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Technical Specifications (In-Cash Procurement)

Transversal engineering services for the diagnostic development

The purpose of this tender is to provide development services for many different Diagnostics. Most of the Diagnostics are the scope of the Domestic Agencies (DAs). About 30% of the Diagnostic scope is however completely IO scope. A large variety of Diagnostics techniques are covered by this contract. The contract defines the scope of the expertise to be provided, the execution and the deliverables of those. This is a framework contract, where each task order is a free standing development ...

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Technical Summary

Transversal engineering services for the diagnostic development

IO/23/CFT/70000938/LLU

1. Purpose

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2. Background

Diagnostics are a critical part of the operation of ITER. They provide the means to observe, control and sustain the plasma performance over long timescales. ITER will operate with a plasma current in the region of 15 MA and toroidal fields of 5 T. The pulse lengths will be in the region of 500 s typically and will extend up to several thousand seconds during more advanced operation. A key objective of this device is Q=10 operation. This means that a typical fusion power of 500 MW will be provided for 50 MW input.

In total there are about 50 diagnostic systems in ITER. These can be grouped as:

- In- and ex- vessel electrical service development,
- Magnetic diagnostics,
- Diagnostics for neutrons and fusion products,
- Optical diagnostics,
- Bolometers,
- Spectroscopic diagnostics,
- Microwave diagnostics,
- Plasma-facing diagnostics.

The diagnostics scope includes also port-plugs and other infrastructure, which hold these diagnostics in place, in the ports and the divertor. Other systems and services, such as

Disruption Mitigation System (DMS), shall also be integrated into ports and buildings. Figure 1 gives an overview of the diagnostic scope inside the tokamak. Figure gives an overview of the typical integrated diagnostic port in ITER.

Most of the diagnostic systems are being procured in kind from the Domestic Agencies (DAs) to functional specifications. Exceptions for which IO has to do detailed design work are the magnetic sensors, and in vessel cable looms which will be procured through built to print contracts. For several other diagnostics, IO has even the full responsibility from conceptual design to procurement. These are thermocouples, erosion monitor, dust and tritium inventory monitors, first wall samples and plasma boundary flow monitor, in-vessel electron cyclotron heating protection probes.

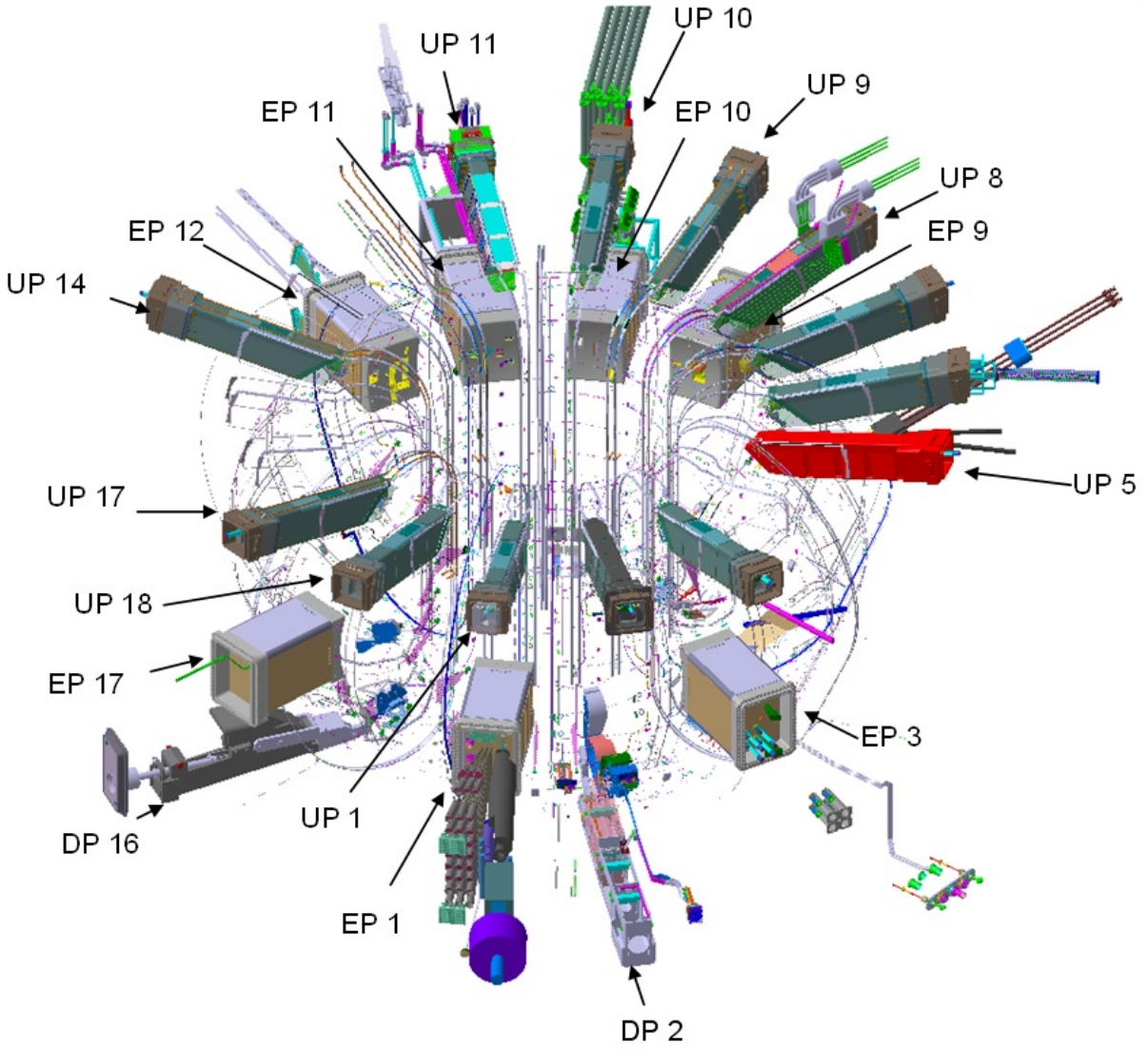

*Figure 1: Overview of diagnostics inside the tokamak (EP means Equatorial Port, UP Upper Port, DP Divertor Port) – note regarding scale: one EP has a cross section of 2m * 2.5 m approximately.*

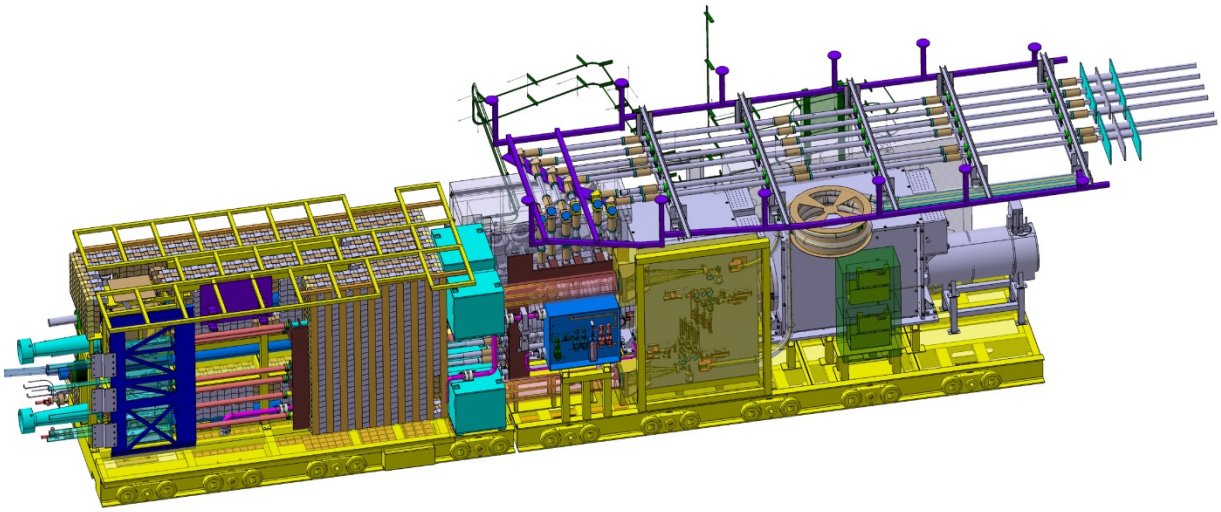

Figure 2: Overview of diagnostics inside integrated port.

3. Scope of work

The scope of work involves the support the ITER Diagnostic Team in definition and follow-up of interfaces for diagnostics and operational systems, such as IVVS and PPTF, including documentation preparation and interface tracking in ITER IDM, MDB and in the PLM.

The specific areas (as Work Packages) of expertise to be covered are listed below:

- WP1 - General Diagnostics physics, engineering, design and development with ability to cover issues from sensor to data analysis, including expertise in plasma-wall interaction physics, plasma physics, neutronics (MCNP calculations), vacuum-physics, low-pressure discharge physics (DC and RF discharges), mechanical design engineering, design engineering (with aid of CATIA V5), electromagnetic analysis, thermo-mechanics, hydraulics, optics, opto-mechanics, Monte-Carlo-straylight analysis, data-analysis (conventional programming and Bayesian analysis), image-processing, data-mining technics,
- WP2 - Physics, concept, engineering, design, realisation, interface definition, prototyping and manufacturing supervision, acceptance testing, installation, commissioning, operation, scientific exploitation and documentation of Plasma diagnostic systems,
- WP3 - Neutron Diagnostics physics, engineering, design, development, integration and manufacturing follow-up, including neutron calibration, neutron cameras, micro-fission chambers, neutron flux monitors, gamma spectrometry, neutron activations systems, lost alpha monitors and neutron spectrometry,
- WP4 - Optical Diagnostics physics, engineering, design, development, integration and manufacturing follow-up, including conventional and Thomson scattering systems, Interferometers and Polarimeters,
- WP5 - Spectroscopic Diagnostics physics, engineering, design, development, integration and manufacturing follow-up, including charge exchange recombination spectroscopy, H-alpha and visible light spectroscopy, VUV spectroscopy, Impurity monitoring in the XUV range, plasma core imaging X-ray spectroscopy, X-ray imaging, neutral particle analysis,

laser induced fluorescence, motional stark-effect spectroscopy, X-ray plasma core spectroscopy, hard-x-ray monitoring and beam emission spectroscopy,

- WP6 - Microwave diagnostics physics, engineering, design, development, integration and manufacturing follow-up, including electron cyclotron emission spectroscopy, mm-wave Collective Thomson scattering and microwave reflectometry,
- WP7 - Operational Diagnostics physics, engineering, design, development, integration and manufacturing follow-up, including visible and infrared imaging and thermographic systems (including spectrally resolved and lock-in thermography), thermocouples, pressure gauges, residual gas analyser (quadrupole-mass analysers), Langmuir probes, Erosion monitoring (speckles interferometry), dust monitoring (endoscope with dust sampler), tritium monitoring (Laser induced desorption and laser induced breakdown spectroscopy) and first wall samples,
- WP8 - Ex-Vacuum electrical distribution systems physics, electrical engineering, design, development, interface management, integration and manufacturing follow-up, including electrical cables (signal and power), looms and connectors,
- WP9 - In-Vessel Viewing diagnostics, physics, engineering, design, development, integration and manufacturing follow-up, including high frequency amplitude modulated laser interferometric metrology and laser reflectometry based imaging and movement (electrically driven) in high vacuum and high magnetic field technology expertise,
- WP10 - Diagnostics engineering interfaces resolution in complex environments, including in-vessel, divertor cassettes, ports, port plugs, cryostat, port interspaces, port cells,
- WP11 - Development, integration and manufacturing follow-up of Diagnostic systems in Buildings and site infrastructure, including galleries and diagnostic building and other buildings used by diagnostics,
- WP12 - Diagnostics Instrumentation and Control, design and development,
- WP13 - Diagnostics project organization and implementation.

The scope of the development services requested in this specification requires that the Contractor's company provides specialized expertise to contribute to, establish and reinforce the ITER diagnostic systems for diagnostics which need to be provided by IO-CT (IO-CT-scope) and DAs (DA-scope).

The work of the awarded contractor for the DA-scope diagnostics will mainly consist in but not limited to:

- Oversight during the design development and procurement:
  - reviewing of technical documents,
  - organization and follow up of review and progress meetings,
- Interface development and maintenance at IO,
- Preparation and management of reception (factory acceptance, site acceptance),
- Preparation and management of installation,
- Preparation and management of commissioning.

The work of the awarded contractor work for IO-CT scope diagnostics will mainly consist in but not limited to:

- Design development from concept to manufacture readiness,
- Prototyping,
- Procurement and manufacturing follow-up (preparation of Technical Specifications).

These technical specifications will be defined specifically for each Task depending on the actual requirement and will include a technical scope, the organization of the task in IO and a description of the deliverables. The work foreseen shall be executed off-site.

4. Tentative Procurement Schedule

The IO considers to combine Prequalification (PQ) and Call for Tender together (CFT) steps with the following tentative schedule:

Issue Call for Nomination to DAs	January 2023
Issue combined PQ/CFT	February 2023
Submission of PQ/CFT offer	April 2023
Contract Award	September 2023

5. Experience

The candidate's company and its personnel shall have adequate experience for the work as detailed below.

Experience in Tokamaks is highly appreciated, and knowledge and experience in design for the following selected activities in nuclear environment is requested:

- General Diagnostics Engineering with ability to cover issues from sensor to data analysis,
- Expertise in concept, design, realisation, interface definition, documentation, manufacturing follow-up and commissioning of Plasma diagnostic systems as per list given in Section 3,
- Diagnostics engineering interfaces resolution in complex environments,
- Diagnostics project organization and implementation,
- Mechanical design engineering (with aid of CATIA V5),
- Structural, neutronic, thermo-hydraulic and electromagnetic analysis of diagnostic systems,
- Integration of Diagnostic systems in Buildings and site infrastructure.

6. Contract Type and Duration of services

The scope of work will be formalised through a Framework Service Contract. The Contract will be carried out over an initial firm period of four (4) years and an optional period of two (2) years.

7. Candidature

Participation is open to all legal persons participating either individually or in a grouping (consortium) which is established in an ITER Member State. A legal person cannot participate individually or as a consortium partner in more than one application or tender. A consortium may be a permanent, legally-established grouping or a grouping, which has been constituted informally for a specific tender procedure.

All members of a consortium (i.e. the leader and all other members) are jointly and severally liable to the ITER Organization.

The consortium groupings shall be presented at the pre-qualification stage. The tenderer's composition cannot be modified without the approval of the ITER Organization after the pre-qualification.

Legal entities belonging to the same legal grouping are allowed to participate separately if they are able to demonstrate independent technical and financial capacities. Candidates (individual or consortium) must comply with the selection criteria. The IO reserves the right to disregard duplicated reference projects and may exclude such legal entities from the pre-qualification procedure.

8. Reference

Further information on the ITER Organization procurement can be found at:
http://www.iter.org/org/team/adm/proc