

Magnetic cusp configuration of the *SPL* plasma generator

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The SPL is a Superconducting Proton Linac for a high power H⁻ beam for neutrino production. As part of this study, a new RF driven external antenna H⁻ plasma generator has been developed to withstand an average thermal load of several kW. The magnetic configuration of the new plasma generator is a dodecapole magnetic cusp field. A magnetic dipole filter field separates the plasma heating and H⁻ production regions, and ferrites are placed around the RF antenna to enhance the coupling of the RF to the plasma. In order to improve the plasma confinement, the N-S configuration of the cusp magnets has been replaced by an offset Halbach configuration where each cusp magnet consists of three magnetic sub-elements with different orientation of the magnetization. A design challenge is the dissipation of RF power induced by eddy currents in the cusp and filter magnets which may lead to demagnetization. A copper magnet cage has been developed that shields the cusp magnets from the radiation of the RF antenna. The approach has been studied by electromagnetic modelling of the plasma generator and the results verified experimentally.