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HV Discharges Monitoring at HVPTF: Perspectives from X-ray Spectroscopy

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MITICA is an experiment located at Consorzio RFX which aims to create a prototype for ITER's Neutral Beam Injector (NBI). Since its design features an unprecedented potential difference (1 MV) there is an interest in researching means to prevent discharges in vacuum, which might prove fatal to the structure of the machine. In this context, High Voltage Padova Test Facility (HVPTF) is an experimental device with the aim of studying the processes leading to such undesirable discharges. HVPTF features a vacuum chamber containing two electrodes which can achieve an HV difference up to 800 kV. Both the vacuum (pressure, gas composition) and the electrodes (shape, distance) can be controlled in order to produce different conditions. Supplied voltage, current and pressure are monitored, as well as the bremsstrahlung hard X-rays produced by the free charges accelerated by the HV interacting with the electrodes.

The aim of this work is to show X-ray spectroscopy to be a promising monitoring mechanism, allowing for various insights in the physics of discharges. This contribution details the scintillators used to collect data (one LYSO and one LaBr), the development of the analyzing software, the resolution of issues like pile-up discrimination and time calibration, and some of first results obtained from the data acquired during the period between 2019 and 2022. Future perspectives will be also drawn, in particular related to the recent installation of a new Gas Electron Multiplier (GEM) detector on HVPTF.

Topic

Experiments and Diagnostics

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