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Characterization of plasma-discharge Capillaries for Plasma-based Particle Acceleration

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Novel particle accelerators based on plasma technology allow a drastic reduction in size, due to the high accelerating field established inside plasmas, which are created and confined by specific devices. Plasma Wakefield Acceleration experiments are performed at the SPARC_LAB test facility (Laboratori Nazionali di Frascati - INFN) by using gas-filled capillaries, in which the plasma formation is achieved by ionizing hydrogen gas through high voltage pulses.

In this work, the characterization of gas-filled plasma-discharge capillaries is presented. Several geometrical configurations are tested, including capillaries with different channel shapes and arrangement of inlets positions for the gas injection. Such configurations are designed in order to enhance the uniformity of the plasma density distribution along the plasma channel, which is necessary to improve particle beam acceleration. Plasma sources are characterized by means of the spectroscopic technique based on the Stark broadening method, which allows to measure the evolution of the plasma density profile along the channel. In addition, the CFD software OpenFoam is used to simulate the dynamics of the neutral gas during the filling of the capillary.

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Footnotes

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Yes

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