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Technical Specifications (In-Cash Procurement)

Technical_Specification_Neutronics Analysis

This document describes technical needs of ITER/TED/PPD Division, with particular reference to theNeutronics analysis and expertise.

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1 Purpose

This document describes technical needs of ITER/TED/PPD Division, with particular reference to the **Neutronics analysis and expertise**.

2 Background and Objectives

ITER is a major new device that is under construction at Cadarache, near Marseille, in the South of France.
The ITER Organization (IO) is bringing together people from all over the world to be part of this unique project and to contribute to building the ITER device which requires the best people from many disciplines. The work environment is flexible and dynamic with opportunities to work closely with many people and cultures from around the world. The device (figure 1.) will study the potential of controlled nuclear fusion to provide energy for the future of mankind. In order to study the behaviour of this device, a set of monitoring systems (called Diagnostics) are required.
The success of ITER will come through its ability to produce large amount of high energy neutrons, i.e. fusion power, for long time.
These measurements are carried out by means of the Neutron Diagnostics systems.
The measurement of the fusion power with 10% accuracy requires the absolute calibration of the relation between plasma neutron source strength and neutron diagnostics. A neutron calibration strategy is under development and based on several steps.
In particular, measurements of neutron emission and fusion power are essential for achieving ITER goals, in particular the fusion gain factor, Q, related to the reactor performance as well for plasma control, machine protection and for plasma optimization.

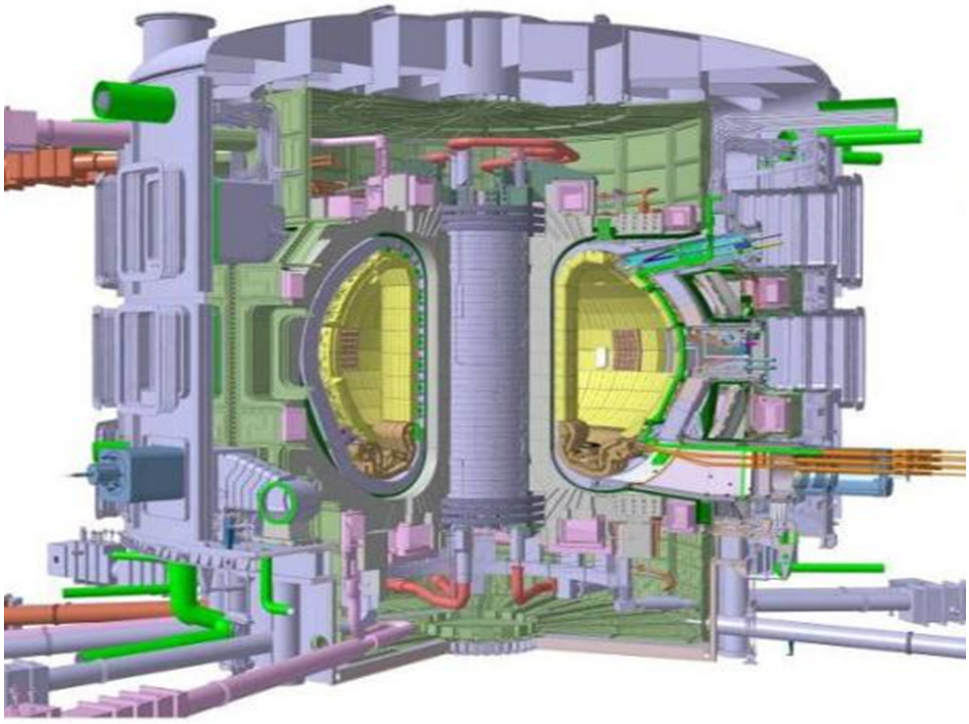

Figure 1. ITER Tokamak.

3 Scope of Work

The objective of this task is working with the ITER Diagnostic Team with particular emphasis in the neutronics analyses.

The work involves technical expertise for assessing the neutronic features of the Diagnostics and Port Integrations systems. This activity will cover the area of Neutronics analysis, e.g. nuclear heating, Plasma operation and Shut Down dose rates, nuclear damage, helium generation, material activation, Radwaste assessment and human dose rates.

4 Estimated Duration and Start of activity

The duration shall be for 12 months from the starting date of the task order. Services to be provided 85% at Contractor premises and 15% at the IO work site.

The start of the activity is foreseen in 1st February 2017

5 Work Description

The work involves technical/neutronics expertise for diagnostics and Port integration projects. The work to be done is in collaboration with the IO Technical Responsible Officer (TRO) for neutronics. It involves many areas of activity that have to be documented

1. Analytic and numerical calculations assisting diagnostic design and diagnostic port integration, in the area of neutronics analysis as required by ITER
2. Neutronic calculations assistance for collaborations between ITER and Domestic Agencies
3. Evaluation of the occupational dose rate during maintenance activity in the Port Interspace and Port Cell (particularly when diagnostics are removed from the Port Plug closure flange)
4. Optimization of radiation shielding properties of the Bioshield structure for the Diagnostic Ports and to study the effect of doglegs for diagnostics in the bioshield plug
5. Calculation/Analysis of the neutron and gamma fluxes in the Port cells
6. Calculation of doses to electronics from activated water.
7. Calculation/Analysis of the Shut Down Dose Rate in the Port Cells and in the Port Interspace as well the dose rate during plasma operation
8. Radwaste assessment of the components in the Port Plugs, Port Interspaces and Port Cells
9. Perform detailed radiation calculations for specific Equatorial, Ports
10. Collating and checking calculations
11. Suggesting means of improving design of diagnostic components based on these finds.
12. Document work as required: reports of the activity carried out, conferences reports and documentation required by STAC, MAC, TED/PPD Diagnostic division.
13. Review technical designs/models and reports from Domestic Agencies
14. Other appropriate work as may be required by the IO-TRO
15. Promoting safety and quality at all times in all job site activities.

16. Ability to provide and deliver documentation in appropriate way

6 Responsibilities

Services to be provided mainly (~ 85 %) at the Contractor site and (15%) at IO site.
The ITER Organization may request Contractor to travel and work at places other than ITER site (especially to make presentations in Topical Technical Meetings).

7 List of deliverables and due dates

Deliverable		Due date
D1	Completion of Generic Upper Port Plug with Short and Intermediate DSM. Analysis will consider also Bioshield and Upper Port Cell. Evaluation of the neutron/gamma fluxes and spectra as well estimation of the SDDR. Optimization of materials. Dose rate evaluation during plasma operation. Evaluation of final activation level for Radwaste. To reduce future R&D costs - development of the common design approach for radiation shielding applicable for upper port-based diagnostic systems in general	T.0 +3 months
D2	MCNP models for Port Plugs Integration of Upper Port 4,5,6 including Vacuum Filter systems. Evaluation of neutron/gamma fluxes and spectra. Optimization of materials with low activation and high shielding characteristics. Dose rate evaluation during plasma operation and shutdown. Evaluation of final activation level for Radwaste. Development of the maintenance scenario of the ports after shutdown, investigation of the questions of remote, semi-remote, or hands-on access to the systems installed inside the Port Interspace	T.0 + 6 months
D3	Design MCNP model of EQ#17 Port Plug and Port Interspace. Evaluation of neutron/gamma fluxes and spectra. Optimization of materials with low activation and high shielding characteristics. Dose rate evaluation during plasma operation and shutdown. Evaluation of final activation level for Radwaste.	T.0 + 9 months
D4	Design MCNP model of EQ#17 Bioshield and Port cell including PCSS. Evaluation of neutron/gamma fluxes and spectra. Optimization of materials with low activation and high shielding characteristics. Dose rate evaluation during plasma operation and shutdown. Evaluation of final activation level for Radwaste. Neutronic analysis for dose rate levels during manual/assisted maintenance activity for replacement or functionality check/control of subsystems in EQ#17.	T.0 + 12 months

8 Acceptance Criteria

The deliverables will be posted in the Contractor's dedicated folder in IDM, and the acceptance by the IO will be recorded by their approval by the designated IO TRO. These criteria shall be the basis of acceptance by IO following the successful completion of the services. These will be in the form of reports as indicated in section 7, Table of deliverables.

9 Specific requirements and conditions

Contractor to carry out the work described in this document must have proven experience, as appropriate.

- Knowledge and working experience of nuclear systems/devices (in particular fusion or high energy physics devices/systems)
- Basic knowledge of ITER Diagnostics systems
- Expertise in performing Neutronics MCNP analysis on ITER Diagnostics systems and ports
- Experience in the development and applications of tools and methods for shutdown dose rate analysis and data pre and post-processing
- Radwaste calculations/analyses
- Technical document generation
- System requirements management

10 Work Monitoring / Meeting Schedule

Work is monitored through quarterly reports (see List of Deliverables section 7) and at monthly project meetings.

It is expected that on occasion the Contractor will be required to make a presentation to Topical Technical Meetings either by videoconference or in person. If in person, the ITER Organization will reimburse travelling expenses, if appropriate, for off-site meetings

11 Delivery time breakdown

See List of Deliverables section.

12 Quality Assurance (QA) requirements

The organisation conducting these activities should have an ITER approved QA Program or an ISO 9001 accredited quality system.
The general requirements are detailed in ITER document ITER Procurement Quality Requirements (22MFG4)
Prior to commencement of the task, a Quality Plan Quality Plan (22MFMW) must be

submitted for IO approval giving evidence of the above and describing the organisation for this task; the skill of workers involved in the study; any anticipated sub-contractors; and giving details of who will be the independent checker of the activities.
Prior to commencement of any manufacturing, a Manufacturing & Inspection Plan Manufacturing and Inspection Plan (22MDZD) must be approved by ITER who will mark up any planned interventions.
Deviations and Non-conformities will follow the procedure detailed in IO document MQP Deviations and Non Conformities (22F53X)
Prior to delivery of any manufactured items to the IO Site, a Release Note must be signed MQP Contractors Release Note (22F52F).
Documentation developed as the result of this task shall be retained by the performer of the task or the DA organization for a minimum of 5 years and then may be discarded at the direction of the IO. The use of computer software to perform a safety basis task activity such as analysis and/or modelling, etc shall be reviewed and approved by the IO prior to its use, it should fulfil IO document on Quality Assurance for ITER Safety Codes Quality Assurance for ITER Safety Codes (258LKL).

13 CAD Design Requirements (if applicable)

For the contracts where CAD design tasks are involved, the following shall apply:
The Supplier shall provide a Design Plan to be approved by the IO. Such plan shall identify all design activities and design deliverables to be provided by the Contractor as part of the contract.
The Supplier shall ensure that all designs, CAD data and drawings delivered to IO comply with the Procedure for the Usage of the ITER CAD Manual (2F6FTX), and with the Procedure for the Management of CAD Work & CAD Data (Models and Drawings 2DWU2M).
The reference scheme is for the Supplier to work in a fully synchronous manner on the ITER CAD platform (see detailed information about synchronous collaboration in the ITER GNJX6A - Specification for CAD data production in ITER Contracts.). This implies the usage of the CAD software versions as indicated in CAD Manual 07 - CAD Fact Sheet (249WUL) and the connection to one of the ITER project CAD data-bases. Any deviation against this requirement shall be defined in a Design Collaboration Implementation Form (DCIF) prepared and approved by DO and included in the call-for-tender package. Any cost or labour resulting from a deviation or non-conformance of the Supplier with regards to the CAD collaboration requirement shall be incurred by the Supplier.

14 Safety requirements

ITER is a Nuclear Facility identified in France by the number-INB-174 (“Installation Nucléaire de Base”).
For Protection Important Components and in particular Safety Important Class components (SIC), the French Nuclear Regulation must be observed, in application of the Article 14 of the ITER Agreement.
In such case the Suppliers and Subcontractors must be informed that:

- The Order 7th February 2012 applies to all the components important for the protection (PIC) and the activities important for the protection (PIA).
- The compliance with the INB-order must be demonstrated in the chain of external contractors.
- In application of article II.2.5.4 of the Order 7th February 2012, contracted activities for supervision purposes are also subject to a supervision done by the Nuclear Operator.

For the Protection Important Components, structures and systems of the nuclear facility, and Protection Important Activities the contractor shall ensure that a specific management system is implemented for his own activities and for the activities done by any Supplier and Subcontractor following the requirements of the Order 7th February 2012 [20].

15 References / Terminology and Acronyms

References links inserted in text.
For a complete list of ITER abbreviations see: ITER Abbreviations (ITER_D_2MU6W5).