

Technical Specifications (In-Cash Procurement)

Technical Summary for Framework Contract to provide a Support Laboratory for the Disruption Mitigation System

This technical summary describes the various tasks required for the Support Laboratory for the ITER Disruption Mitigation System. The document shall serve as a Call for Nomination to establish future task orders.



Technical Summary

Call for Nomination

Support Laboratory for the ITER Disruption Mitigation System

1. Purpose

The purpose of this Contract is to design, to construct, to install and to operate devices in a laboratory to support the design of the ITER Disruption Mitigation System (DMS) by developing and testing various concepts for injecting large amounts of materials rapidly into a plasma. The Support Laboratory should comprise of various test benches to study technologies related to Shattered Pellet Injection (SPI) and other novel methods, potentially proposed in the future. The Support Lab is expected to carry out specific studies as defined by the technology group of the DMS Task Force. The installations will include vacuum, cryogenic and electrical components, various diagnostics including methods based on optical and microwave technologies and hardware required for data acquisition.

2. Background

ITER is the next generation fusion experiment and is presently being constructed at Cadarache, near Marseille, France. This experiment will study the potential of controlled nuclear fusion to provide safe, clean and virtually limitless energy for humankind. In order to protect the machine from the consequences of uncontrolled plasma disruptions during high power operation, a Disruption Mitigation System (DMS) is being designed. The DMS is a protection of investment component with the purpose to reduce the thermal and electromagnetic loads and to dissipate the energy of runaway electrons. The current DMS is based on Shattered Pellet Injector (SPI) technology. This works by freezing gases, such as hydrogen, deuterium, neon, argon and their mixtures, into a solid pellet, and firing the pellet with a high gas pressure pulse against a tilted plate, causing the pellet to shatter into shards. The shards will enter the plasma, ablate and, through radiation, the thermal and electromagnetic loads will be reduced. The efficiency of the mitigation process is determined by various parameters such as shard size, distribution, velocity etc. It is expected that most of the work for this Framework Contract will require the use of a test bench that is able to form,

fire and shatter pellets and will be used for the majority of the contract. The first task of this contract is to design a test bench to study the shatter process in detail as specified by tasks covered with this call for nomination. The second task is to test different shatter tube designs for different pellet sizes and compositions. This call for nomination includes the above two tasks, which will be used as a basis for the contract award.

The following tasks orders within the Framework Contract are expected to be implemented based on the progression of the ITER DMS design, the research plan and separate prototype development of individual components, and may include:

- Testing of an optical pellet diagnostic on the test bench;
- Testing of propellant valve prototypes on the test bench;
- Testing of mechanical pellet release mechanisms, e.g. such as punches;
- Testing of diagnostics, such as e.g. pellet integrity measurements based on optical methods, on the test bench;
- Testing of ITER DMS cold head prototype;
- Testing of different shattered tube designs;
- Testing of state machine for pellet formation.

A possible setup of such a SPI test bench is shown in Figure 1 below. It consists of a fast valve and a reservoir for the propellant gas with pressures up to 10 MPa, a cryogenically cooled cold head with a barrel for the formation of the pellet, a guide tube, expansion volumes (not shown) for propellant gas recovery, a shatter tube with a predefined shatter angle or other shattering geometries and fast cameras and shattering diagnostics.

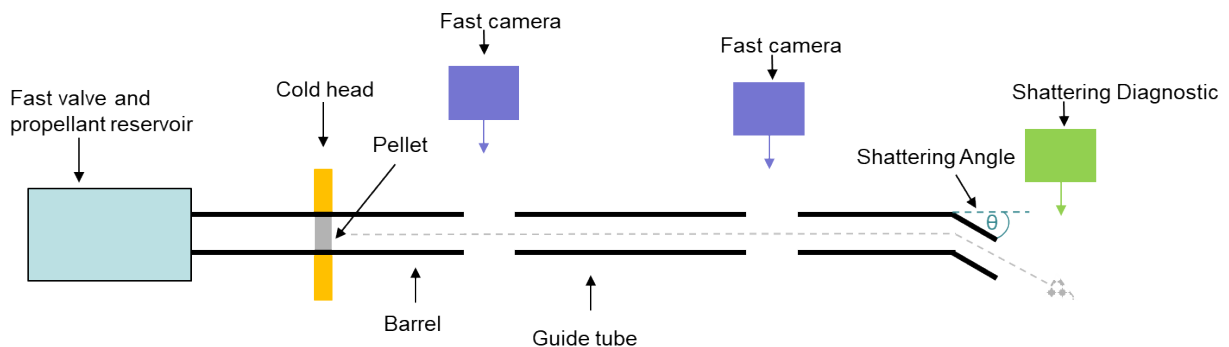


Figure 1: Schematic of the experimental set up for the test bench.

3. Scope of work

The work shall include:

- design and construction of a cryogenic system, ideally compatible with the use of supercritical helium;
- design and construction of a vacuum system for a shattered pellet injector, incorporating different shatter tube designs and pellet diagnostics;

- design and construction of a pressure system to feed pneumatic propellant valves with gas;
- design and manufacture of electronics and software (state machine) to control the injector and propellants;
- design and construction of diagnostics to measure the pellet properties and shard size distributions;
- measurements of shard size distributions for different pellet sizes, compositions and velocities and shattering geometries.

4. Timetable

The tentative timetable is as follows:

Item	Tentative date(s)
Call for nomination issued	November 2019
Call for nomination submission	January 2020
Call for tender issued	February 2020
Call for tender submission	March 2020
Framework Contract Award	May 2020
Start of Framework Contract and 1 st Task Order	July 2020
1 st Milestone: completion of test bench	November 2020
Completion of first task order	December 2021
Completion of Framework Contract	December 2022
(In case of extension option with another 2 years) Completion of Framework Contract	December 2024

5. Experience

The acceptance criteria for the selection of the tender cover a broad range of technical capabilities, and the Contractor and its personnel shall have adequate experience in the areas as listed below:

- design and operation of vacuum, pressurised and cryogenic systems;
- electrical installations;
- ability to manufacture/assemble the required components;
- ability to control the quality by implementing a quality plan;
- capable of handling flammable gases (e.g. hydrogen, deuterium);

- design of electronics, PLC and control software to operate the test bench;
- capabilities for automated data recording with high time resolution;
- experience with optical diagnostics, pellet fabrication, pellet injectors and/or cryogenic plants using supercritical helium would be advantageous;

6. 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.

The UK is not a party to the ITER Agreement but to the EURATOM Treaty. The draft Withdrawal Agreement between the EU and the UK provides that the provisions of the EURATOM treaty continues to apply to and in the UK for a transition period following its withdrawal from the EU and EURATOM. If the Withdrawal Agreement is not ratified (a no-deal Brexit) the EURATOM Treaty ceases to apply to and in the UK on the withdrawal date. Until the Withdrawal Date, the UK remains a full member of the EU and EURATOM and UK entities retain the right to participate in IO procurement procedures. In case they are selected, a Brexit clause is included in the contract. Likewise, during the transition period UK entities may participate in IO procurement procedures. After the end of the transition period, when the EURATOM Treaty ceases to apply to and in the UK, any UK entities bidding as a prime contractor or consortium partner will be rejected from the IO procurement procedures. UK entities will no longer be recognised as entities of an ITER Member and will no longer have the right to participate in IO procurement procedures, unless the UK has entered into an Agreement with EURATOM. Where UK entities can demonstrate a unique and specific competence in a certain field, the IO, with approval of the ITER Council, may also allow them to participate in a procurement procedure.