

Job Title: Postdoctoral Machine Learning Engineer/Scientist IO-PDR-3 & IO-PDR-9

Requisition ID **6161** - 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: 19/06/2022

Domain: Engineering Domain

Department: Engineering Design Department

Division: Port Plugs & Diagnostics Division

Section: In-Vessel Diagnostics Section

Job Family: Scientific Coordination

Job Role: Post Doc Researcher

Language requirements: Fluent in English (written & spoken)

Contract duration: 2 years

Purpose

Two openings

As a Postdoctoral Machine Learning Engineer/Scientist, you will explore the application of machine learning (ML) techniques for improving the verification and calibration of numerical models and algorithms when compared to operational measurements. In particular the scope of the work is focused on the development of ML approaches for the calibration of machine monitoring and calorimetry diagnostics.

Background

ITER is developing machine monitoring systems to interpret the ITER tokamak systems instrumentation and evaluate and understand the behaviour of the ITER tokamak and key parameters of its subsystems, in all phases of the pulse and all phases of operation, from hydrogen to full D-T operation. They provide experimentally derived parameters to assist with validating ITER licensing assumptions during the non-active phase. Top level functions include:

- Verification and calibration of numerical engineering models through measurements. This is the main requirement which underpins all others;
- Derivation of global engineering parameters using underlying numerical models, including various time-dependent thermal, hydraulic, EM, dynamic, mechanical, and structural levels (e.g. strain &

- stress range, heat flows);
- Identification and registration of faults such as accidentally loosened interfaces and resultant dynamic shocks, electrical faults between systems, coolant leaks and pressure excursions, and unexpected contacts;
- Evaluation of margins and lifetime by reconstruction of actual cyclic loading conditions, aimed to record accumulated fatigue damages and residual life-time, in support for the verification and adjustment of ITER operational domain;
- Collection of concise engineering database and statistics related to the ITER tokamak behaviour for supporting the development of future devices and licensing.

Work is performed in close collaboration with ITER Organization stakeholders, industrial partners and other experts.

Key Duties, Scope, and Level of Accountability

- Identifies the strategy and select the ML algorithms suitable for model validation and calibration.
- Implements at least two algorithms using existing ML frameworks for their operation in real-time and offline, respectively.
- Develops the database for training ML algorithms for automated model calibration.
- Agrees the verification and qualification steps for the ML algorithms used for model calibration.
- Demonstrates the algorithms execution in operational conditions, including error and fault analysis.
- Explores applications of ML techniques which may allow improving the time and accuracy of the reconstruction and measurement algorithms developed under existing industrial contracts.
- Supports the identification and characterization of faults using ML approach.
- Evaluates the suitability of ML approach for prognostics of residual lifetime of tokamak systems.
- May be requested to be part of 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, week-ends and public holidays.

Measure of Effectiveness

- Sets up complex multi-physics models for engineering benchmarking within the required timeframe;
- Produces clear analyses to support design choices;
- Evaluates error and assesses performance of algorithms with realistic error sources;
- Interacts efficiently with all ITER Organization stakeholders, industrial partners and other experts;
- Generates clear publication-quality material for conferences and journals.

Experience & Profile

- **Professional Experience:**
 - Minimum 3 years' experience in model-based solving of complex physical problems with preference for power, stress flow or using machine learning;
- **Education:**
 - PhD degree or equivalent in Physics or Engineering field or other relevant discipline;
 - The required education degree may be substituted by extensive professional experience involving similar work responsibilities and/or additional training certificates in relevant domains.
- **Language requirements:**
 - Fluent in English (written and spoken).
- **Technical competencies and demonstrated experience in:**
 - Machine Learning: Awareness of computer science, with experience in coding machine learning and neural networks algorithms.
 - Mechanical engineering: Numerical simulation of electro-mechanical systems (structural, dynamic, EM, etc) and analysis workflows and / or complex thermomechanical problems;
 - Problem Solving: Assessing problems, identifying root causes and reaching practical solution;
 - Knowledge of ANSYS and/or ABAQUS is an advantage;

- Familiarity with framework development in Python and/or C++;
- Experience on tokamak engineering/within a fusion environment would be an advantage.
- ***Behavioral competencies:***
 - Collaborate: Ability to facilitate dialogue with a wide variety of contributors and stakeholders;
 - Communicate Effectively: 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 analyze multiple and diverse sources of information to understand problems accurately before moving to proposals;
 - Instill trust: Ability to apply high standards of team mindset, trust, excellence, loyalty and integrity.

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
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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.