

HVPTF - THE HIGH VOLTAGE LABORATORY FOR THE ITER NEUTRAL BEAM TEST FACILITY

A. De Lorenzi¹, N. Pilan¹, L. Lotto¹, M. Fincato¹, G. Pesavento², R. Gobbo²

¹ *Consorzio RFX – Associazione EURATOM-ENEA per la Fusione
Corso Stati Uniti 4, 35127 Padova, Italy*

² *DIE, Università di Padova, Via Gradenigo 6A, I-35100 Padova, Italy*

Corresponding author: antonio.delorenzi@igi.cnr.it

Voltage Holding is one of the most critical issue for the experiment MITICA (Megavolt ITER Injector & Concept Advancement), aimed at the realization of the 40 A – 1 MV prototype of the ITER HNB, now started at the Consorzio RFX in Padova (I). For this reason, boosting the R&D on this specific problem has been identified as a priority to attain the success of the MITICA experiment, by means of the realization of the dedicated Laboratory HVPTF – High Voltage Padova Test Facility.

This Laboratory is equipped with two different setups, one for experiments up to 300 kV and the other for experiments up to 800 kV; in both cases, the voltage is applied to insulated-to-ground electrodes, polarized by two independent power supplies of opposite polarity, rated respectively $\pm 150\text{kV}-8\text{mA}$ and $\pm 400\text{kV} - 1\text{mA}$.

The two setups share the same Vacuum and Gas Injection systems and the same Control and Safety&Interlock systems.

The vacuum system is capable for both setups to guarantee vacuum level better than 10^{-5}Pa .

The control system implements the man-machine interface, the direct control of the Power Supplies and acts as the supervisor for the Vacuum System and for the Safety & Interlock hardwired system. The Control System has been developed in the programming environment LabVIEW.

The HVPTF has multiple goals: the near term objectives are the test campaign at 300 kV for the validation of the voltage holding predictive model described in [1], followed by the campaign at higher voltage –up to 800 kV– aimed at studying the effect of electrode material, surface finishing and gas injection on the breakdown voltage and dark current generation and at investigating voltage conditioning procedures, in clean and reproducible conditions. During the construction of the 1 MV MITICA accelerator, the HVPTF will be also employed for the development and/or the acceptance of components before their installation inside the vacuum vessel of MITICA, in order to improve the reliability and availability of this experiment.

For these reasons, the HVPTF combines a high degree of flexibility to minimize the shut down period for the setup changes with an accurate control of the vacuum system and of the power supply to guarantee clean and reproducible experimental conditions, making thus possible also a fruitful cooperation with the existing HV laboratories of the Neutral Beam community.

[1] N. Pilan, A. De Lorenzi, P. Veltri, Voltage holding prediction in multi electrode – multi voltage systems insulated in vacuum, submitted at the IEEE Transaction on Dielectric and Electrical Insulation