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Electromagnetic and mechanical optimization for a quadrupole resonator at IMP

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The Quadrupole Resonator (QPR), was invented by Chiaveri et al. at CERN, is a dedicated RF characterization equipment for superconducting material. It employs the calorimetric compensation technique and has a surface resistance resolution of less than 1 nOhm, operating over a wide range of parameters, such as temperatures, resonant frequencies and magnetic fields. As a part of R&D work of superconducting material for SRF application in particle accelerators. A QPR with operating frequency of 325 MHz has been developing at Institute of Modern Physics (IMP), CAS. In this paper, we present the detailed design of the QPR by CST studio and COMSOL Multiphyics. Our design focus on reducing the risk of Multipacting, field emission (B_{pk}/E_{pk}) and mode overlapping (delta f = f_{QPR}-f_{dipole}), maximizing the frequency of the mechanical vibration mode , enhancing the attainable peak magnetic field (H_{sample-pk}), minimizing and the leak field and the frequency shift induced by helium pressure fluctuation (df/dp). Our simulated results indicate that the optimized structure has good electromagnetic performance and mechanical stability. The cavity will be fabricated soon.

Footnotes

Paper preparation format

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Region represented

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