Status of the High Gradient CH – Cavity*

Ali Almomani[#] *and Ulrich Ratzinger*
IAP – Goethe Universität, Frankfurt am Main, Germany

This pulsed linac activity aims on compact designs and on a considerable increase of the voltage gain per meter. A high gradient CH – cavity operated at 325 MHz was developed at IAP – Frankfurt. The mean effective accelerating field for this cavity is expected well above 10 MV/m at β = 0.164. This cavity is developed within a funded project. The results might influence the rebuilt and a later energy upgrade of the UNILAC – Alvarez section. Another motivation is the development of an efficient pulsed ion accelerator for significantly higher energies like 60 AMeV. The new GSI 3 MW Thales klystron test stand will be used for the cavity RF power tests. Detailed studies on two different types of copper plating will be performed with this cavity. The first measurement results for this cavity will be presented.

Introduction

Conventional DTL's are seriously limited in maximum field gain by thick walled drift tubes for housing focusing elements. This geometry causes extended parallel surfaces around the gaps loaded by high electric fields. The multipacting probabilities as well as the stored field energies are rather high at these cavities resulting in a reduced field gain. Additionally, maximum achievable electric fields are reduced by the presence of magnetic fields [1].

This paper is focusing on the development of CH – cavities with a high field gradient. One main goal of this work is to prepare for a possible later energy upgrade of GSI – Unilac, which will in future serve as heavy ion injector for the FAIR project.

CH – Cavity Design

At IAP – Frankfurt, a 7 gap CH – cavity (Figure 1) operated at 325 MHz with constant β=0.164 has been developed and expected to have a field gradient of about 13.3 MV/m [2-4]. This cavity was built in NTG GmbH and was delivered to IAP in December 2014. The main parameters of this cavity are given in table 1.

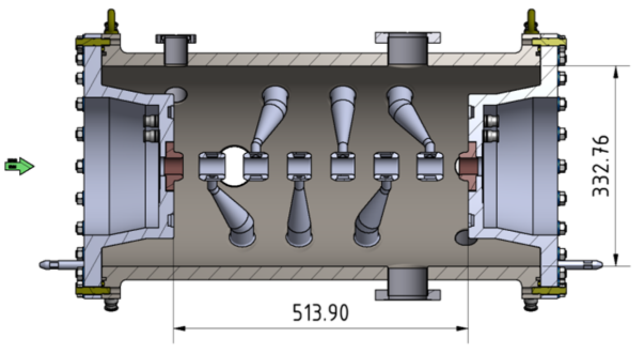

Figure 1: A 3D schematic view of the CH – cavity.

The geometry was optimized for modest surface peak fields – reaching up to 97 MV/m at very small spots on the drift tube edges.

The CH–cavity was built from stainless steel (Figure 2) and will be galvanically copper plated on its inner surface. This will be a challenge for such geometry. The cavity cylinder will contain no screwed connections and the end flanges are sealed by metal joints. Only the end half tubes are from massive copper.

Special care will be taken for the galvanic copper plating of the cavity. Two processes with different bath ingredients will be tested against each other at high rf power levels. Currently, the cavity was sent to Galvano-T for a first copper plating and is expected to be resent by end of March 2015.

Table 1: Main Parameters of the High Field CH – Cavity	
Number of Gaps	7
Frequency (MHz)	325.2
Voltage Gain (MV)	6
Eff. Accel. Length (mm)	513.9
Eff. Accel. Field (MV/m)	13.3
Power Loss (MW)	1.76
Eff. Shunt Impedance (MΩ/m)	52.15
Q_0 – value	12500
Drift Tube Aperture (mm)	27

Figure 2: The 325 MHz high-field cavity before the copper plating.

Conclusion

CH- type cavities may allow for a significant cost and size reduction of future ion linacs in the energy range up to about 100 AMeV.

Detailed investigations on the two different types of copper plating can be performed on this cavity and by using the GSI high power 325 MHz test stand driven by a 3 MW klystron.

References

[1] D. Stratakis et al., NIM A 620, 147–154 (2010).
[2] A. Almomani et al., PRST– AB **15**, 051302 (2012).
[3] A. Almomani et al., IPAC 14, THPWO012 (2014).
[4] A. Almomani et al., LINAC 14, THPB006 (2014).

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[#] a.almomani@iap.uni-frankfurt.de

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