

Measurement of optical emission from the hydrogen plasma of the Linac4 ion source and the SPL plasma generator

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At CERN, a non caesiated H⁻ ion source derived from the DESY ion source [1] is operated on the test stand of CERN's future 160 MeV H⁻ linear accelerator (Linac4) [2]. For a proposed High power Superconducting Proton Linac (HP-SPL) [3], a non caesiated plasma generator was designed [4] to operate at the two orders of magnitude larger duty factor required by the SPL. The commissioning of the plasma generator test stand and the assembly of the plasma generator prototype are scheduled during the summer 2010.

The major design changes to the high power plasma generator include the displacement of the multicusp magnetic confinement, to leave space for the water cooling circuit of the AlN plasma chamber wall; this motivated the change to a Halbach multicusp configuration. The heating of the permanent magnets by RF induced eddy currents will be suppressed by the inclusion of copper shielding [5]. The 2MHz RF generators (100 kW, 50 Hz repetition rate) was successfully commissioned; its frequency and power will be controlled by arbitrary function generators during the 1 ms plasma pulse. The RF antenna is surrounded by ferrites and permanent magnets; its specific coupling to the plasma is being modelled via equivalent electrical circuits [6].

In order to characterize the plasma, an optical spectrometer, a rest gas analyzer and a Langmuir probe will be used. Optical spectrometry allows direct comparison with the currently commissioned linac4 H⁻ ion source plasma.

In this paper, the SPL plasma generator test stand is described, and the first measurements of the optical emission of the Linac4 ion source and of the SPL plasma generator plasmas are presented.

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