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Superconducting thin films on higher order mode antennas for increase the CW performance of SRF cavities at MESA

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The Mainz Energy-Recovering Superconducting Accelerator (MESA), an energy-recovering (ER) LINAC, is currently under construction at the Institute for Nuclear physics at the Johannes Gutenberg-Universität Mainz, Germany. In the ER mode continuous wave (CW) beam is accelerated from 5 MeV up to 105 MeV. The energy gain of the beam is provided through 2 enhanced ELBE-type cryomodules containing two 1.3 GHz 9-cell TESLA cavities each. By pushing the limits of the beam current up to 10 mA, a quench can occur at the HOM Antennas. The quench is caused through the increased power deposition induced by the electron beam in ER mode. Calculation shown that an upgrade from 1 mA to 10 mA is increasing the deposited power in the HOMs up to 3080 mW. 30% of this power will be out coupled with the HOM couplers and can be used as a thermal input. Simulations show a power limit of 95 mW which includes the power for 1 mA but is exceeded at 10 mA. A solution to increase the power limit are superconducting thin films which provides higher critical fields, temperature and currents. As candidates are Nb₃Sn and NbTiN are chosen. First simulations of the power limit for coated HOM antennas are shown.

Footnotes

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