Job Title: Postdoctoral Researcher (Equilibrium Reconstructions) IO-PDR-1

Requisition ID **6428** - Posted - (France, 13067 St Paul Lez Durance Cedex) - **Science and Technology Expertise** - **New Posting**

The ITER Organization brings together people from all over the world to be part of a thrilling human adventure in southern France—building the ITER Tokamak. We require the best people in every domain.

We offer challenging full-time assignments in a wide range of areas and encourage applications from candidates with all levels of experience, from recent graduates to experienced professionals. Applications from under-represented ITER Members and from female candidates are strongly encouraged as the ITER Organization supports diversity and gender equality in the workplace.

Our working environment is truly multi-cultural, with 29 different nationalities represented among staff. The ITER Organization Code of Conduct gives guidance in matters of professional ethics to all staff and serves as a reference for the public with regards to the standards of conduct that third parties are entitled to expect when dealing with the ITER Organization.

The south of France is blessed with a very privileged living environment and a mild and sunny climate. The ITER Project is based in Saint Paul-lez-Durance, located between the southern Alps and the Mediterranean Sea—an area offering every conceivable sporting, leisure, and cultural opportunity.

To see why ITER is a great place to work, please look at this video

Application deadline: 24/07/2022
Domain: Science & Operation Domain
Department: Science, Controls & Operation Department
Division: Science Division
Section: Plasma Modelling & Analysis Section
Group: Not applicable
Job Family: Scientific Coordination
Job Role: Post Doc Researcher
Job Grade: P1
Language requirements: Fluent in English (written & spoken)
Contract duration: Up to 5 years

Purpose

As a Post Doc Researcher for Equilibrium Reconstructions, you will aim to improve the quality of equilibrium reconstructions via the application of a Kalman filtering algorithm to better estimate the plasma state.
You will develop and verify a plasma state estimator for ITER using a suite of synthetic diagnostics and high fidelity plasma simulations. In addition, you will embed knowledge of the evolving nature of the plasma current and pressure distributions within an equilibrium reconstruction tool-chain.

Background

The ability to reconstruct plasma equilibrium from diagnostic measurements lies at the core of ITER's future operations. Equilibria reconstructions will see use in plasma shape and position control, in machine protection and in current profile control during the exploitation of long pulse advanced scenarios.
All equilibrium reconstruction methods build upon a series of diagnostic measurements. These measurements feed mathematical models to provide predictions of the plasma's position and shape along with its internal distribution of current and pressure. The faithful reconstruction of pressure and current

profiles for advanced scenarios can be particularly challenging often requiring a full suite of magnetic and kinetic measurements in addition data received from a baseline set of magnetic sensors.

This postdoctoral project aims to improve the quality of the current state of the art equilibrium reconstructions via the application of state-estimation techniques to better estimate the evolving nature of the plasma current and pressure distributions in ITER. This will require the development and implementation of an appropriate plasma state estimator within the equilibrium reconstruction tools applied to ITER. These tools and estimator will be further improved by the inclusion of plasma dynamics, such as a flux diffusion or transport model, within the reconstruction tool-chain; constraining the evolution of the plasma state to physically plausible configurations based upon the state of the plasma at earlier times. A suite of synthetic diagnostics and time resolved equilibrium solutions available as part of the Integrated Modelling and Analysis Suite (IMAS) will be leveraged to develop, verify, and validate a plasma state-aware equilibrium reconstruction tool-chain.

Key Duties, Scope, and Level of Accountability

- Contributes to the development of plasma reconstruction tools applicable to the IMAS environment;
- Develops models of the plasma's dynamic response and passive conducting structures;
- Uses the Kalman filtering approach to refine evolution of equilibrium with (synthetic) measurement data;
- Demonstrates equilibrium reconstruction capabilities and their performance in preparation for ITER operations;
- Extends techniques for plasma state-estimation to non-causal data for post-pulse use;
- Contributes to the dissemination of scientific results in the area of ITER plasma equilibrium reconstruction in scientific journals, conferences and workshops;
- May be requested to support any of the project/construction teams and to perform other duties in support of the project;
- May be required to work outside ITER Organization reference working hours, including nights, weekends and public holidays.

Measures of Effectiveness

- Contributes effectively to the development of state-of-the-art plasma equilibrium reconstruction tools for ITER;
- Extends equilibrium reconstruction tools and workflows, improving them to more robustly infer the plasma's state consistent with dynamic models and measurements;
- Demonstrates a systematic and goal-orientated approach to addressing equilibrium reconstruction use cases for ITER;
- Authors and contributes to scientific publications and internal reports in the area of ITER plasma equilibrium reconstruction;
- Communicates well and maintains high professional standards when interfacing with staff from the ITER Organization and ITER Members' R&D institutions and Domestic Agencies.

Experience & Profile

- ***Research Experience:***
  - Minimum 3 years' experience of scientific or engineering research involving numerical modelling.
- ***Education:***
  - PhD or equivalent in magnetically confined fusion or other relevant discipline.
- ***Language requirements:***
  - Working knowledge in English (written and spoken).
- ***Technical experience and demonstrated competencies in:***
  - Numerical techniques and numerical modelling;
  - Programming languages and analysis software (e.g. Python, Fortran, C++ or similar);
  - Experience with plasma equilibrium calculations or state-space estimation techniques considered an advantage;

- Problem Solving: Assessing problems, identifying root causes and reaching practical solution;
- Demonstrating 'out of the box' thinking and ability to adapt easily;
- Producing clear technical documentation and publishing or presenting technical and/or scientific reports on specific topics;
- Experience with high performance and high throughput computing on remote clusters considered an advantage.
- *Behavioral Competencies:*
  - Collaborate: Ability to conduct dialogues with a wide variety of actors and stakeholders;
  - Communicate: Ability to adjust communication content and style to deliver messages to work effectively in a multi-cultural environment;
  - Drive results: Ability to persist in the face of challenges to meet deadlines with high standards;
  - Manage Complexity: Ability to gather multiple and diverse sources of information to understand problems accurately before moving to proposals;
  - Ethical values to instill trust: Ability to apply high standards of team mindset, trust, excellence, loyalty and integrity and to adapt to cultural diversity.

Others *Necessary qualifications*

- The applicant must have received their PhD since 1 January 2019, or must receive their PhD prior to the deadline for beginning the Fellowship at the ITER Organization.
- The e-Recruitment system will require you to:
  1) Fill-in an online application file
  2) Upload your Curriculum Vitae (including a list of your publications and photocopies of your highest academic qualification) merged in one unique PDF document
  3) Upload a letter of motivation (limited to 1 page) merged with at least two letters of recommendation into one unique PDF document

The following important information shall apply to all jobs at ITER Organization:

- Maintains a strong commitment to the implementation and perpetuation of the ITER Safety Program, ITER Values (Trust; Loyalty; Integrity; Excellence; Team mind set; Diversity and Inclusiveness) and Code of Conduct;
- ITER Core technical competencies of 1) Nuclear Safety, environment, radioprotection and pressured equipment 2) Occupational Health, safety & security 3) Quality assurance processes. Knowledge of these competencies may be acquired through on-board training at basic understanding level for all ITER staff members;
- Implements the technical control of the Protection Important Activities, as well as their propagation to the entire supply chain;
- May be requested to work on beryllium-containing components. In this case, you will be required to follow the established ITER Beryllium Management Program for working safely with beryllium. Training and support will be provided by the ITER Organization;
- May be requested to be part of any of the project/construction teams and to perform other duties in support of the project;
- Informs the IO Director-General, Domain Head, or Department/Office Head of any important and urgent issues that cannot be handled by line management and that may jeopardize the achievement of the Project's objectives.