MonPS04

Development of a compact high intensity ion source for light ions at CEA-Saclay

O. Delferrière*, J. Franck, F. Harrault, Y. Gauthier, O. Tuske,

Commissariat à l'Energie Atomique, CEA/Saclay, DSM/IRFU, 91191-Gif/Yvette, France

During the past 5 years, a R&D program has been launched to improve the beam quality of ECR 2.45 GHz high intensity light ion sources for high power accelerators like IPHI, IFMIF, or SPIRAL2. The main goal was to minimize the divergence and emittance growth of intense beams due to the space charge as early as possible on the dual solenoid low energy transfer for a better injection in the RFQ, the second stage of acceleration. This has been achieved by reducing the length of the extraction system, and also the length of the LEBT, to be able to put the first solenoid as closely as possible to the extraction aperture. This was performed with the ALISES[1] concept (Advanced Light Ion Source Extraction System). Encouraging results have been obtained in 2012[2] but limitations due to Penning discharges in the accelerating column have been observed and also successfully simulated with 3D electromagnetic TOSCA[3] code. Taking advantages of ALISES source geometry, intensive studies and simulations have been undertaken to find a solution to eliminate the discharge phenomena. Innovative and compact source geometry has been found and all the components of the source have been fabricated. The source has been assembled at the beginning of this year and first tested without plasma, to make high voltage tests with optimal magnetic field. After successful results, the source has been installed on the BETSI test bench to produce the first plasma and extract the first proton beam. A proton beam of 43 mA has been easily produced at 50 kV, with an extraction aperture of 6mm diameter in CW mode.

This new prototype and its performances will be described, as well as magnetic field configuration studies and its influence on the extracted beam.

References

[1]O. Delferrière et al., Rev. Sci. Instrum. 83, 02A307 (2012).
[2]S. Nyckees et al., Rev. Sci. Instrum. 83, 02A349 (2012)
[3]Opera-3D, Cobham, Kidlington, Oxford OX5 1JE, UK