

## Technical Specifications (In-Cash Procurement)

# CFE - Passive Spectroscopy Systems

This document describes technical needs for work on the design and progression of the diagnostics and especially the five Passive Spectroscopy Systems on ITER.

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## 1 Purpose

This document describes technical needs for work on the design and progression of the diagnostics and especially the five Passive Spectroscopy Systems on ITER.

## 2 Scope

This task includes several deliverables that progress the diagnostics design for the X-Ray and Vacuum Ultraviolet Spectroscopy systems on ITER. The work is expected to be carried out in close liaison with the IO-CT TRO and the Diagnostic Designer involved.

## 3 Definitions

For a complete list of ITER abbreviations see: [ITER Abbreviations \(ITER\\_D\\_2MU6W5\)](#).

## 4 Duration

The duration of this work shall be 12 months from the starting date of the Contract. It is anticipated that the work required will be 80% of full-time equivalent, and that approximately 20% of the time will be spent on-site at IO (1 day per week). Due to the COVID-19 pandemic, by agreement with IO, some workload may be done remotely (teleworking).

## 5 Work Description

ITER will be equipped with a suite of passive spectroscopic diagnostics, located in upper and equatorial ports of its vacuum vessel. There are five subsystems covering the range from Vacuum UltraViolet (VUV) to soft X-Ray. Their purpose is to monitor line and continuum radiation from the main, edge and divertor plasmas, and to measure impurity species.

Techniques include neutron shielding, grating spectrometers, grazing incidence optics, crystal optics, and a wide range of photon detectors including Micro Channel Plate, photo-multipliers and Back Illuminated CCDs.

## Vacuum UltraViolet

There are three distinct Vacuum UltraViolet systems provided by the Korean Domestic Agency for Core, Edge and Divertor plasmas respectively:

- The 55.E3 VUV Core Survey in the Equatorial Port #11 (**First Plasma Diagnostic**);
- The 55.EG VUV Divertor also in the Equatorial Port #11 (Figure 1);
- In addition, the 55.EH VUV Edge Imaging in the Upper Port #18 (Figure 2).

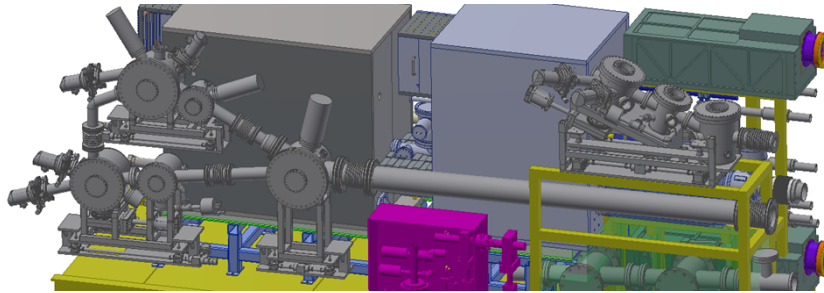


Figure 1: VUV Core Survey and Divertor in the Equatorial Port Cell #11

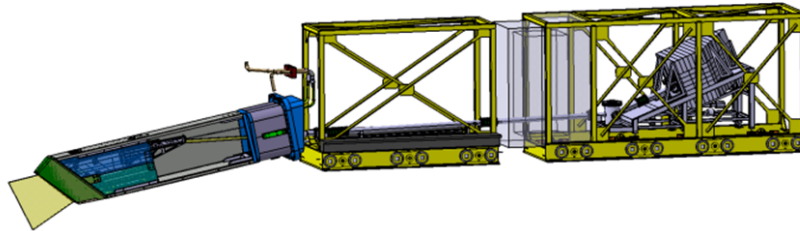


Figure 2: VUV Edge Imaging in Upper Port #18

## Soft X-Ray

There are two distinct X-Ray systems provided by the Indian Domestic Agency for Core and Edge plasmas respectively:

- 55.ED X-Ray Crystal Spectroscopy (XRCS) Survey in Equatorial Port #11 (**First Plasma Diagnostic**) (Figure 3);
- 55.EI X-Ray Crystal Spectroscopy Edge in Upper Port #09 (Figure 4).

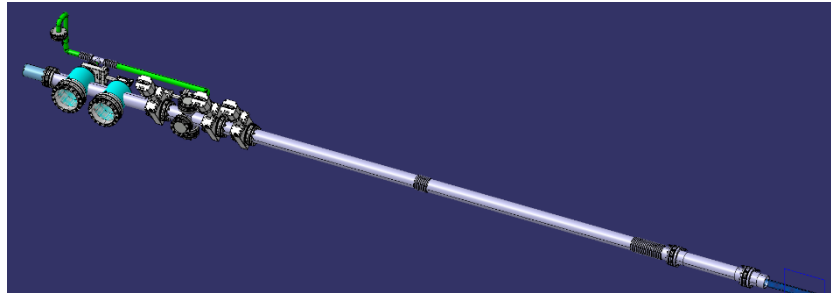


Figure 3: XRCS Survey in Equatorial Port #11

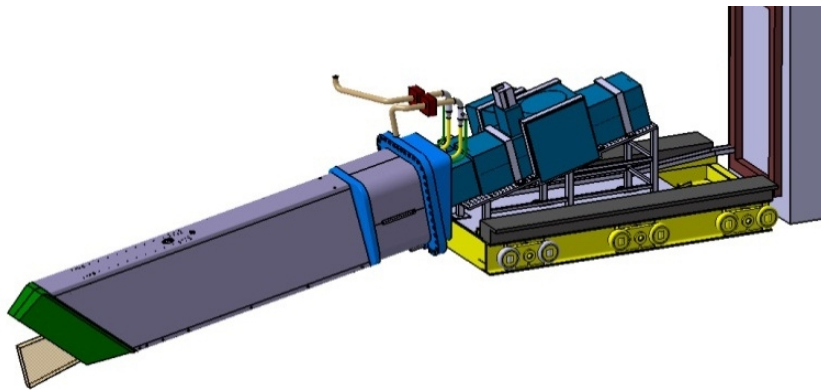


Figure 4: XRCS Edge in Upper Port #09

## 5.1 Objective

The objective of this Task Order is to support and assist the Diagnostics Technical Responsible Officers in the preparation of the passive diagnostic systems for ITER construction, in particular:

- Oversee the design and progression of these 5 diagnostics;
- Close work with the Korean and Indian ITER Domestic Agencies in the specification and realisation of these various systems;
- Work with the Division Head or his appointed experts in all matters related to the diagnostic systems for ITER construction;
- Provide expertise, on passive spectroscopic diagnostics;
- Monitor and manage various technical aspects of these systems;
- Develop the design of interfaces of diagnostics with the main tokamak components;
- Develop detailed project implementation plans for all related work, and monitor and control all related activities;
- Effectively interface with other ITER Organization Departments and with ITER Domestic Agencies as necessary to achieve successful implementation;
- Work on the development of appropriate documentation as needed;
- Assessment of the design and analysis performed at Preliminary or Final Design Phase;

- Resolution of the outstanding issues proposed during the Previous Design Phase;
- Development of essential technology, processes, tooling or innovative design features that require “proving”;
- Executing appropriate test programs to justify any technical risk items;
- Execution of Final Design of the system;
- Remote handling compatibility assessment the components;
- Requirement compliance checking;
- Interface compliance checking;
- Management of deviations;
- Production of the design review documents;
- Design Review organization (PDR or FDR);
- Supporting closure of the Design Review Chits.

## 5.2 Detailed Actions and estimated work load

This task order will need to manage or follow these actions:

- During the period of this task order, not less than seven ITER official Design Reviews are already scheduled. For each Design Review many documents (around 50 per systems) must be identified, updated, uploaded and reviewed before approval. Each document will be stored in the ITER Document Management system (IDM) and connected to the ITER Document Data Base (PLM). **This task represents 50% of full time equivalent.**
- Monthly Progress Meetings will manage the work for the five Passive Spectroscopy Systems. In addition to the Progress Meetings, if necessary, additional meetings to address specific issues to be resolved may be requested. These five meetings per month (minimum) will follow the good practice of Project Management (Agenda, Minutes, Actions list...). Each report will be stored in the ITER IDM in order to ensure traceability of the work performed. **This task represents 15% full time equivalent.**
- The task needs also to actively participate to the General Domestic Agency Monthly Meeting (GDAMM) with tracking and updating the action list. The review of the Monthly Progress Report (MPR) provide by the Diagnostics Designer is also in the fields of this work. **This task represents 10% full time equivalent.**
- The Quality Assurance and the Safety of this project is very important as ITER is classified as an INB (Installation Nucléaire de Base) and these five diagnostic have many Safety Important Components (SIC) and many Protection Important Activities (PIA). One of the tasks will be to update regularly (at least two times per year) the Surveillance Plan Annexes and validate with the Diagnostics Designer involved the propagation of the Quality and Safety rule over all the sub-contractors... **This task represents 5% full time equivalent.**

## 6 List of deliverables and due dates in months

#	Deliverables	Date
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D#01	<b>Quality Plan</b> Prior to commencement of the task, a Quality Plan will be submitted for IO approval.	To + 01
D#02	<b>Final Design Review for the VUV Core Survey – 55.E3</b> Support and assist Diagnostic TRO where appropriate as listed in section 5.1. Oversee the FDR of 55.E3 VUV Core Survey according to the schedule. Deliver interim report comprising: a) record of activities performed, b) status, outlook and issues, c) links to relevant documents including: <ul style="list-style-type: none"> <li>- Minutes and actions of progress meetings</li> <li>- Notification of FDR of 55.E3 VUV</li> <li>- FDR Final panel Report &amp; Minutes of 55.E3 VUV</li> <li>- FDR chit resolution plan for 55.E3 VUV</li> </ul>	To + 04
D#03	<b>Preliminary Design Review for the XRCS Survey – 55.ED / I&amp;C</b> Support and assist Diagnostic TRO where appropriate as listed in section 5.1. Oversee the PDR of 55.ED XRCS Survey I&C according to the schedule. Deliver interim report comprising: a) record of activities performed, b) status, outlook and issues, c) links to relevant documents including: <ul style="list-style-type: none"> <li>- Minutes and actions of progress meetings</li> <li>- Notification of PDR of 55.ED XRCS / I&amp;C</li> <li>- PDR Final panel Report &amp; Minutes of 55.ED XRCS / I&amp;C</li> <li>- PDR chit resolution plan for 55.ED XRCS / I&amp;C</li> </ul>	To + 07
D#04	<b>Final Design Review for the VUV Core Survey – 55.E3 / I&amp;C</b> Support and assist Diagnostic TRO where appropriate as listed in section 5.1. Oversee the FDR of 55.E3 VUV Core Survey I&C according to the schedule. Deliver interim report comprising: a) record of activities performed, b) status, outlook and issues, c) links to relevant documents including: <ul style="list-style-type: none"> <li>- Minutes and actions of progress meetings</li> <li>- Notification of FDR of 55.E3 VUV / I&amp;C</li> <li>- FDR Final panel Report &amp; Minutes of 55.E3 VUV / I&amp;C</li> <li>- FDR chit resolution plan for 55.E3 VUV / I&amp;C</li> </ul>	To + 10

D#05	<p><b>Final Design Review for the VUV Divertor – 55.EG</b></p> <p>Support and assist Diagnostic TRO where appropriate as listed in section <b>5.1</b>. Oversee the FDR of 55.EG VUV Divertor according to the schedule.</p> <p>Deliver interim report comprising:</p> <ul style="list-style-type: none"> <li>a) record of activities performed,</li> <li>b) status, outlook and issues,</li> <li>c) links to relevant documents including: <ul style="list-style-type: none"> <li>- Minutes and actions of progress meetings</li> <li>- Notification of FDR of 55.EG VUV Div.</li> <li>- FDR Final panel Report &amp; Minutes FDR of 55.EG VUV Div.</li> <li>- FDR chit resolution plan for 55.EG VUV Div.</li> </ul> </li> </ul>	To + 12
D#06	<p><b>Final summary report.</b></p> <p>This document will summarise all the Technical Progress Meetings done during this contract with the Indian and the Korean Domestic Agencies.</p>	To + 12

## 7 Acceptance Criteria

All the documents shall comply with the Design Review Procedure ([2832CF](#)) according to Template and ITER System Design Process Working Instruction ([4CK4MT](#)). These criteria shall be the basis of acceptance by IO following the successful completion of the services.

## 8 Specific requirements and conditions

- Demonstrable experience in VUV System development
- Demonstrable experience in X-Ray systems development
- Demonstrable experience in diagnostic development
- At least ten years' experience in a technical development environment
- Demonstrated ability to work in English language, both verbally and written
- Demonstrable technical writing skills

### Skills

Knowledge and experience working with appropriate software tools to meet the technical requirements, for example IDL (Interactive Data Language) or MATLAB;

Knowledge of special codes for the passive spectroscopy field would be a big benefit.

- Experience with formal project management system;
- Excellent presentational skills;
- Project planning tools.

### Information Technology

IT hardware and services will be provided by the ITER Organization.



## 9 Work Monitoring / Meeting Schedule

The work will be managed by means of Progress Meetings and formal exchange of documents transmitted by emails that provide detailed progress. The ITER Organization, to review the progress of the work, the technical problems, the interfaces and the planning, will call Progress Meetings.

The main purpose of the Progress Meetings is to allow the ITER Organization, Diagnostics Division and the Technical Responsible Officers to:

- Allow early detection and correction of issues that may cause delays;
- Review the completed and planned activities and assess the progress made;
- Permit fast and consensual resolution of unexpected problems;
- Clarify doubts and prevent misinterpretations of the specifications.

In addition to the Progress Meetings, if necessary:

- Additional meetings to address specific issues to be resolved may be requested;
- Some visit to the Domestic Agency shall be requested to address specific issues (one travel per year and per DA).

For all Progress Meetings, a document describing tasks done, results obtained, blocking points must be submitted. Each report will be stored in the ITER IDM in order to ensure traceability of the work performed.

## 10 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 Procurement Quality Requirements \(ITER\\_D\\_22MFG4\)](#).

Prior to commencement of the task, a Quality Plan 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 (see [Procurement Requirements for Producing a Quality Plan \(ITER\\_D\\_22MFMW\)](#)).

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, in accordance with [Quality Assurance for ITER Safety Codes \(ITER\\_D\\_258LKL\)](#).

## 11 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 7<sup>th</sup> 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 7<sup>th</sup> 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 7<sup>th</sup> February 2012 [20].