Contribution ID : **78** Type : **Poster**

MITICA Intermediate Electrostatic Shield: concept design, development and first experimental tests identification

Tuesday, 4 September 2018 15:30 (2:30)

Content

The high-Q operation of the ITER tokamak will require two Neutral Beam Injectors (NBIs) for plasma heating and current drive. Each beam will be generated by a 40A current of Deuterium negative ions, accelerated up to the specific energy of 1MeV and then neutralized. The power delivered to the plasma by each NBI shall reach 16 MW with a duration up to 1h. The beam source will be constituted by an RF-driven negative ion source at –1 MV potential, by a Multi-Aperture, Multi-Grid (MAMuG) electrostatic accelerator (consisting of 5 stages at intermediate potentials), and a gas-box neutralizer at ground potential. All components will be installed in a vacuum vessel (also at ground potential), together with a high-capacity cryo-pumping system which controls of the background gas pressure. In order to validate the ITER NBI design and address all the outstanding issues related to these demanding requirements, a full scale prototype called MITICA (Megavolt ITER Injector & Concept Advancement), is under construction in Padova at Consorzio RFX. Voltage insulation in vacuum and/or very low-pressure gas on a single gap is indeed one of the expected issues which MITICA will have to deal with. In this paper, a numerical tool, called Voltage Holding Prediction Model (VHPM) and based on the clumps theory in vacuum, is applied to the MITICA beam source for evaluating and optimizing the high voltage insulation of the experiment. The tool parameters have been recently "calibrated" based on the (few) experimental results presently available in the case of large gaps. Since the initial results suggest that the breakdown probability will be rather high when the beam source will operate at nominal voltage (-1MV), preemptive solutions for increasing the voltage holding capability in the gaps between the beam source, the accelerator grids and the vacuum vessel have been considered ad compared . A very effective solution for increasing the voltage holding capability of the system consists in the use of an intermediate electrostatic shield between the source and the vessel. Using the above-mentioned numerical tool, a conceptual design of such intermediate electrostatic shield has been developed and optimized, taking into account also mechanical constraints, and the effects of the presence of the shield on the background gas pressure distribution. Finally also an experimental program for anticipating the full-scale voltage holding tests is studied and proposed, using the real MITICA vacuum vessel (on-site) together with a beam source mock-up (with a simple geometry) without and with an intermediate electrostatic shield, in order to get a first voltage holding characterization of the vacuum vessel, to evaluate the effect of the shield, and to benchmark the VHPM for large gaps.

Primary author(s) : Dr. PATTON, Tommaso (Consorzio RFX)

Co-author(s) : Prof. BETTINI, Paolo (Dipartimento di Ingegneria Industriale, Università degli Studi di Padova); Dr. PILAN, Nicola (Consorzio RFX); Prof. CHITARIN, Giuseppe (Consorzio RFX - Università degli Studi di Padova); Dr. DE LORENZI, Antonio (Consorzio RFX); Dr. MARCUZZI, Diego (Consorzio RFX); Dr. SARTORI, Emanuele (Dipartimento di Tecnica e Gestione dei Sistemi Industriali, Vicenza, Italy); Dr. SIRAGUSA, Marco (Consorzio RFX); Mr. TREVISAN, Lauro (Consorzio RFX)

Presenter(s) : Dr. PATTON, Tommaso (Consorzio RFX)

Session Classification : Poster Session #2

Track Classification : Beam lines and facilities