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Technical Specifications

for

Accelerator and Beam Physics Design Analyses for the ITER Neutral Beam System

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1 Abstract

This document describes technical needs of the neutral beam section for beam physics design analyses for the ITER neutral beam system.

2 Background and Objectives

ITER is a major new device that is under construction at Cadarache, near Marseille, France. This device will study the potential of controlled nuclear fusion to provide energy for mankind. The neutral beam system consists of two heating neutral beams (HNBs), with the provision for upgrading to include a third HNB and a diagnostic neutral beam injector (DNB). The 2(3) HNBs provide 33(50) MW of the 72(130) MW required to heat the plasma. The radiation due to the interaction of the beam from the DNB with the plasma particles will provide information on the alpha particles created in the fusion reactions, the temperature and temperature distribution of the ions in the plasma and several other plasma parameters.

The work described below is related to the physics associated with the design of the injectors, and that of the accelerators in particular.

3 Scope of Work

The objective of this engineering contract is to support the ITER Neutral Beam Section in the analysis that supports the design of the injectors, particularly in the accelerators, e.g. physics design of the 1 MV accelerators of the HNBs, provision of information to the mechanical engineers designing the accelerators, physics design of the accelerated electron control system and preparing technical documentation.

4 Estimated Duration

The duration shall be 125 working days from the starting date of the contract.

The work base is at the ITER work site.

5 Work Description

Description of the tasks to perform:

- Review and revise the detailed design document of the ITER HNB system (DDD5.3) and modify as necessary.
- Follow the MAMuG accelerator design activities (emphasis on beam optics and electron production) by the JA DA using 2D and 3D particle beam transport codes (e.g. SLACCAD and Opera 3D) to verify design and to carry pout sensitivity analyses.
- Calculation of the electron creation and acceleration in the HNB accelerators and the electron energy spectrum for electrons emerging from the HNB accelerator using a suitable 3D code, e.g. EAMCC, TRACK.
- Evaluate mitigation of the electron power transmitted to the cryopumps considering different possible types of electron dumps and baffles protecting the cryopumps from the electrons using MCNP.
- Benchmarking the BTR code for beam transmission through the ITER plasma by comparison with established codes such as PENCIL and NEMO
- Calculations on the beam shinethrough for selected ITER plasmas.

6 List of deliverables and due dates

Subtask	Deliverable	Dates
1	Progress report	2.4 months after starting date
2	Progress report	4.8 months after starting date
3	Progress report	7.2 months after starting date
4	Progress report	9.6 months after starting date
5	Final report	12 months after starting date

Each report will be stored in the ITER IDM in order to ensure traceability of the work performed.

The expected starting date of this contract is 21 February, 2011.

7 Evaluation Criteria

The selection will be done taking into account the following criteria:

1) Expert CV 60%
2) Price 40%

8 Specific requirements and conditions

The staff proposed by the bidder to carry out the work described in Section 5 must have proven experience in the following areas:

- the design of negative ion based neutral beam injectors using appropriate bean transport codes such as PDP and BTR and gas density calculation codes such as MC Gas Flow (at least 5 years);
- the design of high current density negative ion (D^- or H^-) accelerators using appropriate particles transport codes such as SLACCAD and OPERA3D and secondary electron tracking codes such as EAMCC (at least 5 years);
- electron reflection and transport using codes such as EAMCC
- beam (tokamak) plasma interaction
- capability to work in English language, both verbally and written
- excellent technical writing skills

The staff proposed by the bidder to carry out the work must be prepared to participate in a minimum of 2 meetings off site, in the EU, typically 2 days at the RFX site in Padua, Venice, or the F4E site in Barcelona, Spain. The cost of these missions is to be paid by the bidder.

9 Work Monitoring / Meeting Schedule

Meetings and Progress Reports

The work will be managed by means of the Neutral Beam Section Progress Meetings and/or formal exchange of documents transmitted by emails which provide detailed progress. The Neutral Beam Section Progress Meetings, which review the progress of the work in the section,

the technical problems, the interfaces and the planning, are held every week and the expert will be expected to report once every two meeting.

The main purpose of the Progress Meetings is to allow the ITER Organization/Neutral Beam Section 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) Clarify doubts and prevent misinterpretations of the specifications.
d) Agree work priorities.

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 occasions the Contractor will be required to make a presentation to Technical Meetings either by videoconference or in person.

10 Payment schedule / Cost and delivery time breakdown

Interim payments will be made monthly upon satisfactory completion and IO approval of progress reports and upon submission of a valid invoice.

11 Quality Assurance (QA) requirement

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 document ITER Procurement Quality Requirements (22MFG4). Prior to commencement of the task, a Quality Plan Quality Plan (22MFMW) 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.

Prior to commencement of any manufacturing, a Manufacturing & Inspection Plan Manufacturing and Inspection Plan (22MDZD) must be approved by ITER who will mark up any planned interventions.

Deviations and Non-conformities will follow the procedure detailed in IO document MQP Deviations and Non Conformities (22F53X)

Prior to delivery of any manufactured items to the IO Site, a Release Note must be signed MQP Contractors Release Note (22F52F).

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, it should fulfil IO document on Quality Assurance for ITER Safety Codes Quality Assurance for ITER Safety Codes (258LKL).