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HOM antenna upgrades and refurbishment of TESLA cavities for the MESA ER-Mode

Thursday 25 September 2025 14:30 (3 hours)

The Mainz Energy-Recovering Superconducting Accelerator is currently under construction at the Institute for Nuclear Physics on the campus of the Johannes Gutenberg University Mainz. A future upgrade is planned for the multi-turn Energy Recovery (ER) mode, increasing the beam current from 1 mA to 10 mA in continuous wave at 1.3 GHz. Simulations have calculated an increased power deposition of 3 W in the Higher Order Modes (HOMs) of the TESLA cavities. The power, which is deposited by the passing electron beams through the cavity, is reduced in the cavity through the HOM dampers, but the power at the HOM antenna will increase up to 1 W. This will exceed the current limits and lead to a quench of the antenna. The quench limit could be increased by using an alternative superconducting material with a higher critical temperature than Niobium. Two candidates like Nb3Sn on Cu and NbTiN on Nb will be coated as a thin film on the antenna. Simulations have shown that the limit can be increased up to 1.1 W for NbTiN on Nb and 4.7 W for Nb_3Sn on Cu. Two TESLA cavities, from a cryomodule (CM) of the decommissioned ALICE(*) project, are refurbished in the clean room infrastructure of the Helmholtz Institute Mainz (HIM). The performance of the cavities will be tested in several configurations: after refurbishment, with the original antenna design, with coated antennas, and in the fully assembled cryomodule with an electron beam.

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Yes

Footnotes

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Author: PLATTNER, Paul (Johannes Gutenberg University Mainz)

Co-authors: HUG, Florian (Johannes Gutenberg University Mainz); STENGLER, Timo (Institut für Kernphysik)

Presenter: PLATTNER, Paul (Johannes Gutenberg University Mainz)

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