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Injection of auxiliary electrons for increasing plasma density in highly charged and high intensity ion sources

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Different electron guns based on cold cathode or hot cathode technology have been developed since 2009 at INFN for operating within ECR plasma chamber as sources of auxiliary electrons with the aim of boosting the source performances. Electron guns have been characterized in terms of duration, stability and impact on the plasma density and successfully tested on the CAESAR source. Their application to Microwave Discharge Ion Source, where plasma is not confined, has required an improvement of the gun design, in order to "screen" the cathode from the plasma particles and enable it to survive in a high energy content plasma environment. The experimental tests carried out on a plasma reactor show a boost of the plasma density, ranging from 10 to 90% when the electron guns are used, depending on the plasma regions (more relevant in the halo). The results will be commented along the paper and interpreted by plasma diffusion models.