The RFQ-IH Matching Section of REX-ISOLDE

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For a matched transition between the RFQ and the IH-structure of the REX-accelerator [1], it is necessary to control the longitudinal and radial beam parameters. This is done by the system shown in fig.1. The matching section consists of two quadrupole triplets, a buncher and a diagnostic box. In order to keep the line short, quadrupoles with small apertures are used. The use of triplets allows a "round" and focused beam at the buncher and at the IH entrance. This is one important aspect, because a limited extension of the beam is needed in the buncher gaps to minimize defocusing effects and radial dependencies of the transit time factor.

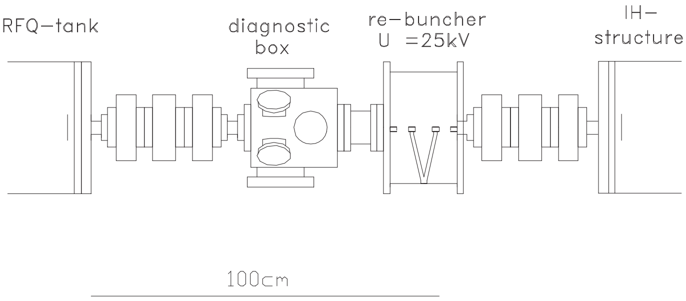

Fig. 1: The Matching Section of REX-ISOLDE

The buncher of the matching section is designed to match the exit phase spread of the RFQ beam of about $\pm(°14)$ to the longitudinal acceptance of $\pm 10°$ of the IH-structure. The length of the structure, including beam diagnostics, the rebuncher and the quadrupole triplets, totals 1.50 m. Fig.2 shows a plot of the 3-gap spiral resonator.

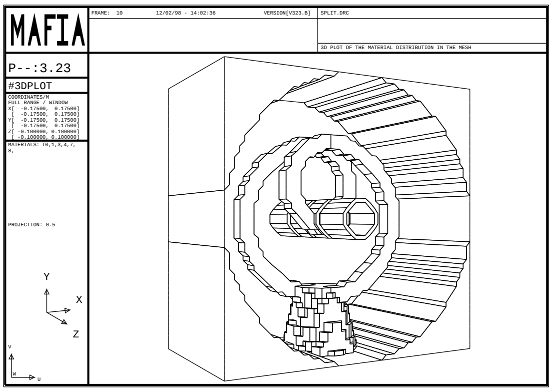

Fig. 2: MAFIA Plot of the 25 kV rebuncher, showing the center drift tubes supported by the split ring as well as the two drift tubes mounted on the end flanges of the resonator

The buncher itself has a length of 256 mm and a diameter of 350 mm. It contains four drifttubes with a diameter of 40 mm and a gap-width of 10mm between them. The maximum voltage between the gaps will be U = 25 kV. Layout, construction and measurements of the bunching device are made at the Institut für Angewandte Physik (IAP) in Frankfurt. The resonator is a spiral structure which is a well known and common structure for buncher cavities [2]. Optimization was done using the program MAFIA [3]. The operating frequency will be 101.28 MHz, the particle energy after the RFQ will be 300 keV/u or $\beta = 2.54\%$.

MAFIA calculations deliver the rf-parameters like quality factor and shunt impedance and the field distribution. Preliminary results show values for Q=7000 and $R_p = 2.8\,M\Omega$, which have to be compared to lumped circuit results and extrapolation to other resonators of the same type [4]. In comparison to measured values of the quality factor and the shuntimpedance of similar resonators the values of the MAFIA calculations are about a factor of 2 higher, which is typical for all structures with resonant lines. Fig.3 shows the distribution of the electric field along the axis.

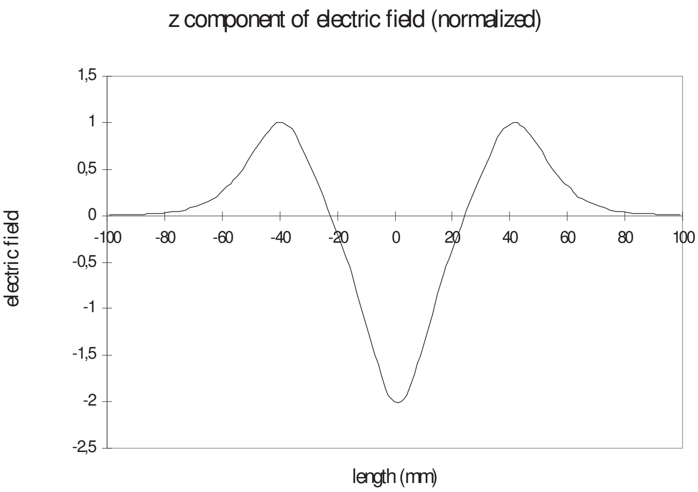

Fig. 3: electric field distribution along beam axis

References

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