Contribution ID: **41** Contribution code: **1** Type: **not specified**

Double pulse generator for discharge plasmas for particle accelerators

Thursday 7 July 2022 09:43 (8 minutes)

N. Torrado 1, N. Lopes 1, J. Fernando Silva 2, C. Amoedo 3 and A.Sublet 3

1 GoLP/IPFN, Instituto Superior Técnico, Lisbon, Portugal
2 INESC-ID, Instituto Superior Técnico, Lisbon, Portugal
3 CERN, Geneva, Switzerland

The AWAKE experiment, running at CERN, investigates particle acceleration in plasma wakefield [1]. Since the current plasma source (10 m long and created in a rubidium vapour by laser field ionization [2]) is applicable only to a limited length, new scalable technologies are being developed, namely a helicon plasma source [3] and direct current gas discharges. The latter is a method that rapidly ignites the plasma and further heats it by applying a current between two electrodes immersed in the gas, inside a glass tube.
To produce the required plasma discharges, a high-power double pulse generator was designed and tested using a 5 m plasma cell setup [4]. The first pulse uses up to 120 kV to ignite the plasma into a relatively low current arc (10 A). The reduction in impedance allows the second pulse to increase the arc current up to 400 A using a lower voltage (up to 10 kV). This raises the ionisation fraction of the plasma to the AWAKE required density range [5]. The scalability is possible due to magnetic circuits (composed of common-mode chokes) that guarantee synchronization of discharges and current uniformity across multiple series tubes with shared electrodes.
In this presentation, I will describe the electrical components of the plasma source and the experimental results obtained from the double pulse generator and the current balancing magnetic circuit.

References

[1] A. Caldwell et al., Nature Physics 5, 363 (2009)
[2] G. Plyushchev et al., Journal of Physics D: Applied Physics 51 (2018)
[3] B. Buttenschon et al., Plasma Physics and Controlled Fusion 60 (2018)
[4] N. Torrado et al., IEEE Transactions on Power Electronics (submitted 2022)
[5] P Muggli et al., Plasma Phys. Control. Fusion 60, 014046 (2018)

Primary author: TORRADO, Nuno (GoLP-IPFN)

Presenter: TORRADO, Nuno (GoLP-IPFN)

Session Classification: Scientific session