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PROFILE 2

Follow-up for DNB Post-PA design activities, ESPN classification and NB magnetic analysis

Technical Specifications

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1 Abstract

This document describes technical needs of the Neutral Beam Heating and Current Drive (NB H&CD) section in engineering support to design the Diagnostic Neutral Beam Injector (DNB) including design activities and follow up activities.

2 Background and Objectives

The Diagnostic Neutral Beam (DNB) is designed to provide a probe beam of 100 keV H^0 to be used by the Charge Exchange Recombination Spectroscopy (CXRS) diagnostic system. The main purpose of this diagnostic is to allow a measurement of the local density of thermal alpha particles (helium ash). It may also be used for other diagnostic measurements which provide information on:

- The local density of light impurities (Be, C, O, Ne)
- The plasma rotation velocity
- The ion temperature

The DNB can also be used for Motional Stark Effect (MSE) measurements and Beam Emission Measurements (BES).

The DNB is installed in the NB Cell which occupies a large part of the ground level of the tokamak building. The DNB system has been designed for maximum commonality with the Heating Neutral Beam (HNB) systems, so that the injector utilises components identical to those of the HNB injector whereever possible. A 3D view of the injector is shown in Figure 1.

Table DNB performance Parameters

Ion species	H^-
Beam energy	100 keV
Beam current	60 A
Duty cycle and modulation	3s ON/ 20s OFF, 5 Hz
Accelerated current density	300 A/m^2
Beamlet divergence (core)	<7 mrad

The DNB is covered by two procurement arrangements (PAs): one for the DNB Power Supplies and one for the DNB Beamline. The first has been signed in April 2009 and the second one in March 2010. The Beamline PA covers items with built-to-print (BTP), Detailed Design (DD) and Functional specifications, necessitating different levels of IO involvement in the design effort carried out by the Indian DA. IO is not only responsible for monitoring the design effort of the Indian DA, but also for the integration of the system. Interface issues have to be addressed continuously for all components as the design of the interfacing systems evolves.

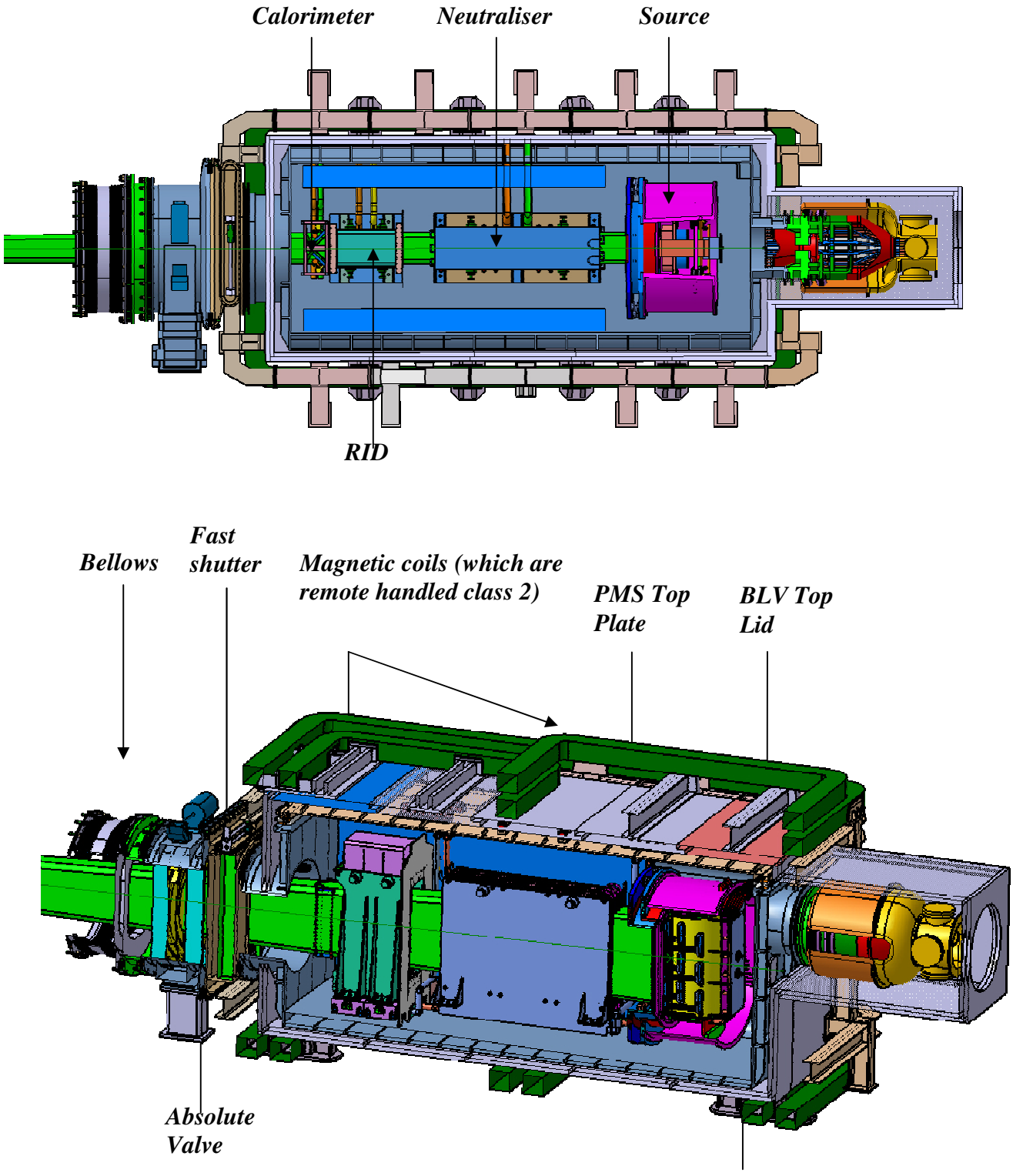

Figure 1: *3D view of diagnostic neutral beam injector.*

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3 Scope of Work

The objective of this contract is to support the NB H&CD team in the follow-up of design activities related to the DNB Injector with emphasis on the DD and Functional Specification items and BLC and DNB injector interface issues. The candidate has to act as liaison engineer and contact point for the DNB Team in ITER India for all mechanical engineering and interface issues arising. The tasks envisaged are

- Follow the design progress of the DNB injector (Vessel, shielding, support structure, Active Corrections and Compensation Coils, front-end-components and calorimeter and exit scraper);
- Follow the interface issues impacting on the DNB components (beamline components such as bushing, neutralizer, RID, calorimeter) and the other components;
- Follow the manufacturing and quality process of the DNB components in the Indian DA
- Oversee the design exchange between IO and ITER India;
- Analyse the magnetic field requirements in the DNB and HNB injectors due to improvement of the ACCCs;
- Prepare documents for the Remote Handling interface;
- Collect data related for classification of pressurized components;
- Collect list of and data on materials used in the DNB & HNB to provide input into the ITER Materials Handbook.

4 Estimated Duration

The duration shall be 1 year (220 working days) from the starting date of the contract.
2 travels to India are foreseen.

5 Work Description

Description of the tasks to perform:

Follow up the design of DNB components:

The vessels and beamline components of the ITER diagnostic neutral beam injectors (DNB) are to be supplied by the India Domestic Agency. Even if both Pas have been signed in 2009 and 2010, ITER India will provide updated models and drawings of the components as the design advances. The components concerned in the frame of this engineering support are: the electron dump, the vessel and the beam exit scraper. It is expected that the neutraliser, the residual ion dump, the calorimeter and the bushing will undergo minor modifications as the interfaces are still in progress.

A mechanical engineer is needed to oversee the production of the drawings; cross check all design details, to ensure correct interfaces between the components and the DNB vessel, ensure correct interfaces with services in the NB cell and to oversee the integration of the drawings into ENOVIA.
The engineer will work under the direct responsibility of the IO RO.

Missions may be necessary during this contract to attend design review meetings of ITER task(s), coordinate and follow up the design activities in India or visit companies or institutes which have relations to NB activities.

Subtask 1: Design exchange and evolution

The detailed design (3D models and 2D drawings) of the DNB is made in India; nevertheless data have to be frequently saved in the IO database.
A mechanical engineer is needed to write the design exchange document (DER, DET) and to follow up this activity helping the design collaboration in the understanding of the data and the Indian domestic agency in the specific methodology used by IO for this exchange procedure.

In the future Indian DA will be directly connected to the replication of the Enovia database; the mechanical engineer will be in charge to follow the respect of IO CAD quality by Indian designers in collaboration with the NB design coordinator (DECO).

Subtask 2: Magnetic Field Analyses

The reduction of the magnetic field in the Ion beam region is one of the crucial points for the performance of the NB systems. Due to constant progress on the PMS and coils design taking into account detailed design, RH and integration the impact on the magnetic field in the NB injectors has to be checked.
A mechanical engineer with knowledge of the ANSYS Software is needed to perform new calculation on the DNB and HNB injectors.

Subtask 3: Load specifications:

In order to design the beamline components, the loads which will be applied in ITER must be taken into account. Some documents summarizing the loads must be written, and the engineer in charge of the work will have strong interactions with people in charge of load definitions. This information will be necessary for the technical specifications of the components.

Subtask 4: ESPN classification

Due to high power deposition on BLCs due to direct interception of the high power neutral beam by the beamline components, they must be water cooled. The beamline component cooling circuits in ITER have been designed with a certain internal pressure and their classification under ESPN rules must be examined and assessed. A study is ongoing through safety group to collect all data and prepare a report which must be submitted to the French regulator in order to determine if components can be exempted or not. Consequently, the result of this work could have a strong impact on components design. A first report will be submitting end of 2009. Updates of the work must be foreseen, depending on the results, and if data is found to be missing. In parallel some data regarding corrosion analysis inside the cooling circuit will be collected.
The work already performed can be found via the following link: **HNB-DNB PED-ESPN classification (2NFSQK v1.0) (current)**

6 Responsibilities

The engineer will work under IO neutral beam section member responsibility.

7 List of deliverables and due dates

Subtask	Deliverable	Dates
Overall	Report of on-going activities during each NB section's progress meeting	Each two weeks
Overall	Report listing all documents/study performed within the contract	End of the contract
Overall	Any presentations/documents requested by IO to support NB section	When needed by IO
1	CAD models exchange with IN DA and reconciliation follow up ion IO side	At each design step approved by NB section
1	Interfaces documentation (ICD/IS) of DNB components (other than with Remote handling) with other systems	At each design review/end of the contract
1	Follow up of IN DA design via technical meetings. Minutes and action list to be written.	At each technical meeting (each 2 weeks)
2	Magnetic field analysis for HNB/DNB PMS and ACCC design and design recommendations	When needed by IO
3	Load specifications of DNB components	At each design review/end of the contract
4	Compliance with PED/ESPN rules of DNB components	At each design review/end of the contract

Written reports discussed each two weeks during NB section progress meeting.

8 Acceptance Criteria

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

1) Expert CV 60%
2) Price 40%

9 Specific requirements and conditions

The contractor has to work on the ITER premises. The working language is English. The contractor may be asked to participate in meetings and visits at ITER India and Indian supplier premises.

10 Work Monitoring / Meeting Schedule

Final Reports should be self-contained, and relevant documentation, such as drawings, should be supplied together with it in electronic form. Deviations from the Task Order Specifications, approved by the ITER Organization, shall be recorded in a specific chapter of the relevant final report.

Meetings and progress reports

The work will be managed by means of Progress Meetings and/or formal exchange of documents transmitted by emails which provide detailed progress. Progress Meetings will be called by the ITER Organization, to review the progress of the work, the technical problems, the interfaces and the planning.
A progress meeting is organized by H&CD NB section each week. The engineer will have to report every two weeks in the progress meeting dedicated to mechanical activities.

The main purpose of the Progress Meetings is to allow the ITER Organization/H&CD NB 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 asses 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.

For all Progress Meetings, a document describing tasks done, results obtained, blocking points must be written by the engineer. Each report will be stored in the ITER IDM in order to ensure traceability of the work performed.

Every 3 months, the Contractor shall submit to ITER Organization a Progress Report to be issued five working days before the each Progress Meeting so that the report can be reviewed prior to, and discussed at, that Meeting.

The quarterly Progress Report shall illustrate the progress against the baseline work plan and indicate variances that should be used for trending. Performance indicators suitable to measure the progress of the work as compared to the approved work plan shall also be reported in the Monthly Progress Report.

On request and by agreement, meetings will be organised by videoconference. The Contractor shall facilitate proper tools for the videoconference in accordance with the Associated Framework Contract.

Experts from the Domestic Agencies may be invited by ITER Organization to participate in the meetings or other involved parties.

11 Payment schedule / Cost and delivery time breakdown

Interim payment after approval of quarterly reports and final report final acceptance.

12 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).

13 References / Terminology and Acronyms