Status of the cold model for the HE-Linac cavities

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Design of a ten gap model

In order to meet the challenges of the FAIR project requiring highest beam intensities an upgrade of the existing Universal Linear Accelerator (UNILAC) is planned. The 108.408 MHz post-stripper section is recommended to be replaced after almost 40 years in operation. All activities are focused on substitution of this UNILAC section by an improved Alvarez DTL [1]. Simulations are done to improve the rf-properties. The geometry of the drift tubes is to be changed to improve the ratio of shunt impedance to maximum surface field [2]. This geometry allows a more homogeneous surface current distribution as well.

A test bench for low power rf measurements with a 10 gap aluminum model (scale 1:3) is under construction (Fig. 1). The frequency scales correspondingly to three times 108.408 MHz (= 325.224 MHz). In the simulations the frequency is 324.694 MHz. It is chosen a bit lower than the reference frequency to have some freedom to reach the right frequency after the fabrication and shift it up with tuners. There could be some small unexpected errors in fabrication which influence the frequency. If the frequency is too high it is hard to tune it to lower frequency.

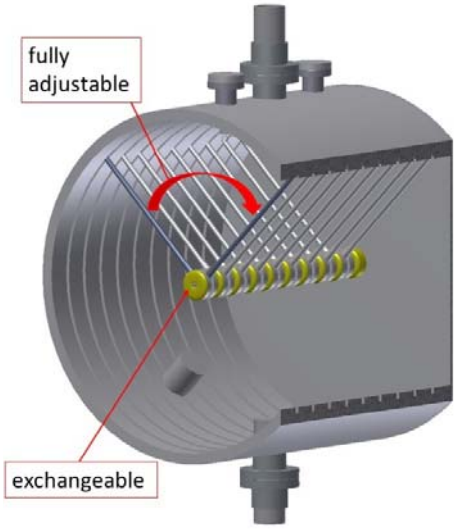

Figure 1: Design of the ten gap Alvarez model for a test bench for low power rf measurements.

The ten gap model with nine full and two half drift tubes at the tank cabs allows to vary the angle between the stems. The stem configuration of each drift tube has an influence on the field stability. In addition the drift tube cabs are dismountable to compare different drift tube geometries as mentioned above.

The goal is to optimize the rf-design geometry with respect to the field distribution stability. The calculated electric field profile along the beam axis shows a flatness better than 3 % (Fig. 2).

With the bead pull method the electrical field distribution will be confirmed as well as the field stability with respect to parasitic modes.

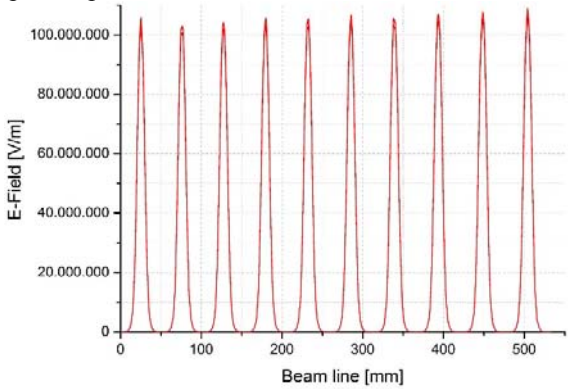

Figure 2: The calculated accelerating electrical field is very flat a βλ-type structure.

Tuning

To match the operation frequency tuners are needed. Three different positions for the tuners along the tank are investigated. The inductively coupling tuners are cylindrical with a diameter of 60 mm. The frequency deviation is 0.4 MHz per Tuner per 100 mm plug-in depth (Fig. 3). The field distribution is independent of the tuner position for all three tuners. The frequency shift of each tuner is the same.

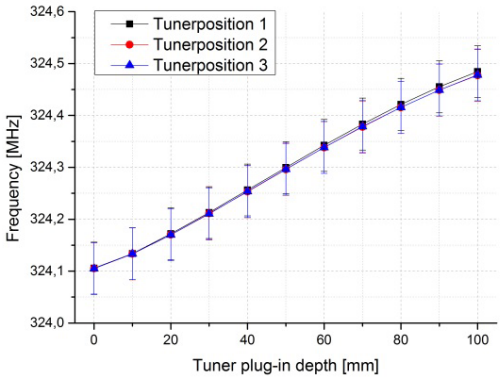

Figure 3: Simulated frequency deviation for the three possible tuner positions to test different fix and dynamic tuners.

Outlook

The fabrication of the 10 gap model is already started. The delivery of the model is expected in summer 2015. Tests are planned at the p-linac test bench.

References

[1] S. Mickat et al., internal report 2014
[2] X. Du et al. (this report)

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