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Development of a Marx Generator Discharge Circuit for High-Current Plasma Capillary Discharges

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In the context of plasma-based accelerators, one of the main advantages lies in their compactness and lower overall cost compared to conventional machines. Beyond acceleration, plasma can also be used to focus (plasma lens) and bend particle beams within compact structures such as discharge-based plasma capillaries. Beam bending in such devices requires a tailored capillary geometry and a dedicated discharge circuit capable of delivering high currents —typically above 10 kA—through the plasma. In this work, we present the development of a new type of discharge system based on a Marx generator, specifically designed to deliver more than 50 kV and 15 kA into a 20 cm-long capillary.

Several discharge configurations have been tested to optimize the setup for this application. Spectroscopic diagnostics were employed to characterize the plasma parameters. Additionally, numerical simulations were conducted to estimate the resulting magnetic field distribution, and beam dynamics studies were performed to evaluate the guiding effect on a charged particle beam.

Primary author: DEMITRA, Romain (Istituto Nazionale di Fisica Nucleare)

Co-authors: BIAGIONI, Angelo (Istituto Nazionale di Fisica Nucleare); PELLEGRINI, Donato (Istituto Nazionale di Fisica Nucleare); CRINCOLI, Lucio (Istituto Nazionale di Fisica Nucleare); FERRARIO, Massimo (Istituto Nazionale di Fisica Nucleare); Dr POMPILI, Riccardo (Istituto Nazionale di Fisica Nucleare); DE NARDIS, Thomas (INFN); LOLLO, Valerio (LNF)

Presenter: DEMITRA, Romain (Istituto Nazionale di Fisica Nucleare)

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