外部委託業者の募集

References: IO/26/OT/70001544/LLU

"Framework　Contract for Tokamak Systems Monitor Implementation"

（トカマクシステムモニター導入に関する枠組み契約）

IO 締め切り 2026 年 9 月 26 (土)

〇はじめに

本事前情報通知（PIN）は、作業契約の入札授与および実行につながる公開入札調達プロセスの最初のステップです。

本文書の目的は作業範囲と入札プロセスに関する技術的な内容の基本的な要約を提供することです。

〇背景

ITER は平和利用の核融合発電の科学的および技術的な実現可能性の実証を目的とした、国際共同研究開発プロジェクトです。ITER 機構の 7 つのメンバーは、;欧州連合（EURATOM が代表）、日本、中華人民共和国、インド、大韓民国、ロシア連邦、および米国です。

ITER の敷地はフランス南東部のブーシュデュローヌ地区にあり、ITER 本社（HQ）もあるフランス CEA サン・ポール・レ・デュランス に近いところに位置しています。詳細については、ITER のウェブサイト http://www.iter.org を参照して下さい。

〇作業範囲

技術仕様書の付属書 1 G98ETE v1.1を参照下さい。

〇調達プロセスと目的

目的は、競争入札プロセスを通じて供給契約を落札することです。

この入札のために選択された調達手続きは公開入札手続きと呼ばれます。

オープン入札手順は、次の 4 つの主要なステップで構成されています。

- ステップ 1-事前情報通知（PIN）

  事前情報通知は公開入札プロセスの第一段階です。IO は、関心のある候補企業に対し、以下の概略日程に示された期日までに担当調達担当官に添付の関心表明フォームで以下の情報を提出し、競争プロセスへの関心を示すよう正式に要請します。

  特に注意:

  関心のある候補企業は、IO Ariba の電子調達ツール 「IPROC」 に登録してください（まだ登録していない場合）。手順については、

  https://www.iter.org/fr/proc/overview

  を参照してください。

Ariba (IPROC) に登録する際には、お取引先様に最低 1 名の担当者の登録をお願いします。**関心表明書において特定された担当者は、IPROC に登録されている必要があります。**

- ステップ 2-入札への招待
  PIN の発行から 10 作業日経過後、提案依頼書（RFP）を 「IPROC」 に掲載します。この段階では、担当の調達担当者に関心を示し、かつ IPROC に登録している関心のある候補企業は、RFP が公表された旨の通知を受けることができます。その後、RFP に詳述されている入札説明書に従って提案書を作成し、提出します。

  このツールに登録されている企業のみが入札に招待されます。

- ステップ 3-入札評価プロセス
  入札者の提案は、IO の公平な評価委員会によって評価されます。入札者は、技術的範囲に沿って、かつ、RFP に記載された特定の基準に従って作業を実施するために、技術的遵守を証明する詳細を提供しなければなりません。

- ステップ 4-落札
  認定は、公開されている RFP に記載されている、コストに見合った最適な価格または技術的に準拠した最低価格に基づいて行われます。

〇概略日程

概略日程は以下の通りです：

マイルストーン	暫定日程
事前指示書（PIN）の発行	2026 年 9 月 16 日
関心表明フォームの提出	2026 年 9 月 26 日
iPROC での入札への招待の発行	2026 年 10 月初旬
入札提出	2026 年 11 月中旬
契約評価と授与	2027 年 1 月初旬

〇契約期間と実行

ITER機構は2027年のQ1ごろ供給契約を授与する予定です。予想される契約期間は固定期間の最初の４年および、オプショナルな延長期間として２年です。

〇経験

候補者は、以下の経験および能力を有していることが求められます。

- 計測機器データおよびシミュレーションデータに基づく再構築アルゴリズムを含め、構造、熱

流動（水力学）および電磁気システムに関する有限要素解析ならびに低次元モデルの経験を有すること。

- ソフトウェアアーキテクチャ、構成管理、インターフェース、リポジトリおよび分散データ処理アプリケーションを含む、科学技術分野または産業分野向け監視ソフトウェアの開発、統合、試験および保守に関する経験を有すること。

- EPICS ベースの制御システム、ヒューマン・マシン・インターフェース（HMI）、リアルタイム監視環境、試運転（コミッショニング）活動、性能分析、不具合解析（トラブルシューティング）および運用ワークフローとの統合に関する経験を有すること。

- 機械学習モデルの開発および導入、異常検知、複雑な産業施設向けのデータ駆動型監視アプリケーションに関する経験を有すること。また、MLOps およびモデルライフサイクル管理に関する知識・経験を有すること。

- 科学技術計算プログラミング（Python、MATLAB、C++）、Linux 開発環境、データベース、イベント管理システムおよび分析用データ処理環境に関する経験を有すること。

〇候補

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法人は、単独で、またはコンソーシアムパートナーとして、同じ契約の複数の申請または入札に参加することはできません。共同事業体は、恒久的な、法的に確立されたグループ又は特定の入札手続のために非公式に構成されたグループとすることができます。

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た委任状の形式で、しかるべき時期に IO に提出しなければなりません。

【※　詳しくは添付の英語版技術仕様書「**Tokamak Systems Monitor Implementation**」をご参照ください。】
ITER 公式ウェブ　http://www.iter.org/org/team/adm/proc/overview からもアクセスが可能です。

「核融合エネルギー研究開発部門」の HP：　http://www.fusion.qst.go.jp/ITER/index.html
では ITER 機構からの各募集（IO 職員募集、IO 外部委託、IO エキスパート募集）を逐次更新しています。ぜひご確認ください。

イーター国際核融合エネルギー機構からの外部委託
に関心ある企業及び研究機関の募集について

＜ITER 機構から参加極へのレター＞

以下に、外部委託の概要と要求事項が示されています。参加極には、提案された業務に要求される能力を有し、入札すべきと考える企業及び研究機関の連絡先の情報を ITER 機構へ伝えることが求められています。このため、本研究・業務に関心を持たれる企業及び研究機関におかれましては、応募書類の提出要領にしたがって連絡先情報をご提出下さい。

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PRIOR INFORMATION NOTICE (PIN)

IO/26/OT/70001544/LLU

Tokamak Systems Monitor Implementation

Prior Indicative Notice annexes:

- Annex I: Technical Specification G98ETE v1.1
- Annex II: Expression of Interest

Abstract.

The purpose of this summary is to provide prior notification of the IO's intention to launch a competitive Open Tender process in the coming weeks. This summary provides some basic information about the ITER Organisation (the "IO"), the technical scope for this tender, and details of the tender process.

1 Introduction

This Prior Information Notice (PIN) is the first step of an Open Tender Procurement Process leading to the award and execution of a Service Contract.

The purpose of this document is to provide a basic summary of the technical content in terms of the scope of work, and the tendering process.

The Domestic Agencies are invited to publish this information in advance of the forthcoming tender giving companies, institutions or other entities that are capable of providing these services the prior notice of the tender details.

2 Background

The ITER project is an international research and development project jointly funded by its seven Members being, the European Union (represented by EURATOM), Japan, the People's Republic of China, India, the Republic of Korea, the Russian Federation and the USA. ITER is being constructed in Europe at St. Paul–Lez-Durance in southern France, which is also the location of the headquarters (HQ) of the ITER Organization (IO).

For a complete description of the ITER Project, covering both organizational and technical aspects of the Project, visit www.iter.org.

3 Scope of the Package

Please refer to Annex 1 of Technical Specification G98ETE v1.1.

4 Procurement Objective & Process

The objective is to award a Supply Contract through a competitive bidding process.

The Procurement Procedure selected for this tender is called the **Open Tender** procedure.

The Open Tender procedure is comprised of the following four main steps:

- Step 1- Prior Information Notice (PIN) - publication on IO web procurement page

  The Prior Information Notice is the first stage of the process. The IO formally invites interested candidate companies to indicate their interest in the competitive process, within **10 calendar days**, by returning to the Procurement officer:
  - Name of candidate company
  - Country of registration
  - Point of contact name, email, title, and phone number.

  Interested tenderers are kindly requested to return the expression of interest form (Annex II) by e-mail by the date indicated in the procurement time table below.

  Special attention:

  Interested candidate companies are kindly requested to promptly register in the IO Ariba e-procurement tool called "IPROC", if not so done yet. The process on how to do is described at the following link: https://www.iter.org/fr/proc/overview.

  When registering in Ariba (IPROC), suppliers are kindly requested to register at least the contact person. This contact person will be receiving the notification of publication of the Request for Proposal and will then be able to forward the tender documents to colleagues if deemed necessary. **Therefore, the person identified in the Expression of Interest must be registered in IPROC.**

- Step 2 - Invitation to Tender

  After the full registration of interested candidate companies, the Request for Proposals (RFP) will be published in "IPROC". This stage allows interested candidate companies

who have indicated their interest to the Procurement Officer in charge AND who have registered in IPROC to receive the notification that the RFP is published. They will then prepare and submit their proposals in accordance with the tender instructions detailed in the RFP.
Only companies registered in this tool will be invited to the tender and registered company can only submit a proposal in their name.

- Step 3 – Tender Evaluation Process

  Tenderers proposals will be evaluated by an impartial evaluation committee of the IO. Tenderers must provide details demonstrating their technical compliance to perform the work in line with the technical scope and in accordance with the particular criteria listed in the RFP.

- Step 4 – Contract Award

  The award will be done on the basis of best value for money or lowest price technically compliant offer as described in the published RFP.

5 Procurement Timetable

The tentative timetable is as follows:

Milestone	Date
Publication of the Prior Information Notice (PIN)	16 September 2026
Submission of expression of interest form	26 September 2026
Tender Launch	Beginning of October 2026
Tender Submission	Mid of November 2026
Tender Evaluation & Contract Award	Beginning of 2027

6 Experience Requirements

The candidates shall have the following experience and competences:

- Experience in finite element and reduced-order modelling for structural, thermal-hydraulic, and electromagnetic systems, including reconstruction algorithms based on instrumentation and simulation data.
- Experience in the development, integration, testing, and maintenance of scientific or industrial monitoring software, including software architecture, configuration management, interfaces, repositories, and distributed data processing applications.
- Experience with EPICS-based control systems, Human-Machine Interfaces (HMI), real-time monitoring environments, commissioning activities, performance analysis, troubleshooting, and operational workflow integration.
- Experience in machine learning model development, deployment, anomaly detection, and data-driven monitoring applications for complex industrial facilities, including MLOps and model lifecycle management.
- Experience with scientific programming (Python, MATLAB, C++), Linux development environments, databases, event management systems, and analytical data processing environments.

7 Quality Assurance Requirements

Prior to commencement of any work under this Contract, a “Quality Plan” shall be produced by the Contractor and submitted to the IO for approval, describing how they will implement the ITER Procurement Quality Requirements.

8 Contract Duration and Execution

The ITER Organization will award the Contract in Q1 2027. The estimated contract duration is with an initial firm period of 4 years with an option of extension for 2 years.

9 Candidature

Participation is open to all legal entities participating either individually or in a grouping/consortium. A legal entity is an individual, company, or organization that has legal rights and obligations and is established within an ITER Member State.

Legal entities cannot participate individually or as a consortium partner in more than one application or tender of the same contract. 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.

In order for a consortium to be acceptable, the individual legal entities included therein shall have nominated a leader with authority to bind each member of the consortium, and this leader shall be authorised to incur liabilities and receive instructions for and on behalf of each member of the consortium.

It is expected that the designated consortium leader will explain the composition of the consortium members in a covering letter at the tendering stage (the Invitation to Tender). Following this, the Candidate's composition must not be modified without notifying the ITER Organization of any changes. Evidence of any such authorisation shall be submitted to the IO in due course in the form of a power of attorney signed by legally authorised signatories of all the consortium members.

10 Sub-contracting Rules

All sub-contractors who will be taken on by the Contractor shall be declared with the tender submission. Each sub-contractor will be required to complete and sign forms including technical and administrative information which shall be submitted to the IO by the tenderer as part of its tender.

The IO reserves the right to approve (or disapprove) any sub-contractor which was not notified in the tender and request a copy of the sub-contracting agreement between the tenderer and its subcontractor(s). Sub-contracting is allowed but is limited to 40% of the total Contract value. Rules on subcontracting in details will be indicated in the RFP itself.

IDM UID

G98ETE

VERSION CREATED ON / VERSION / STATUS

04 Aug 2026 / 1.1 / Approved

EXTERNAL REFERENCE / VERSION

Technical Specifications (In-Cash Procurement)

Technical Specification of the FWC for the Tokamak Systems Monitor Implementation

Framework contract for 55.GT implementation phase, covering MRR, manufacturing, CODAC integration, FAT, SAT and commissioning.

SERVICE

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1 Preamble

This Technical Specification is to be read in combination with the General Management Specification for Service and Supply (GM3S) – [Ref 1] that constitutes a full part of the technical requirements.

In case of conflict, the content of the Technical Specification supersedes the content of Ref [1].

2 Purpose

This document specifies the requirements for the framework contract "Tokamak Systems Monitor Implementation". It defines the scope of the services to be provided, the execution and the deliverables associated. This is a framework contract, where each task order is a free self-standing activity with its own budget.

3 Acronyms & Definitions

3.1 Acronyms

The following acronyms are the main one relevant to this document.

Abbreviation	Description
CCP	Common Components Procurement Project
CODAC	Control, Data Access and Communication
Contractor	The supplier of the services to which this Call for Nomination applies
CRO	Contract Responsible Officer
CWP	Construction Work Package
DA	Domestic Agency
EWP	Engineering Work Package
FDR	Final Design Review
FEA	Finite element analysis
FEM	Finite element method
FTE	Full-time equivalent
GM3S	General Management Specification for Service and Supply
I&C	Instrumentation and Control
IMAS	Integrated Modelling Analysis Suite
IMD	Imaging and Monitoring Diagnostics Project
IO	ITER Organization
MRR	Manufacturing Readiness Review
OPI	Operator Interface
PBS	Plant Breakdown Structure
POZ	Plant Operation Zone
PRO	Procurement Responsible Officer
TSM	Tokamak Systems Monitor
XPOZ	External to POZ
WP	Work Package

3.2 Definitions

Contractor: shall mean an economic operator who have signed the Contract in which this document is referenced.

Imaging and Monitoring Diagnostics (IMD) Project is also part of the Diagnostics Programme, grouping more specialized optics-based diagnostics.

POZ: A collection of computer or hardwired networks, and of plant system equipment connected to those networks, required for integrated plant operation.

XPOZ: A part of CODAC located outside the POZ boundary. Used for dissemination of experiment results, remote participation, as well as for CODAC activities not directly related to plant operation.

Engineering disciplines: This term denotes distinct fields of interest for various Tokamak Systems. These fields encompass electromagnetic, structural static, thermal-hydraulic, thermal-mechanical, structural dynamic, accumulated structural damage, and thermal & electrical contacts.

Tokamak systems: The subset of ITER PBS under the scope of the TSM: PBS 11 Magnets, PBS 15 Vacuum Vessel, PBS 16 Blanket System, PBS 17 Divertor, PBS 24 Cryostat, PBS 27 Thermal Shield, PBS 55 Diagnostics (Port Plugs and Plasma Diagnostics), PBS 52 Electron Cyclotron Heating & CD System, PBS 53 NB Heating & CD System.

Monitoring function: A TSM software procedure that derives the status of a tokamak system or component using instrumentation variables as inputs.

Reconstruction function: A type of monitoring function which derives global output parameters of a generic tokamak system or component for a specific engineering discipline. It calculates the response of non-directly measured variables of a system based on the values provided by the machine instrumentation through an algorithm based on the representation of the system (e.g., transfer functions computed using a finite element model).

POZ monitoring application: Software that runs a specific monitoring function integrated in the CODAC environment consuming from and feeding data to different networks (e.g., PON, DAN). It corresponds to the instantiation of a generic monitoring (e.g., reconstruction) function with the specific parameters required to its application to a system or component: algorithm parameters, system data, etc.

Synchronous monitoring application: A TSM POZ monitoring application which delivers outputs at the same pace as the inputs are received.

Note: In previous TSM task orders, this concept was referred to as 'online', which is now obsolete.

Asynchronous monitoring application: A TSM POZ monitoring application that does not necessarily deliver outputs at the same pace as the inputs are received.

> *Note: In previous TSM task orders, this concept was referred to as 'offline', which is now used for XPOZ.*

XPOZ monitoring application: Offline Software that implements a specific monitoring function or group of functions using the archived values of the machine instrumentation.

Tokamak Simulator: TSM software running in POZ which manages the state and execution of the sync and async monitoring applications. It also interfaces with SUP for configuration and automation purposes. It makes available the configuration of the system as a whole as well as the configuration of the different Monitoring Applications.

4 Applicable Documents & Codes and standards

4.1 Applicable Documents

This is the responsibility of the Contractor to identify and request for any documents that would not have been transmitted by IO, including the below list of reference documents.

This Technical Specification takes precedence over the referenced documents. In case of conflicting information, this is the responsibility of the contractor to seek clarification from IO.

Upon notification of any revision of the applicable document transmitted officially to the contractor, the contractor shall advise within 4 weeks of any impact on the execution of the contract. Without any response after this period, no impact will be considered.

Ref	Title	IDM Doc ID	Version
1	General Management Specification for Service and Supply (GM3S)	82MXQK	1.4
2	Sub-System Requirement Document sSRD-55.GT: Tokamak Systems Monitor	WYWPGS	1.4
3	CODAC Core System Overview	34SDZ5	7.5
4	Plant Control Design Handbook	27LH2V	7.1
5	SEQA-45 – Software Engineering and Quality Assurance for CODAC	2NRS2K	3.2

4.2 Applicable Codes and Standards

This is the responsibility of the contractor to procure the relevant Codes and Standards applicable to that scope of work. TSM software shall be compatible with CODAC environment [3]. Operator interfaces must follow the PCDH guidelines [4].

5 Scope of Work

The implementation of the PBS 55.GT Tokamak Systems Monitor [2] covers the phase between the Final Design Review and the Commissioning of the system, requiring very specific skills from numerical algorithms to integrated FEA modelling I&C software development. The TSM is designed to provide a comprehensive overview of the Tokamak's state by using optic-fibre and resistive instrumentation measurements, mixed with other monitoring diagnostics data such as electromagnetic diagnostics and infrared cameras. The TSM algorithms compare the current state with reference design values, detects anomalies, and manages the health and lifetime of the Tokamak.

It has been identified that the following groups of activities will be required to complete the implementation of the system:

- Algorithms specialization:
  - Reconstruction algorithms for structural integrity, electromagnetic identification, as well as thermohydraulic and thermomechanical disciplines;
  - Limits and lifetime monitoring,
  - Anomaly detection,
- POZ software development and CODAC integration, and
- XPOZ software development and events database integration.

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This framework contract focusses on maximizing the value of the engineering developments, technologies and processes required and shared by these activities for completing the TSM implementation through the manufacturing, CODAC integration, deployment, acceptance testing and commissioning phases.

5.1 Work description

The Tokamak Systems Monitor (TSM) is a software suite that uses available discrete sensor data to reconstruct critical information not directly available from the implemented sensors. It is designed to provide an integrated view of the ITER's Tokamak from an engineering standpoint. The TSM is responsible for reconstructing global engineering parameters (Thermo-hydraulic, Thermomechanical, Structural Static, Structural Dynamic, and Electromagnetic) and evaluating margins and lifetime, detecting anomalies, reporting, analysing operational data, and verifying and calibrating numerical engineering models.

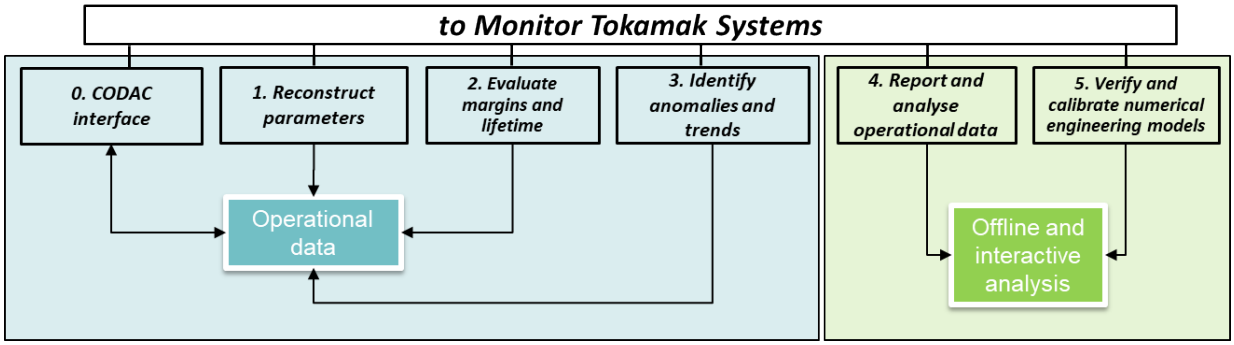

Figure 1: Top-level functions of 55.GT TSM

This framework contract will provide specialist engineering expertise in order to successfully implement the TSM, ensuring the manufacturing, CODAC integration, testing and installation activities are completed on time and to high levels of quality.

In more detail for the different areas (note that these are indicative activities and not intended to cover all but most of the activities to be performed):

Algorithms specialization:

- Specialization of TSM reconstruction algorithms for Start of Research Operations (SRO) scenarios, including configuration of system-specific parameters, operational envelopes and reference cases.
- Completion and consolidation of monitoring algorithms for structural integrity, thermo-hydraulic, thermo-mechanical, structural dynamic and electromagnetic disciplines relevant to SRO operation.
- Definition and implementation of SRO-specific limits, margins, warning thresholds and lifetime indicators for Tokamak systems and components monitored by the TSM.
- Implementation of anomaly detection functions adapted to SRO operational phases, including validation against expected transient behaviour and representative abnormal conditions.
- Integration of supplier, analytical and finite element models into the ITER system databases and TSM configuration files required for operational execution.
- Verification and validation of algorithm inputs, outputs, units, data quality rules and failure modes before deployment in the CODAC environment.

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- Preparation of synthetic and archived test cases to demonstrate algorithm behaviour under representative SRO pulses, commissioning scenarios and degraded instrumentation conditions.
- Implementation and testing of algorithm workflows within the Integrated Modelling Analysis Suite (IMAS), including mapping of reconstructed quantities to the appropriate IDS variables.
- Support to POZ deployment of synchronous and asynchronous monitoring applications, including interface definition with CODAC, data streams, configuration management and execution control.
- Executing Factory Acceptance Testing (FAT) and Site Acceptance Testing (SAT) when needed.
- Supporting TSM commissioning and integrated commissioning activities.
- Preparation of technical documentation, verification reports and acceptance evidence demonstrating readiness of the TSM algorithms for SRO operations.
- Planning and realizing any of the previous activities in preparation for DT operations.

POZ software development and CODAC integration

- Development and completion of TSM POZ monitoring applications for synchronous and asynchronous execution within the ITER CODAC environment.
- Implementation of the application software architecture required to instantiate generic TSM monitoring functions with system-specific configuration data, algorithm parameters and operational limits.
- Integration of TSM POZ applications with CODAC services, including data acquisition, data publication, configuration management, timing, supervision and execution control interfaces.
- Definition and implementation of input and output interfaces with the relevant CODAC networks and data streams, including PON and DAN connections where applicable.
- Implementation of data mapping between CODAC variables, TSM internal data structures and IMAS IDS variables (if needed) as required for monitoring, reconstruction and reporting functions.
- Development of the Tokamak Simulator functions required to manage application states, execution modes, configuration loading, automation sequences and interaction with the CODAC SUP layer.
- Implementation of robust error handling, data quality checks, alarm conditions, fallback modes and diagnostic information required for POZ operation.
- Integration and testing of SRO-specific monitoring workflows in the POZ environment using synthetic signals, archived data and representative CODAC test benches.
- Verification of application performance, latency, synchronization, data throughput and resource consumption against the requirements of synchronous and asynchronous monitoring functions.
- Preparation and execution of software integration tests, Factory Acceptance Testing and Site Acceptance Testing in coordination with CODAC and TSM stakeholders.
- Support to deployment, configuration control, version management and release procedures for TSM POZ applications during manufacturing, integration and commissioning phases.
- Support to TSM system commissioning activities, including verification of installed software baselines, configuration files, CODAC connectivity, data acquisition chains, supervision interfaces and end-to-end execution of monitoring applications in the commissioned plant environment.

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- Support to Tokamak integrated commissioning phases by executing and analysing representative commissioning scenarios, confirming the correct interaction of TSM POZ applications with plant systems, CODAC services, operational procedures and SRO-readiness criteria.
- Preparation of software design documentation, interface control documentation, test procedures, test reports and acceptance evidence demonstrating readiness for CODAC-integrated POZ operation.
- Support to commissioning and troubleshooting of the TSM POZ applications during integrated CODAC tests, SRO preparation activities and subsequent evolution towards DT operations.

XPOZ software development and events database integration

- Development and completion of TSM XPOZ monitoring applications dedicated to offline analysis, calibration and post-processing of archived Tokamak monitoring data.
- Integration of XPOZ applications with the Events Database to retrieve, organize, query and correlate archived monitoring data with pulses, operational phases, events, alarms and commissioning scenarios.
- Implementation of data access workflows allowing TSM-ThermaVIP to load, process and visualize archived instrumentation data, reconstructed quantities, monitoring outputs and associated metadata.
- Development of post-processing functions to replay monitoring algorithms on archived data, compare POZ results with offline recalculations and support detailed investigation of abnormal or unexpected behaviour.
- Implementation of calibration workflows using archived monitoring data to adjust algorithm parameters, sensor mappings, reference cases, engineering limits and model-based reconstruction coefficients.
- Integration of TSM-ThermaVIP with the Events Database for event-driven analysis, including selection of relevant time windows, retrieval of contextual information and generation of analysis-ready datasets.
- Development of tools for trend analysis, data mining, statistical assessment and long-term evolution of reconstructed quantities, margins, lifetime indicators and anomaly detection results.
- Implementation of interfaces for importing and exporting datasets, configuration files, calibration parameters, analysis results and reports between TSM-ThermaVIP, the Events Database and other ITER data systems where applicable.
- Verification of data consistency, traceability, units, timestamps, synchronization and metadata completeness across archived signals, reconstructed outputs, events and analysis products.
- Preparation of representative offline analysis cases using synthetic data, archived commissioning data and SRO operational scenarios to validate XPOZ workflows and post-processing functions.
- Support to model validation and improvement by comparing archived measurements with analytical models, finite element model outputs and reconstructed engineering parameters.
- Implementation of user-oriented analysis functions, visualisation views and reporting templates enabling engineering teams to review monitoring results, calibration outcomes and post-event analyses.
- Preparation and execution of software integration tests, verification tests and acceptance tests for XPOZ applications, TSM-ThermaVIP workflows and Events Database interfaces.

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- Support to deployment, configuration control, version management and release procedures for XPOZ software components and associated analysis workflows.
- Preparation of software design documentation, interface control documentation, user guidance, test procedures, test reports and acceptance evidence demonstrating readiness for offline TSM analysis and calibration activities.
- Support to system commissioning and Tokamak integrated commissioning by performing post-shot analysis, calibration updates, event reconstruction and feedback to POZ monitoring applications and SRO-readiness assessments.
- Planning and realization of XPOZ analysis, calibration and post-processing capabilities required to support the progressive evolution from SRO operation towards DT operation.

5.2 Indicative Work packages

The following activities are foreseen as indicative work packages. The indicative work packages are not task orders by themselves and only define some span of work expected within the current Framework Contract. The work is to be performed predominantly off-site, with occasional visits.

Three different categories of activities are foreseen:

- Category 1 – for activities which can be spread in time, i.e. those with workloads less than 0.5 person per day or less of 0.5 full-time equivalent (FTE).
- Category 2 – for activities which will be the main occupancy for a person during some period, i.e. workloads between 0.5 to 1.0 person per day, and total allocation of at least 0.5 FTE.
- Category 3 – for those activities involving for sure more than one person, i.e. those with workloads higher than 1.0 person per day, and total allocation of at least 0.5 full-time equivalent (FTE).

The work packages (WPs) will use the previous classification along with an estimate of total hours. The contractor will then add the proposed details of the delivery and the price for this work package. Some indicative WPs are listed in the following table.

Indicative work package	Category & duration	Hours
Complete the implementation of the dynamic structural algorithm for the equatorial port plug:	Cat 1, 6 months	820
- FEM model processing: inclusion of sensors and definition of loading parameters		200
- Generation of system data files		250
- Sensitivity analysis for defining best combination of algorithm parameters		200
- Analysis of the test cases for defining the accuracy of the algorithm		80
- Study of the sensitivity to sensor noise and failure rate		90

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Indicative work package	Category & duration	Hours
Integration of POZ application with CODAC SUP: - Define the SUP integration implementation steps for the TSM POZ application, including application states, commands, configuration parameters, supervision variables, alarms and execution modes to be exposed to CODAC SUP. - Implement the TSM interface with CODAC SUP to manage monitoring application start-up, shutdown, state transitions, configuration loading, automation sequences and execution control. - Configure and validate the exchange of supervision data between the TSM POZ application and CODAC SUP, including status publication, command reception, error reporting, alarm handling and diagnostic information. - Perform integration and regression testing on CODAC test benches using representative synchronous and asynchronous monitoring workflows, including nominal, degraded and failure scenarios. - Prepare the interface documentation, test procedures, test reports and acceptance evidence required to demonstrate readiness of the TSM POZ application for operation under CODAC SUP supervision.	Cat 3, 12 months	2300 200 600 500 400 600

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Indicative work package	Category & duration	Hours
Integrate the Events Database with the ThermaVIP interface application:	Cat 2, 9 months	1500
- Define the Events Database and ThermaVIP integration requirements, including archived data access, event metadata, query mechanisms, user permissions, bidirectional control commands and the information required by anomaly detection workflows.		200
- Implement the bidirectional interface allowing ThermaVIP to retrieve events, signals, tags and contextual information from the Events Database, and to write back analysis results, calibration updates, user annotations, derived events and post-processing status.		300
- Implement tagging and traceability functions for archived monitoring data, including pulse identification, operational phases, anomaly labels, calibration versions, algorithm versions, data quality flags and links to engineering analysis cases.		300
- Implement the MLOps support required by anomaly detection algorithms, including dataset preparation, feature extraction, model version tracking, training and validation metadata, inference result storage, performance monitoring and feedback from expert review.		500
- Perform integration, regression and acceptance testing of the ThermaVIP–Events Database workflows using representative archived data, including nominal analysis, calibration updates, anomaly review, tag editing and failure-recovery scenarios.		200

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6 IO Documents

All technical documentation is already available within the 55.GT folders in IDM:
55.GT-Tokamak Systems Monitor

7 List of deliverables and due dates

The implementation details of deliverables and priorities will be agreed between the Contact Persons under each separate Task Order. No element of work or activity shall begin without the prior written notification by the ITER Organization in the form of a "Task Order" signed by both Parties.

The deliverables will depend on the type of a task, but they shall be well defined before the start of the Task order in question and shall be based on the expertise requested in Section 5 of these Technical Specifications. The examples of the deliverables include, but are not limited to, the following items:

1. Reports or minutes of the kick-off meeting including list of all input information and requirements.
2. Progress reports containing:
    a. Summaries of meetings and decisions,
    b. Drafts of material to be used in final reports,
    c. Issues that have arisen in the course of the work, along with suggested approaches to addressing these issues.
3. Deliverables of Task orders in the form of:
    a. Report,
    b. Technical note,
    c. Any other relevant documents.
4. Reports or minutes of the meeting for completion of the task order containing:
    a. Deliverables acceptance statement,
    b. Report on outstanding issues identified during Task Order execution, forward action plan,
    c. Summary of the Task Order outcome.
5. Delivery on ITER site (or other agreed location) of prototypes and components manufactured under this contract.

8 Quality Assurance requirements

Software delivered in scope of this Framework is classified as SWIL-2 (ITER Quality Class 3). Quality validation defined in SEQA-45 Guidelines [5] applies in accordance with the chosen quality classification level. The Quality class under this contract is therefore QC3, [1] GM3S section 8 applies in line with the defined Quality Class.

9 Safety requirements

No specific safety requirement related to PIC and/or PIA and/or PE/NPE components apply.

10 Special Management requirements

Requirement for [Ref 1] GM3S section 6 applies in full.

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10.1 Work Monitoring

The work on individual task orders shall be started by dedicated kick-off meetings and managed by means of Progress Meetings. It is expected that Progress Meetings will be held as frequently as required, generally bi-weekly, written progress reports are required monthly.

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

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

In addition to the Progress Meetings, if necessary, the ITER Organization and/or the Contractor may request additional meetings to address specific issues to be resolved.

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 a presentation in person at an off-site meeting is required, the ITER Organization will reimburse travelling expenses.

For all Progress Meetings, a document (the Progress Meeting Report) describing tasks done, results obtained, blocking points and action items shall be written by the Contractor. Each report will be stored in the ITER IDM in order to ensure traceability of the work performed.

10.2 CAD design requirements

This contract requires for CAD activities, [Ref 1] GM3S section 6.2.2.2 applies.

10.3 Specific requirements and conditions

Successful performance is mandatory.

It shall be noted that Contractor's personnel visiting the ITER site shall be bound by the rules and regulations governing safety and security.

The Contractor shall have and maintain the necessary equipment and licenses to run the software tools required to carry out the tasks and produce the deliverables in accordance with the tools adopted by the IO. This concerns the CAD, FEA simulation software and any complementary tool. The Contractor shall ensure that experts are adequately supported and equipped. The official language of the ITER project is English. Therefore, all input and output documentation relevant to this Contract shall be in English. The Contractor shall ensure that all the professionals in charge of the Contract have an adequate knowledge of English, to allow easy communication and adequate drafting of technical documentation. This requirement also applies to the Contractor's staff working at the ITER site or participating in meetings with the ITER Organization.

Documentation developed shall be retained by the Contractor for a minimum of 5 years and then may be discarded at the direction of the IO. All source code required to run, configure, test and calibrate the algorithms and TSM applications will be uploaded to the TSM repository along with the numerical models, scripts and simulations supporting the configuration of the algorithms.

ANNEX II

EXPRESSION OF INTEREST

To be returned by e-mail to: Lijun.Liu@iter.org in copy to Amankumar.Joshi@iter.org

Tender Ref.: **IO/26/OT/70001544/LLU**

Description: **Tokamak Systems Monitor Implementation**

Procurement Officer: **Lijun LIU**

Company Name: .....

Country of Origin: .....

☐ WE ACKNOWLEDGE HAVING READ THE PIN NOTICE FOR THE ABOVE-MENTIONED TENDER AND ARE INTERESTED IN PARTICIPATING IN THIS TENDER

☐ WE ARE ALREADY REGISTERED IN IPROC

☐ WE INTEND TO REGISTER IN IPROC BEFORE THE TENDER LAUNCH DATE

Ariba Network (IPROC) ID if already registered in IPROC:

Please list the users of ARIBA/IPROC that you wish to add as response team for this tender:

Name	E-mail
…	…

Signature: COMPANY STAMP

Name: .....
Position: .....

Date: .....