HIGH CURRENT ECR PROTON SOURCES FOR LINEAR ACCELERATORS [[1]](#footnote-1)\*)

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Ion sources are one of the key elements of any heavy particle accelerator. As the characteristics of accelerator systems improve, so do the requirements for ion injectors. In the largest projects, such as “The International Fusion Materials Irradiation Facility” (IFMIF), “Large Hadron Collider” (LHC), “European Spallation Source” (ESS), hydrogen and deuterium ion beams with a current of 100 mA at normalized emittance not more than 0.2 π‧mm‧mrad are needed. One of the promising sources of ions is a source based on a discharge maintained in open magnetic traps by powerful radiation from gyrotrons under conditions of electron cyclotron resonance (ECR). The fact is that the use of high-power radiation in the millimeter wavelength range makes it possible not only to significantly increase the plasma density (which increases in proportion to the square of the frequency of the radiation supporting the discharge), but also to switch from the classical (collisionless) to the quasi-gasdynamic plasma confinement regime keeping electron temperature at significantly high level, but with a significantly lower lifetime (~10 μs), which ensures an increase in the plasma flux density from the trap by hundreds of times (plasma fluxes with an ionization degree close to 100% with an equivalent current density of up to 10 A/cm2 have been obtained). The use of powerful millimeter radiation from modern gyrotrons ensures the maintenance of a discharge with a record high specific energy input for ECR ion sources (up to 200 W/cm3), which makes it possible to maintain a dense plasma (up to 1014 cm–3) with an optimum temperature of 50–100 eV for hydrogen dissociation and ionization. In experiments, continuous and pulsed proton and deuteron beams were obtained with a current of up to 100 - 500 mA and an RMS normalized emittance of 0.2 π·mm·mrad. The possibility of generating a pure proton beam without molecular ions (the fraction of impurity ions is less than 0.1%) is demonstrated.

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/R/ru/KT-Skalyga.docx) [↑](#footnote-ref-1)