Status of the IH-structure for REX-ISOLDE ◇

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For the REX-ISOLDE-project at CERN an IH-structure has been designed serving as booster accelerator for radioactive ions from an energy of 300 keV/u to an extraction energy, which can be varied from 1.1 MeV/u to 1.2 MeV/u by capacitive plungers [1]. The power resonator was developed according to results of a diploma thesis [2]. The resonator has been assembled and successfully vacuum-tested. A view inside the power-resonator is shown in figure 1.

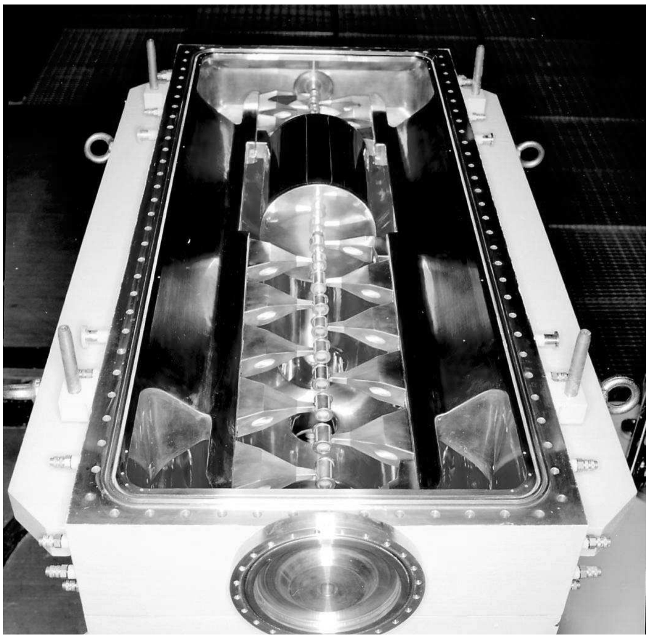

Fig. 1: A view inside the opened IH-structure. One can see the drift tubes and the inner-tank-quadrupole-triplett serving as thick drift-tube with radial focusing forces.

A too thick copper layer (500 μm instead of 50 μm) was put on the drift tubes by the fault of the company doing the copper-plating and for this reason the resonance frequency is too low. Therefore several problems arose [3]: One problem of the too low resonance frequency is that the plungers can not be put close enough to the drift-tubes in order to adjust the gap voltage distribution for 1.1 MeV/u. To reach the lower energy of 1.1 MeV/u, it will be necessary to build a new drift-tube-structure with proper size. The new structure has been ordered so far. From low level-measurements it could be shown, that a reduction of the undercut-length in the low energy part will give the ability to reach the gap-voltage-distribution for the final energy of 1.2 MeV/u. Measurements with a well defined undercut-length reduction were made to get to know the proper undercut length (see fig. 2). In figure 3 the result of reducing the undercut length in the low energy part is shown. As result of displacing the magnetic field in the area where the reduction-plate is located, the gap voltages in this area, which are produced by induction, are reduced as well. From this it was estimated that an undercut-length-reduction of 6 mm is necessary.

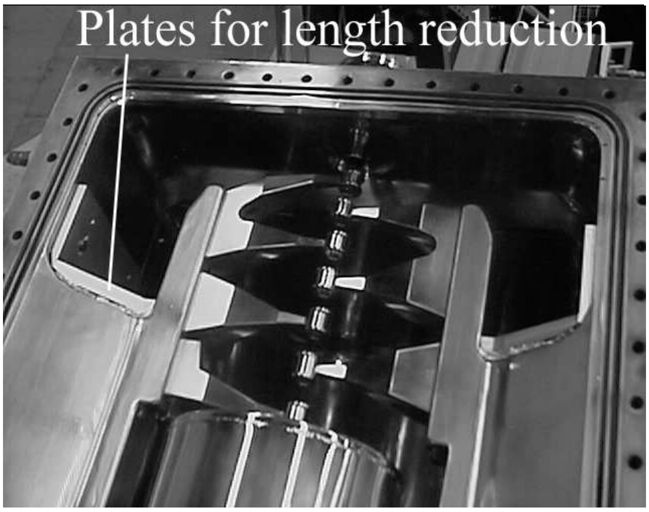

Fig. 2: Aluminium-plates are used to reduce the undercut-length at the low-energy-side of the IH-structure.

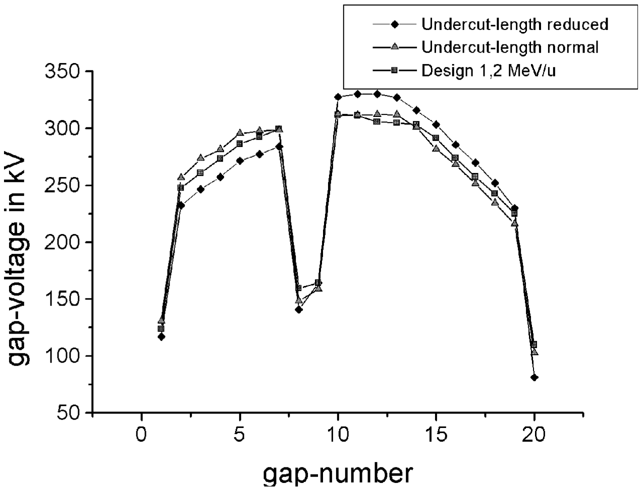

Fig. 3: Comparison of the gap voltage distribution with and without undercut-length reduction. With this reduction the wanted design-gap-voltage distribution could be calculated. The low energy part is on the left handside of the graph, the high energy part on the right handside.

The measured quality factor is - in dependence of plunger positions - 15500 to 16500, the shunt-impedance 300 - 330 MΩ/m. These values are comparable to GSI-HLI IH-structure (Q=20000; Z=370 MΩ/m) and the tank 1 of CERN-LINAC3 (Q=12550; Z=340 MΩ/m) [4]. With the measured data it is expected that about 60 kW rf-power will be sufficient to reach the wanted gap-voltage distribution.

References

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[4] U. Ratzinger, habilitation thesis, Johann Wolfgang Goethe Universität Frankfurt am Main, Jul. 1998

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