

Technical Specifications (In-Cash Procurement)

**Neutronic Analysis of ITER Diagnostics and Port
Integration systems**

Contract technical specification

Technical Specifications

for

**Neutronic Analysis
of ITER Diagnostics
and Port Integration systems**

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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 Scope

The work aligns with the ITER project which will study the fusion concept on a scale previously unequalled on earth. To study the behaviour of this device (fig.1), a set of monitoring systems (called diagnostics) are required. This will provide all the information to show and understand the performance of the device.

The work involves technical expertise for assessing the neutronic features of the Diagnostics and Port Integrations systems Fig.2 and 3. This activity will cover the area of Neutronics analysis, e.g. determination of neutron and gamma fluxes as well spectra, evaluation of background noise, response functions of neutron and gamma detectors, nuclear heating, Plasma operation and Shut Down dose rates, nuclear damage, helium generation, material activation, Radwaste assessment and human dose rates.

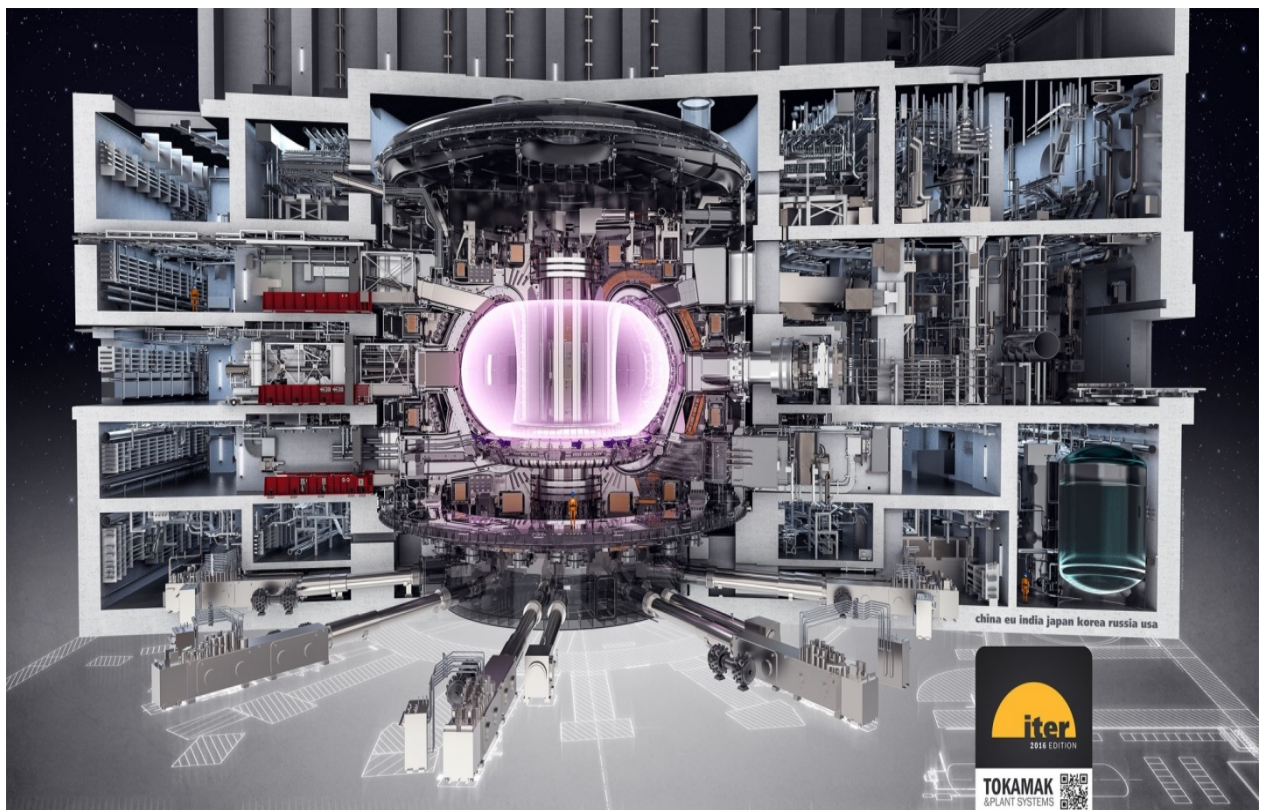


Figure 1. ITER Tokamak.

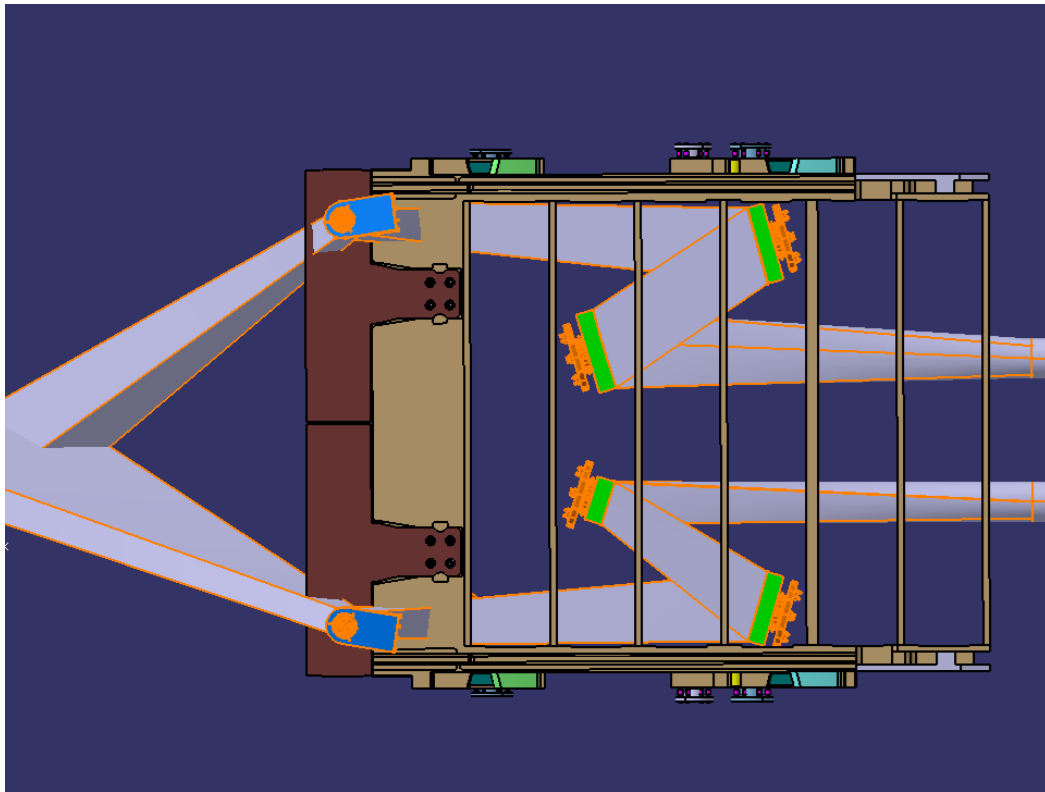


Fig 2. 55 EC CXRS diagnostics in EQ#3 Port Plug.

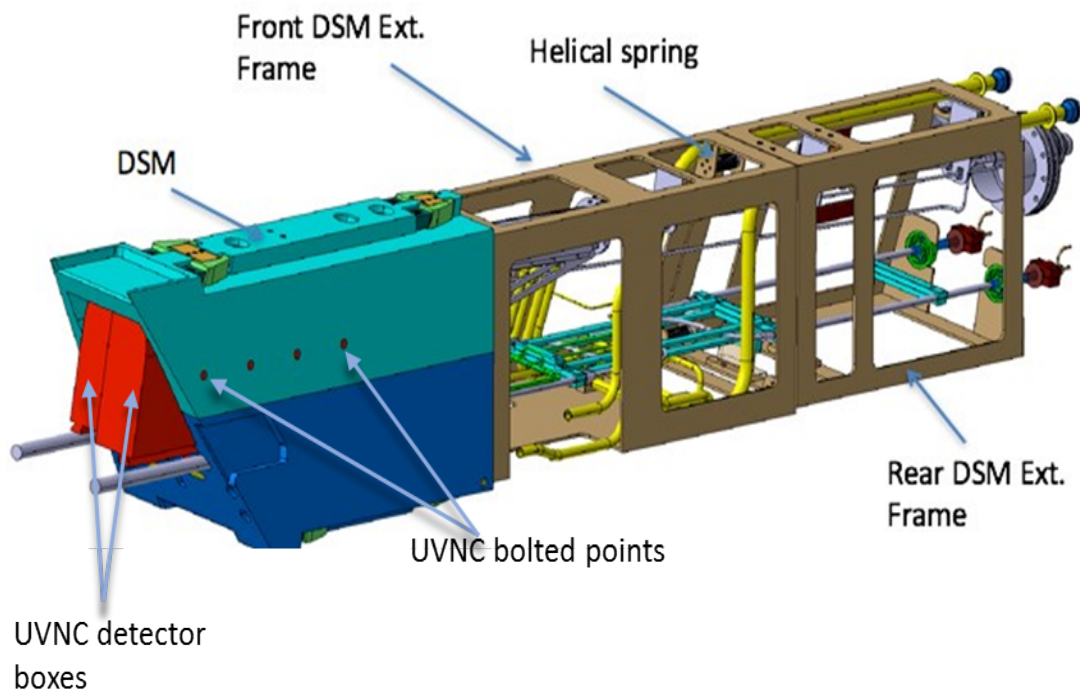


Fig 3. Upper Port Plug #18

3 Definitions

IO: ITER Organization

DA: Domestic Agency

SDDR: Shut Down Dose Rate

IO-TRO: ITER Organization technical Responsible Officer.

For a complete list of ITER abbreviations see: ITER Abbreviations (ITER_D_2MU6W5).

4 References

Links inserted in text.

5 Estimated Duration and Start of activity

The duration shall be for 12 months from the Kick Off Meeting date of the contract. Services to be provided 95% at Contractor premises and 5% at the IO work site.

Signature date is foreseen for the 1st of July 2018

The start of the activity is foreseen on the 15th of July 2018 at the KoM.

6 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. Perform detailed radiation calculations for specific Diagnostic systems and Ports
3. Neutronic calculations assistance for collaborations between ITER and Domestic Agencies
4. 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)
5. 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
6. Calculation/Analysis of the neutron and gamma fluxes in the Port cells
7. Calculation of doses to electronics from activated water.
8. 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
9. Radwaste assessment of the components in the Port Plugs, Port Interspaces and Port Cells
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

7 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).

8 List of deliverables and due dates

Deliverable	Due date	
D1	Completion of MCNP model of EQ#8 Equatorial Port Plug (based on new DSM), Port Interspace and Port Cell. Global analysis of radiation features. Evaluation of the neutron/gamma fluxes and spectra as well estimation of the SDDR. Optimization of materials with low activation and high shielding characteristics. Dose rate evaluation during plasma operation. Evaluation of final activation level for Radwaste.	T.0 +3 months
D2	Completion of MCNP model of 55 EC CXRS Edge Diagnostics in Equatorial #3 Port Plug (based on new DSM), Port Interspace. Global analysis of radiation features. Evaluation of the neutron/gamma fluxes and spectra as well estimation of the SDDR. Optimization of materials with low activation and high shielding characteristics. Dose rate evaluation during plasma operation. Evaluation of final activation level for Radwaste.	T.0 + 6 months
D3	MCNP Modelling and calculations/analyses for Diagnostic systems in various ports (55BE Tangential Neutron Spectrometer, 55 EE Hard X-ray Spectrometer). 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	MCNP Modelling and calculations/analyses for Diagnostic systems in various ports (55B7 Radial gamma Rays Spectrometers, 55BB High Resolution Neutron Spectrometers.). 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. -- Executive summary of the performed activities and to draft next steps of engineering, project and integration design, for support to the Port Plug Diagnostics Division	T.0 + 12 months

9 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.

10 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

11 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

12 Delivery time breakdown

See List of Deliverables section.

13 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 \(22F53X\)](#): version 7.0 for the Non-conformities and version 6.2 for Deviation request

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 \(258LKL\)](#).

14 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.

15 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,

[[ITER_D_7GJHSE - Order dated 7 February 2012 relating to the general technical regulations applicable to INB - FR](#)].