



# Technical Summary

## Irradiation, testing and qualification of ITER diagnostic windows.

Ref: IO/21/CFT/70000687/LLU

### 1. Purpose

This Framework contract has two main objectives, which are:

1. Assess through experiments the effect radiation has over the performance of ITER's diagnostic windows
  - a. Optical performance after irradiation for coated and un-coated windows
  - b. Delamination of coating systems
2. Qualify the different bonding techniques used to achieve the required leak tightness
  - a. Strength of the bond after irradiation for (quantification aging)
  - b. Qualification against synergetic effects

In this framework contract, there is also the possibility to perform R&D for the radiation effect on EM absorbing coating applied on metallic substrate (SS316L and Molybdenum). The main effects to be studied are:

- Delamination due to swelling
- Absorption coefficient after irradiation

### 2. Background

The purpose of this document is to provide a summary of the technical specifications for a framework contract for the assessment of the irradiation damage of Diagnostic's windows. The detailed technical specification will be provided at the time of Call for Tender.

The Safety function achieved by the diagnostic window assemblies is the confinement of toxic and radioactive products inside the vacuum vessel and attached vacuum extensions.

The irradiation campaigns are part of the functional and safety qualification of the windows.

Each window assemblies is composed by:

- A structural body provided with a bolted flange, for the mechanical and vacuum tight attachment on a vacuum extension also called "mating flange".
- Two transparent discs assembled into metallic ferrules by aluminium diffusion bonding.
- An interspace volume between both discs, whose pressure is permanently monitored by the Service Vacuum System (SVS).

An example of a Fused Silica window can be seen in Figure 1.

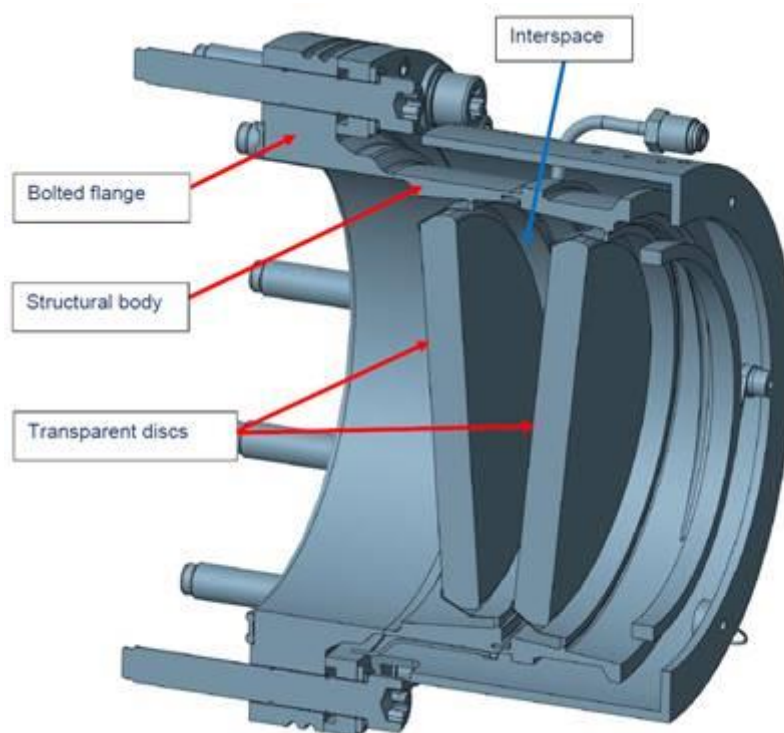


Figure 1: Section of Window Assembly

The design of the bolted flanges is similar to the one of the ITER standard vacuum flange. The size of the bolted flange is tailored to the clear aperture.

- DN 100 mm → Ø70 mm clear aperture,
- DN 150 mm → Ø110 mm clear aperture,
- DN 200 or 250 mm → Ø160 mm clear aperture.

### 3. Scope of Work

The scope of work covered will be to:

1. Irradiation (1 MGy of gamma of electron beam equivalent and  $8.46 \times 10^{16}$  n/cm<sup>2</sup> with energies > 1MeV neutron) of
  - a. Window Assemblies
  - b. Un-coated ceramic samples (transparent trapezoids, tentative dimensions of 25 x 2.5 x 2 mm<sup>3</sup>, from now on referred as beams)
  - c. Coated ceramic samples (Anti-reflecting coating)
  - d. EM absorbing coating applied on metallic substrates
2. Non-destructive test of irradiated samples
  - a. Activation of components
  - b. Optical test
  - c. Helium leak test (upon agreement with IO)
  - d. Scratch test
3. Destructive test, in this case only push out test

As a general statement, the details of the task to be provided by the Contractor will be defined in the Task Order Technical Specification

These Technical Specifications will be defined specifically for each Task Order depending on the actual requirement and will include a technical scope, the organization of the Task Order within IO and a description of the deliverables.

#### 4. Work Description

This framework contract covers the safety and functional qualification of all the different window assemblies, in Figure 2 all the window variations (each material can be considered as a work package) and expected tests to be performed inside this framework contract are displayed.

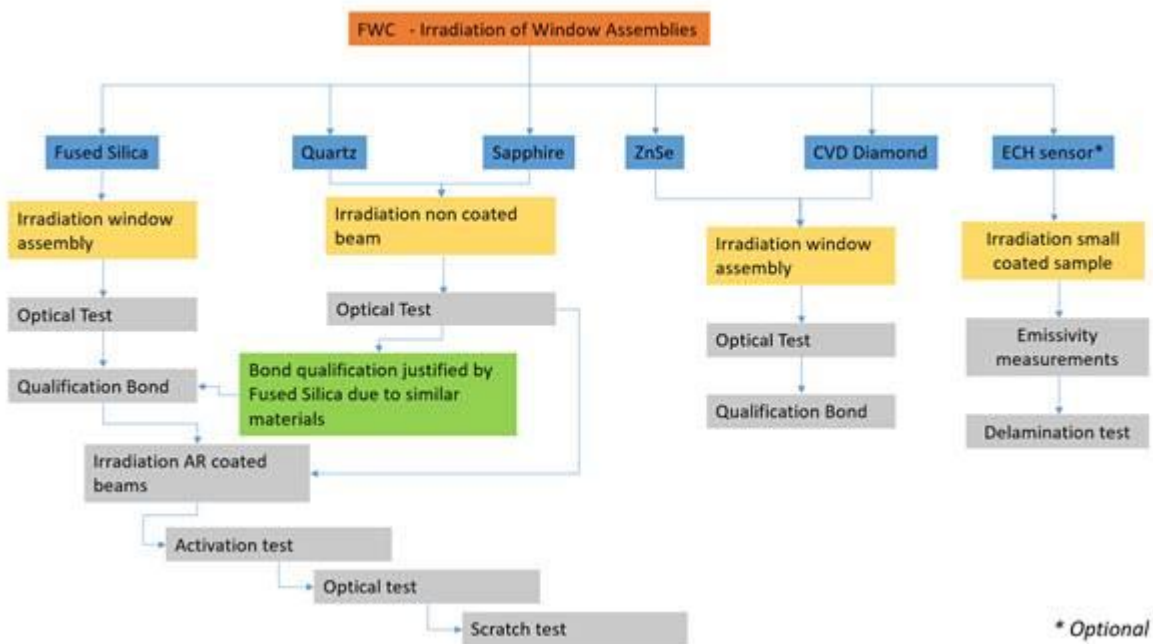
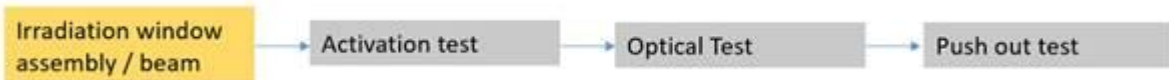


Figure 2: Tentative scheme for tasks under this FWC

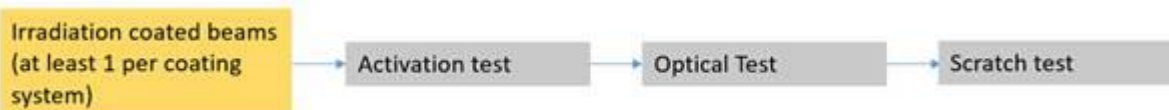
#### 4.1 Work Package

Each work package is expected to be divided in 2 activities

1. Irradiation of Window assemblies (or beams) for functional and safety qualification



2. Functional Qualification of coated (Anti-reflecting coating) samples



#### 5. Required Experience and Facilities

The Candidate shall have facilities and experience such that they can perform:

- Neutron and gamma irradiation of components
- Manufacture test rigs for irradiation of components
- Facilities capable of manipulating and performing tests on activated components (Hot Cell facilities)
- Leak tightness measurements
- Measurement of optical transmission of transparent materials at different wavelengths,

## **6. Duration of Service**

The contract will be carried out over an initial firm period of four (4) years and an optional period of one (2) year. The contract is scheduled to come into force in end of 2021.

## **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 cannot be modified later without the approval of the ITER Organization.

Legal entities belonging to the same legal grouping are allowed to participate separately if they are able to demonstrate independent technical and financial capacities. Bidders' (individual or consortium) must comply with the selection criteria. IO reserves the right to disregard duplicated references and may exclude such legal entities from the tender procedure.

## **8. Tentative schedule**

The indicative Call for Tender milestones are:

- |   |                        |
|---|------------------------|
| • Call for Nomination                     | Mid of April 2021      |
| • Issuing of Prequalification Invitations | Beginning of May, 2021 |
| • Issuing of Call for Tender              | Mid of August, 2021    |
| • Submission of Tenders                   | End of September, 2021 |
| • Award of Contract                       | End of 2021            |

## **9. Reference**

Further information on the ITER Organization procurement can be found at:

<http://www.iter.org/org/team/adm/proc>