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Development of a Single Mode Cavity for the Third Harmonic RF-System of PETRA IV

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PETRA IV will use the BESSY HOM damped cavities for the fundamental 500 MHz RF system. In order to reduce the negative effects of Touschek and intrabeam scattering on the lifetime and emittance of the electron bunches, third harmonic cavities will be installed. They elongate the bunches and thus reduce their charge density. One possible candidate for a third harmonic cavity is the 1.5 GHz ALBA HOM damped cavity which is mainly a 500 MHz HOM damped BESSY cavity scaled down by a factor of three. This cavity has, in active operation at BESSYII, successfully extended bunches at low beam currents. The resonator is expensive to build due to its complexity and the many independent cooling water circuits. The many independent cooling water circuits require complex water manifolds with all necessary flow and pressure meters. In PETRA IV, 24 of these cavities are required. Therefore, it is reasonable to look for an alternative cavity design. It should:

- Have a simple cavity design that is easy to fabricate.
- Have few cooling circuits.
- Have a higher HOM damping efficiency compared to the ALBA cavity.
- Have an adjustable coupling factor from zero to five.

An interesting candidate among the few single-mode structures is the “Shintake cavity”, named after its inventor. We have optimized the cavity design and have worked out the permissible mechanical tolerances to fulfill the electrical requirements using CST Microwave Studio. Results and are presented.

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