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Thin films on HOM antennas to push the limits for higher beam currents 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 continues 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. This is caused by an extensive power deposition within the antenna. Calculations have shown that a power transfer of 1 W must be assumed. However, tests of the 1.5 GHz version of the TESLA HOM coupler have shown a quench limit of 43 mW in CW. To prevent a quench of the HOM antennas by high beam currents without mayor modification of the design of the HOM antenna and F-part it is necessary to find suitable materials. Nb3Sn and NbTiN can be applied as a coating to the HOM antennas and have higher critical parameters than pure Nb which will lead to a higher power limit. As a further approach to improve the power transfer the material for the HOM antenna will be changed to oxygen-free high thermal conductive (OFHC) Copper. The antennas with a Cu core will be coated first with Nb. The limit of the coated antennas will be tested with the cavities of a cryomodule from the decommissioned ALICE accelerator from STFC Daresbury.

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