Preliminary design and fabrication of the CER microwave proton ion source

Gábor Anda, S. Bató, B. Leskó, D. Oravetz, A. Zsákai
Centre For Energy Research, Budapest, Hungary
E-mail anda.gabor@ek-cer.hus

A new medium current (20mA max), low normalized beam emittance (< 1 π mm.mrad) ECR microwave H^+ source is currently in the last stages of fabrication at the Centre for Energy Research, Budapest, Hungary. The design is intended to be a high stability (energy ripple below 1%) ion source capable of delivering a 20 mA continuous or pulsed (0.1-10ms @ 0.01-25Hz) proton beam with 35-70 keV beam energy. The proton source is part of the compact neutron research laboratory will be built in Martonvásár, Hungary.

The design is based on the most commonly used arrangement [1]: MW generator followed by a four stub tuner, E-bend, DC-break, window (vacuum boundary), E-bend, and at last a four section matching transformer [2] connected to a 90/100mm (diameter/length) cylindrical chamber.

Magnetic field is generated by permanent magnets (6 magnet bars surround the chamber axially). Among the magnet bars 15 pieces of 2 mm holes are placed (at 5 section, 3 in a row) to have the possibility to observe the discharge at different parameter settings, measure the vacuum in the chamber and for hydrogen gas inlet.

Simulations are conducted to determine the parameters of the permanent magnet bars (sizes, grade) and ferromagnetic components to ensure the desired magnetic field inside the cylindrical chamber.

High voltage insulators are installed vertically instead of horizontally. This way the distance between the extraction slit and the entrance of the ion optic can be extremely short. Having the possibility to move the ion source physically (a few mm) it might be reliable to leave out the LEBT line from the system.

References

[1] Rev. Sci. Instrum. 81, 02B313 (2010); https://doi.org/10.1063/1.3266145
[2] Rev. Sci. Instrum. 85, 063301 (2014); https://doi.org/10.1063/1.4881782