Test and results of the electro-hydraulic breaks for the SPIDER cooling plant

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In the framework of the activities foreseen for PRIMA (Padova Research Injector Megavolt Accelerated) the SPIDER (Source for Production of Ion of Deuterium Extracted from Rf plasma) experiment plays an essential role on the goal of extracting, from an ITER size negative ion source, an ion beam current of 60 A (H-), 40 A (D-) and 100 keV as acceleration energy.
The main components of the SPIDER experiment consist of a beam source, a 100kV accelerator, a short pulse calorimeter (STRIKE) and a beam dump. All the components are positioned inside a cylindrical vacuum vessel (6000mm long and internal diameter of 4000mm approximately).
Being at -100kV electrical potential the beam source is installed on an electrically insulated frame.
The connection between the SPIDER cooling plant and the beam source shall be realized by an interface suitable to guarantee the electrical insulation, being the entire cooling plant at ground potential.
The electrical insulation is done by means of two high voltage bushings (positioned on the bottom part of the vacuum vessel) and a set of electro-hydraulic breaks. The bushings guarantee the insulation between the beam source and the vacuum vessel; the electro-hydraulic breaks guarantee the electrical insulation.
The aim of the tests is to study and characterize the behaviour of standard commercial pipes, made of non conductive material, working on non standard condition. The SPIDER working condition will be replicated by means of 100 kV_{dc} voltage application between the electrical break ends and ultrapure water flow inside the break.
In particular the results of three types of tests will be presented: tests on insulating breaks in dry condition (carried out in order to measure the leakage current due to bulk/superficial material conductivity); tests on insulating breaks in wet condition (the breaks will be filled with ultrapure water at atmospheric pressure and at room temperature); combined electrical and thermo-hydraulic tests (in order to be subjected to conditions similar to those occurring during SPIDER operations). To evaluate erosion and corrosion (due to electrochemical phenomena) the water conductivity, temperature and flow velocity will be monitored.