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## Conceptual RF design and modelling of a 704 MHz pillbox cavity for the Muon Cooling Complex

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The Muon Cooling Complex (MCC) is a prospective facility to develop technology essential for ionization cooling for a future high-energy Muon Collider at CERN. This cooling technique necessitates the utilization of normal conducting, RF accelerating cavities operating within a multi-Tesla magnetic field.

This study illustrates the conceptual RF design of a 704 MHz cavity equipped with beryllium windows for the muon cooling demonstrator. Based on the specifications from the beam dynamics, frequency-domain eigenmode simulations have been conducted to calculate the primary RF figure of merits for the cavity. Several materials were simulated for the cavity walls, including copper, beryllium, and aluminum. In selected cases, more advanced engineering analyses, including thermo-mechanical simulations and design of the cooling channels, have been performed to enable operation at gradients up to 44 MV/m within strong solenoidal magnetic fields up to 13 T. Furthermore, the impact of the beam loading on the muon energy spread is investigated, and appropriate mitigation techniques are proposed.

### Footnotes

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