry out beam dynamics simulations and iterate these with respect to the relevant experimental results.
- To assist with commission planning with a view to optimise beam characteristics of the LIPAc accelerator in coordination with the accelerator operation team
- To participate to the beam commissioning and the operation of the LIPAc, including the operation of the main sub-systems (ion source, RFQ, MEBT, HEBT, superconducting linacs, and associated diagnostics),
- To assist in operating, troubleshooting and repairing elements part of the LIPAc.

- To write and to have approved procedures/report to safely and efficiently perform tasks.

Education

- University degree

Recommended education and skills

- University degree in Physics or Engineering
- At least three years of proven professional experience, experimental work for a thesis included.
- At least two years of accumulated professional experience in particle accelerators or nuclear fusion facilities or similar;
- Working experience in a European or international setting

Additional recommended skills

- Ability to integrate into an international and multicultural environment;
- Strong communication skills.
- Good organisational skills and ability to work under pressure.
- Good command of both written and spoken English.

1.b. 1 position for Beam Operation Engineer

Task descriptions

- To support LIPAc Unit Leader on all technical aspects of the accelerator.
- To manage operation team resources to implement experimental programme,
- To coordinate the daily operation by defining daily operation schedule, reporting on the progress, and liaising with the maintenance leader to organize maintenance plans/interventions,
- To participate to the beam commissioning and the operation of the LIPAc, including the operation of the main sub-systems (ion source, RFQ, MEBT, HEBT, superconducting linac, and associated diagnostics).

- To write and to get approved procedures to perform experimental tasks and ensure their safe and efficient execution.
- To ensure regular maintenance and instant repair work on equipment of accelerator systems.

Education

- University degree

Recommended education and skills

- University degree in Physics or Engineering
- At least three years of proven professional experience, experimental work for a thesis included.
- At least two years of accumulated professional experience in particle accelerators or nuclear fusion facilities or similar;
- Working experience in a European or international setting

Additional recommended skills

- Ability to integrate into an international and multicultural environment;
- Strong communication skills
- Good organisational skills and ability to work under pressure.
- Good command of both written and spoken English.

1.c. 2 positions for Electrical/Mechanical Engineering

Task descriptions

- To manage electrical interfaces, installation and operation of advanced and complex electrical equipment, including preventive and curative maintenance (Electrical engineering) or to manage the integration, installation and operation of the LIPAc equipment and to follow-up of the engineering design review(s) of the different prototypes already manufactured and commissioned (Mechanical engineering).

- To provide the electrical and/or mechanical engineering support during installation, checkout, commissioning, beam operation and maintenance phases at Rokkasho,
- To contribute to the definition of the maintenance plan of the LIPAc accelerator and ensure the execution of the preventive and corrective maintenance of accelerator components of the LIPAc facility,
- To troubleshoot technical issues with a view to proposing and implementing technically and administratively appropriate solutions,
- To analyse the feedback on operation in order to improve the reliability, availability and the maintainability of the LIPAc facility,
- To assist the Maintenance leader in implementing and following up the maintenance plan and procedures for the LIPAc (e.g. Electrical distribution board, Alignment, Vacuum…)

Education

- University degree

Recommended education and skills

- University degree in electrical engineering, mechanical engineering.
- At least three years of proven professional experience, experimental work for a thesis included.
- At least two years of accumulated professional experience in particle accelerators or nuclear fusion facilities or similar.
- Working experience in a European or international setting.

Additional recommended skills

- Ability to integrate into an international and multicultural environment.
- Strong communication skills.
- Good organisational skills and ability to work under pressure.
- Good command of both written and spoken English.

1.d. 1 position for Accelerator Control System

Task descriptions

- To assist in the hardware commissioning tasks in Rokkasho in particular in integrating as a whole the different Local Control System into the Central Control System, beam operation, instrumentation performance, and machine and personal protection systems.
- To participate to the beam commissioning and the operation of the LIPAc, including the operation of the main sub-systems (ion source, RFQ, MEBT, HEBT, superconducting linac, and associated diagnostics).
- To participate in the engineering design of the new control system in the frame of enhancement activities of the LIPAc Control System (e.g. Engineering, Follow-up, Procurement, Installation ...).
- To assist the Maintenance leader in implementing and following up the maintenance plan and procedures for the LIPAc.

Education

- University degree

Recommended education and skills

- University degree in physics or engineering
- At least three years of proven professional experience, experimental work for a thesis included.
- At least two years of accumulated professional experience in particle accelerators or nuclear fusion facilities or similar.
- Working experience in a European or international setting.

Additional recommended skills

- Experience in EPICS, Linux and other relevant technologies, such as Siemens PLC, National Instruments cRIO, FPGA, VxWorks
- Ability to integrate into an international and multicultural environment;
- Strong communication skills
- Good organisational skills and ability to work under pressure.
- Good command of both written and spoken English.

2. Center: KIT (Karlsruhe, Germany)

2.a. 1 position on Neutronics for DONES

Task descriptions

- Conducting neutronics simulations in support of IFMIF-DONES design optimizations and radiation protections for target system, accelerator system, lithium system and other systems.
- Developing of neutronics simulation models from CAD data.
- Performing radiation transport, activation and shutdown dose rate simulations with appropriate level of verifications and quality assurance measures (technical checking, review, cross-comparisons, sensitivity studies, etc.)
- Evaluating nuclear performances and radiation protection capabilities and identifying further areas of work.
- Reporting and presenting all aspects of work, interacting with multi-disciplinary design teams and consulting on suitable design modifications.

Education

- PhD degree

Recommended education and skills

- PhD degree or equivalent in a relevant field
- At least 3 years of relevant work experiences in the following areas:
  - Radiation transport simulations using MC codes, preferably MCNP.
  - Creating and modifying the MCNP geometry using CAD modeling tools and conversion tools.
  - Performing activation inventory calculations using FISPACT/ACAB.
  - Performing data analysis using scientific visualization codes, e.g. ParaView, VisIt, Origin.
- Fluid communication and documentation using English.

Additional recommended skills

- Scientific computation using supercomputers.
- Programing using language Fortran, python or other programing languages.
- Knowledge in accelerator physics and fusion neutron physics.

2.b. 1 position on DONES irradiation modules design and validation

Task descriptions

The task comprises to support the multidisciplinary team at KIT in the engineering design task of the DONES High Flux Test Module and other modules. Among the specific tasks are:

- Optimizing the design in respect to fabrication procedures / quality assurance, reliability and irradiation performance.
- Integrating changes in the 3D CAD models.
- Performing thermal-hydraulic and mechanical analyses.
- Devising instrumentation and control of the local control system in interaction with the DONES central control system.
- Verification of performance against requirements and codes&standards.
- Managing requirements and interfaces in interaction with other teams for design and transversal activities of the European DONES project.
- Documentation and presentation of results

Education

- MSc or equivalent or higher (PhD)

Recommended education and skills

- MSc or equivalent or higher (PhD) in mechanical engineering, process engineering or physics.
- at least 3 years of work experience.
- Fluid mechanics, structural mechanics.

Additional recommended skills

- English language (written and in speech) to communicate with the local team, the international DONES teams and to contribute to the documentation.
- Nuclear engineering.
- Systems engineering.
- Materials, fabrication (welding, brazing, electric discharge machining, conventional machining).
- Pressure vessel codes (PED, ASME, RCC).
- Instrumentation and control.
- Proficiency in programming (Matlab/Scilab, C/C++, Python, others).
- German language, to communicate in the team, with workshop and service staff.

Qualifications to be trained on the job

- Background of the fusion projects IFMIF-DONES and DEMO.
- Working in a multi disciplinary science and engineering team.
- Management of requirements, interfaces, design changes.
- Integrating aspects of neutronics, thermal-hydraulics, mechanics, materials and fabrication in the design of irradiation devices.
- Use of CAE tools: Computer Aided Design (CAD), Computational Fluid Dynamics (CFD), Finite Element Method (FEM).
- Specifics of low pressure helium cooling in irradiation devices.

2.c. 1 position on He cooling and DONES

Task descriptions

The task comprises to support the multidisciplinary team at KIT in the experimental tasks for the DONES High Flux Test Module and other experimental setups. Among the specific tasks are:

- Deriving mock-ups from the existing test module definitions which are adapted to the necessities of experiments (added instrumentation, accessinbility, mounting etc.)

- Verification of the design against codes&standards, i.e. Pressure Equipment Directive.
- Devising instrumentation, integrating the instrumentation in the experimental setup (together with the test engineer and technician).
- Elaborating in cooperation with workshops and suppliers the manufacturing definition of mock-upsion procedures.
- Performing quality assurance and manufacturing documentation. Feedback to the HFTM design process.
- Performing thermal-hydraulic and mechanical analyses for the expected or experienced experimental conditions.
- Supporting the execution of experiments in the HELOKA-LP, FLEX and Q-PETE facilities (together with the test engineer and technician).
- Documentation and presentation of results.

Education

- MSc or equivalent or higher (PhD).

Recommended education and skills

- MSc or equivalent or higher (PhD) in mechanical engineering, process engineering or physics.
- At least 3 years of work experience.
    - Materials, fabrication (welding, brazing, electric discharge machining, conventional machining).
    - Fluid mechanics, structural mechanics.
- English language (written and in speech) to communicate with the local team, the international DONES teams and to contribute to the documentation.

Additional recommended skills

- Nuclear engineering.
- Systems engineering.
- Pressure vessel codes (PED, ASME, RCC).
- Instrumentation and control.
- Proficiency in programming (Matlab/Scilab, C/C++, Python, others).
- German language, to communicate in the team, with workshop and service staff.

Qualifications to be trained on the job

- Background of the fusion projects IFMIF-DONES and DEMO.
- Working in a multidisciplinary science and engineering team.
- Management of requirements, interfaces, design changes.
- Integrating aspects of neutronics, thermal-hydraulics, mechanics, materials and fabrication in the design of irradiation devices.
- Use of CAE tools: Computer Aided Design (CAD), Computational Fluid Dynamics (CFD), Finite Element Method (FEM).
- Specifics of low pressure helium cooling in irradiation devices.

2.d 1 position on Li jet diagnostics and characterization

Task descriptions

- Development, verification and qualification of optical measurement techniques and sensors to acquire a lithium jet within required accuracy.
- Identification of optimal sensor positions on a scaled mock-up to derive relevant interlock signals for deuteron beam in case of a lithium loop malfunction or unintended beam operation.
- Elaboration of an operational scheme for the different operation stages of the lithium system.
- Identification of instrumentation types and their placement to allow for redundancy, early failure detection to enhance availability of the target assembly including qualification in alkali liquid metal systems.
- Investigation on the correlation of the impurity size at the nozzle and the surface profile downstream.

Education

- MSc or equivalent

Recommended education and skills

- MSc or equivalent in mechanical engineering, process engineering, Physics, Electronics, Fluid mechanics.
- English language (written and in speech) to communicate with the local team, the international DONES teams and to contribute to the documentation.

Qualifications to be trained on the job

- Background of the fusion projects IFMIF-DONES and DEMO.
- Working in a multi disciplinary science and engineering team
- Management of requirements, interfaces, design changes.
- Integrating aspects of neutronics, thermal-hydraulics, optics, functionality of materials and measurement devices in a highly irradiating nuclear ambient environment.
- Use of Computational Fluid Dynamics (CFD).

3. Center: ENEA (Brasimone, Italy)

3.a. 1 position for DONES Remote Handling

Task description:

The maintenance activity of DONES components and systems is very a demanding task to be addressed to satisfy one of the main requirements of DONES plant availability that is of 70%. Due to the harsh environment maintenance will be performed by using remote handling (RH) techniques.
The development of the maintenance processes in the RH filed covers several aspects, among these there are:

- Development of the maintenance procedures, operations and their optimization.
- Design of RH equipment and tooling.
- Development of R&D program for the engineering and experimental validation tests of the RH operations on DONES systems and components.

In the near future, the validation of the main RH maintenance operations to be performed in the most critical area of the DONES, which is the Test Cell (TC), is planned. This area hosts the Target assembly (TA) and the High Flux Test Module (HFTM) that are the mostly exposed components to the neutron flux and then

requiring regular preventive maintenance. Almost all these maintenance validation activities will be performed in the DRP facility at ENEA Brasimone (It).

The candidate will be required to prepare an R&D program for the engineering and experimental activities for the validation/qualification of the maintenance operations to be performed on the TC components. The activity will include the following topics:

- Definition of the R&D program with the objective of a fully test and qualification of the maintenance operations for the TC components, on the basis of international standards and rules.
- Planning of the experimental program, including evaluation/optimization of the resources needed.
- Studying the configuration of the DRP facility and, if required, propose the upgrading of the equipment/tooling and of the layout modification of the facility.
- Preparation and follow up of the execution of the experimental test campaigns
- Reporting and post data analyses.

The candidate will work in tight collaboration with an international team (DONES project) and with researchers from ENEA, Italian Universities and industries.

Education

- University degree

Recommended education and skills

- University degree in physics or engineering (preference is for a Mechanical or Mechatronic engineer).
- At least three years of proven professional experience, experimental work for a thesis included.

Additional recommended skills

- Ability to integrate into an international and multicultural environment.
- Strong communication skills.
- Good organisational skills and ability to work under pressure.
- Good command of both written and spoken English.

4. Center: ENEA (Frascati, Italy)

4.a. 1 position for RAMI studies for DONES

Task description:

DONES (DEMO Oriented Neutron Source) will be a neutron source able to irradiate, up to 30, 40 and 50 dpa with a neutron spectra similar to the one in the fusion reactors, sets of specimens of materials relevant for the construction of the future DEMO reactor.

Key elements of its engineering development are identification of reliability and availability requirements (or targets), reliability and availability analysis, reliability testing, and "reliability growth", the structured process of finding root causes for reliability problems and predicting and monitoring the increase of system's reliability through successive phases. Since reliability and availability are strictly related to maintenance and inspection activities performed on the plant during the operating phases, the integrated approach in reliability and availability optimization is based on the four issues: Reliability, Availability, Maintainability and Inspectability (RAMI).

Many factors are important to achieve a satisfying RAMI level: design of systems; manufacturing quality; the operational environment; the design and development of the support systems; the level of training and skills of the people operating and maintaining the system; the availability of spare parts to repair the system; and the diagnostic aids and tools (instrumentation) available to check system processes and capability to detect normal and abnormal operating parameters. All these factors must be understood to achieve a plant with a desired level of RAMI. During pre-conceptual design phases, the most important activity is to understand the rationale of the plant, the related functions, requirements and constraints for the different systems. During plant development, the most important RAMI activity is to identify potential failure mechanisms and to make design changes to remove them or to mitigate consequences of the failures. During realization and installation, the most important RAMI activity is to ensure quality in manufacturing so that the inherent RAMI qualities of the design are not degraded. Finally, in operations and support, the most important RAMI activity is to monitor performance in order to facilitate retention of RAMI capability, to enable improvements in design (if new plant upgrading will be foreseen), or of the support system (including the support concept, spare parts storage, etc.).

Inadequate reliability or failed failure indications of components deemed safety critical items may directly jeopardize the public and worker safety. For that reason, deterministic and probabilistic safety assessments (PSA) have to be strongly integrated with the RAMI assessments.

Once reliability and safety of plant operation is assured, further objective is to obtain plant's mission at minimum cost. Then, cost/benefit analysis to justify and prioritize plant changes, modifications and enhancements during design and operation have to be undertaken and have to be matched with RAMI and PSA during the overall phases of plant life.

The above relationship between the facility design process and the parallel development of the facility safety analysis lets us to set the RAMI programme in a widest context called more generically the reliability assurance programme.

The post-doc will work with RAMI and nuclear safety specialists in the Research Unit (RU) working in the Eurofusion ENS work programme. Periods working in European RUs are foreseen. In the course of the study, the successful applicant will gain a good understanding of fusion systems and aspects of the DONES design, will further deepen his/her knowledge of RAMI and nuclear safety principles and their application to fusion, and gain good experience of setting up and using complex engineering computer models for RAMI analyses.

Education

- University degree

Recommended education and skills

- University degree in physics or engineering.
- At least three years of proven professional experience, experimental work for a thesis included.
- Knowledge of nuclear reliability and safety issues.
- Competent in scientific/engineering computing, with capability of setting up complex computer models.

Additional recommended skills

- Ability to integrate into an international and multicultural environment;
- Strong communication skills
- Good organisational skills and ability to work under pressure.
- Good command of both written and spoken English.