Status of the IH-7-gap Structure (IH7SS) for MAFF

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The IH-7-gap structure (IH7SS) [1] is the energy variable part of the MAFF-LINAC [2], which is planed to accelerate heavy, neutron rich fission fragments produced at the new highflux reactor FRM-II. The final energy of the ion beam is varied by two identical 7-gap resonators, which will be placed after the booster LINAC. Due to the higher shunt impedance of IH-structures compared to splitring resonators a higher resonator voltage in combination with a very compact design can be achieved with the same generator power.

In march 2000, the 1:1 model of one resonator was finally assembled and measurements could be performed to verify the MAFIA calculations. The IH-eigenmode ($TE_{(1,1,1)}$ Mode) frequency of the resonator, the gap-voltage distribution and the influence of the capacitive plunger turned out to be in good agreement with the measured characteristics of the resonator. The model was designed with several interchangeable parts (plungers, undercuts, flanges), so a variety of different design modifications could be tested.

Fig. 1: Partly assembled 1:1 copper model of the IH-7-gap structure with different plungers, assorted copper blocks to change the undercuts and copper bars to vary the flanges of the halfshells

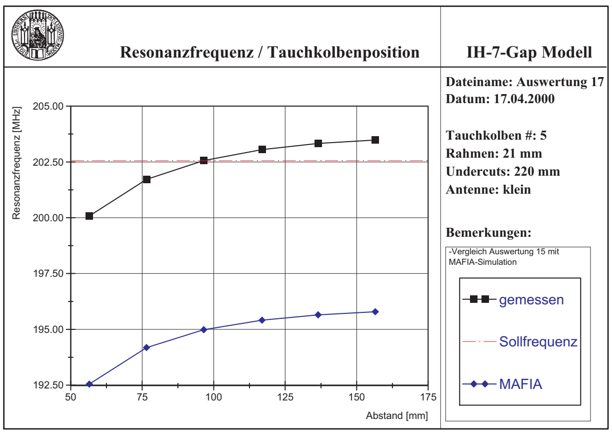

Fig. 2: Output sheet (DIADEM) of the eigenmode frequency depending on the plunger position showing the frequency shift between MAFIA calculations and the model measurements

Compared to the calculated frequencies the measured eigenmode frequencies were shifted between +3.80% and +3.93%. Considering a linear systematic error of +3.86% within the limits of the tested modifications, an accuracy of +/- 0.07% could be achieved!

The measurements also showed that the position of the capactive plunger used to finetune the eigenmode frequency of the resonator has no significant influence on the gap voltage distribution as long a reasonable distance to the beam axis is kept. Also different antenna designs and orientations had been tested to optimize the performance. One important result of these tests is, that due to the compact design the antenna influences the gap voltage distribution and eigenmode frequencies more than anticipated.

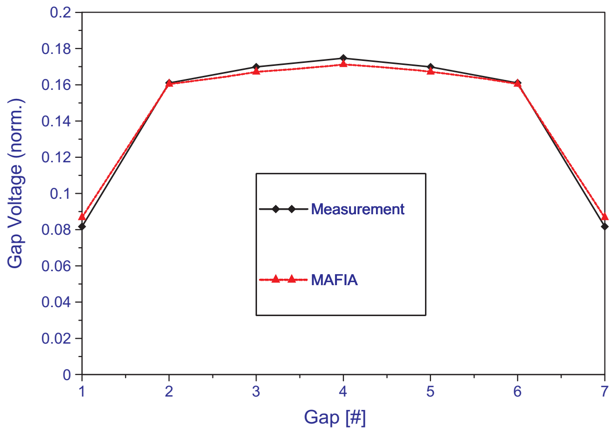

Fig. 3: Comparison between MAFIA calculations of the gap voltage distribution and the model measurements

The calculated shunt impedancy of 150 MΩ/m [1] could not be verified with the model, since the variable setup causes too much damping to aquire usefull results. Using different sets of copper blocks to assemble the same resonator geometry (two 5 mm undercut blocks instead of one 10 mm block e.g.) could change the measured quality factor by nearly one order of magnitude. However, experiences from the REX-ISOLDE IH-structure [3] justify the assumption that the quality factor and the shunt impedancy of the power resonator will be even higher than the calculated value.

Based on results of the resonator characteristics, the final dimensions of the power resonators had been determined and detailed construction drawings are already produced. The flanges of the halfshells and the undercuts are oversized, so frequency differences due to production tolerances can be corrected (milling the flanges increases the frequency of the IH-mode, milling the undercuts decreases the frequency). Manufacturers are contacted for offers to built the prototype of one resonator and the rf-power generator. The construction of a test bench is currently prepared in Halle 2 at the -25^o beam line, so that testing of the power resonator can start as soon as the resonator is delivered to Garching and assembled.

References

[1] H. Bongers *et al.*, Jahresbericht 1999, p. 78
[2] O. Kester, H. Bongers *et al.*, Jahresbericht 1998, p. 71
[3] S. Emhofer,H. Bongers *et al.*, Jahresbericht 1999, p. 74