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Cavity Design Simulation for an Atomic Fountain Clock KRISS-F2

A cesium atomic fountain clock KRISS-F1 and an optical lattice clock KRISS-Yb1 share their duty of steering a hydrogen maser that generates local time scale in Korea. In order to secure the redundancy of primary frequency standards, we plan to build another fountain clock named KRISS-F2. Since the performance of a fountain clock depends largely on the microwave cavity, we make efforts on the cavity design estimating the distributed cavity phase (DCP) and cavity pulling effects by calculating field distribution using the finite element method (FEM). We have built a Monte-Carlo simulation code using MATLAB that calculates DCP shifts from the field distribution inside the cavity. Another effort we make on the cavity design is to reduce the rate of change of the cavity resonance frequency against temperature variation (df/dT) for the robust operation under loosely temperature-controlled environment. We find that a bimetal cavity with around 10-cm long aluminum caps plus a copper cylinder tube exhibits fairly reduced df/dT value with only a small loss of Q. In this symposium, we present our cavity design and the estimated shifts and uncertainties of cavity-related effects like DCP and cavity pulling under temperature changes.

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