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Development of a 217-MHz superconducting CH-structure*

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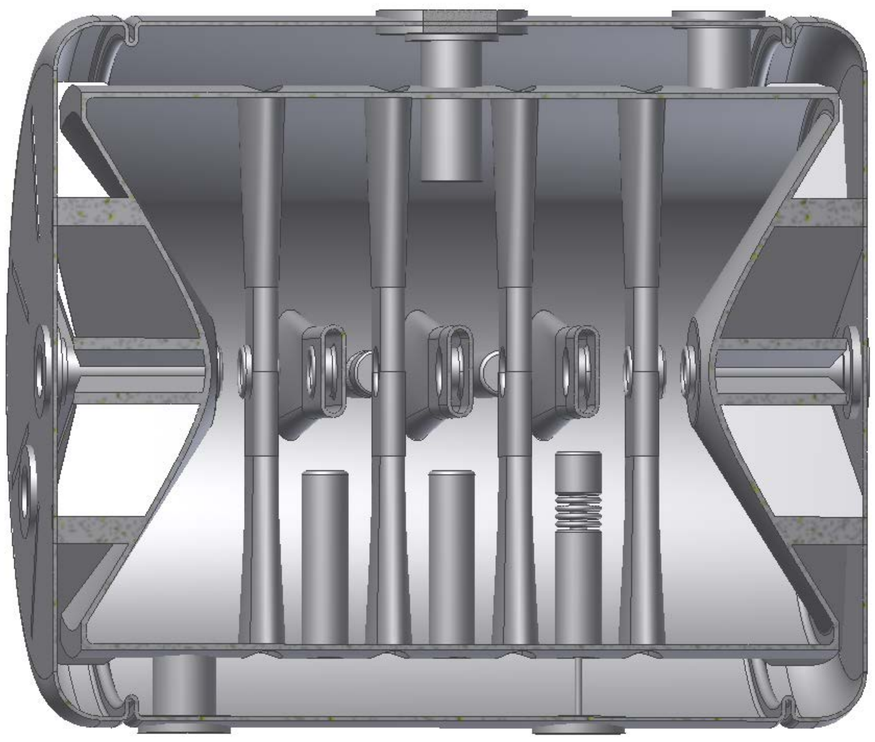
Abstract:

To compete in the production of Super Heavy Elements (SHE) in the future a 7.3 AMeV superconducting (sc) continuous wave (cw) LINAC is planned at GSI. The baseline design consists of 9 sc Crossbar-H-mode (CH) cavities operated at 217 MHz. Currently an advanced cw demonstrator is under design at the Institute for Applied Physics (IAP) at Frankfurt University. The purpose of the advanced demonstrator is to investigate a new concept for the superconducting CH structures. It is based on shorter CH-cavities with 8 equidistant gaps without girders and with stiffening brackets at the front and end cap to reduce pressure sensitivity. One major goal of the advanced demonstrator is to show that the new design leads to higher acceleration gradients and smaller E_p/E_a values. In this contribution first simulation results and technical layouts will be presented.

Structure layout

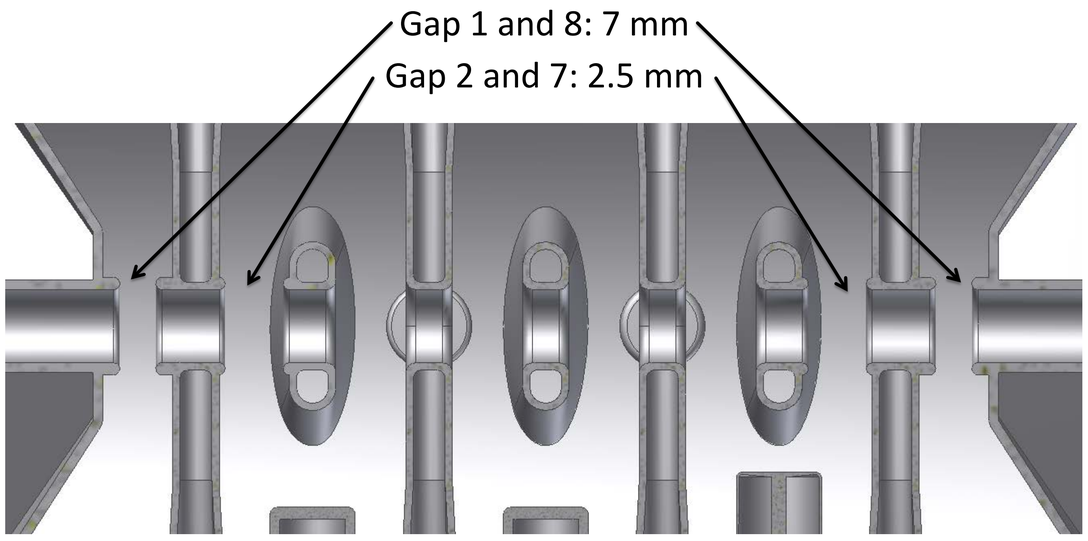


Layout of the sc 217 MHz CH cavity

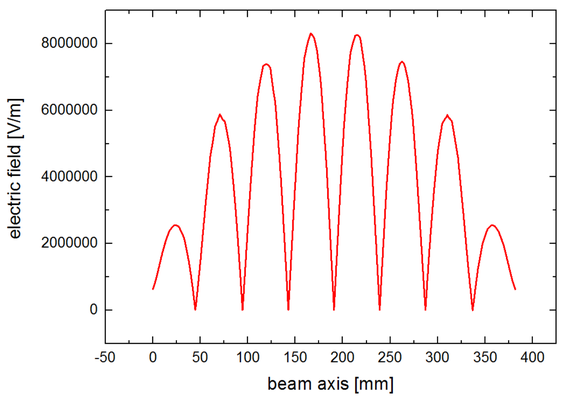
Parameter	β	f	#cells	Eff. length	Inner diam.	E_a	E_p/E_a	B_p/E_a	G	R/Q
Unit	-	MHz	-	mm	mm	MV/m	-	mT/(MV/m)	Ω	Ω
Value	0.069	215.5	8	381.6	412	5	5.2	8.5	51	1045

Drifttube design

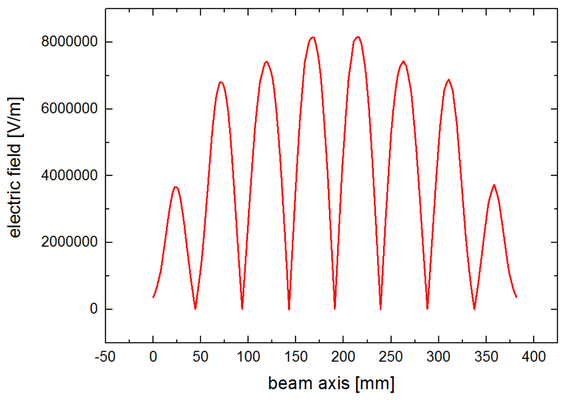
- To increase the electric field along the beam axis several CST simulations have been performed to determine the optimum drifttube length for the different gaps



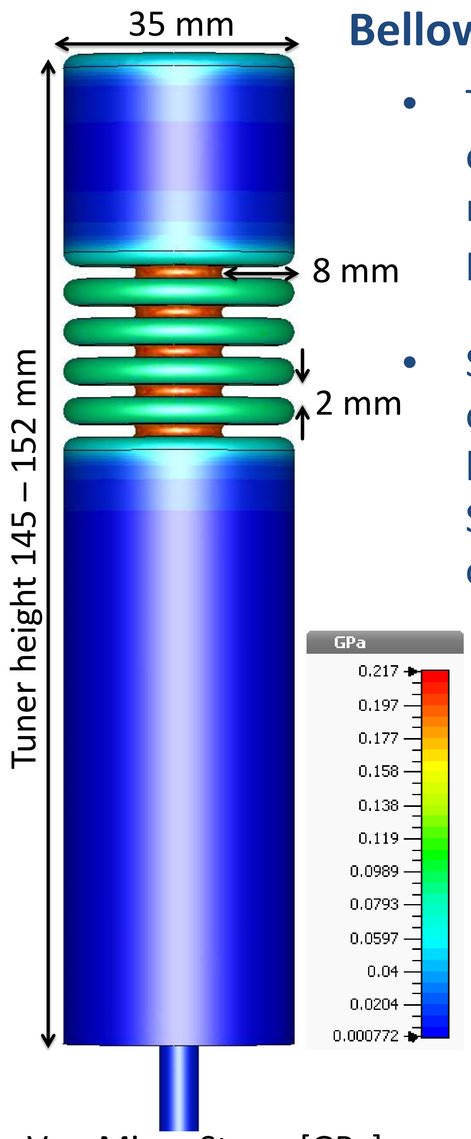
Electric field without drifttubes



Electric field with drifttubes

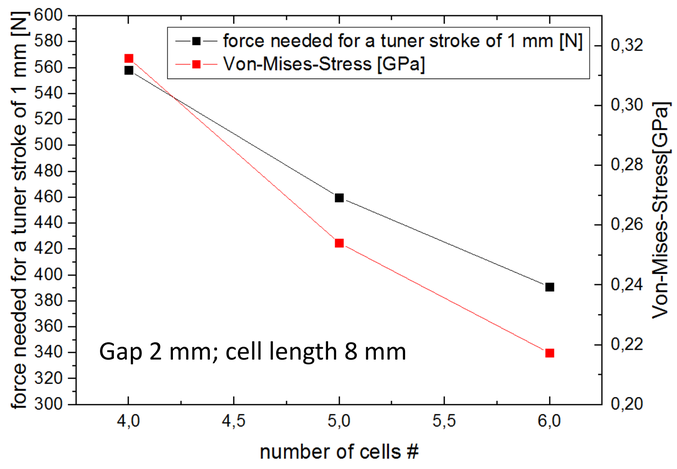


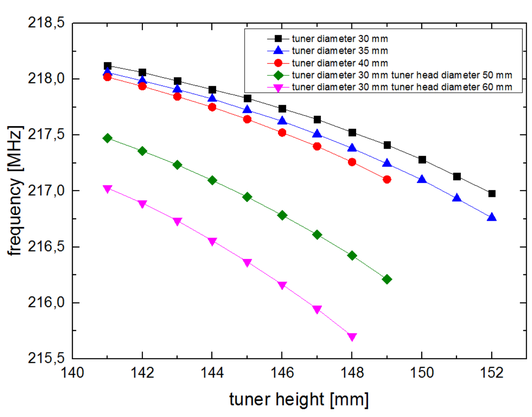
Bellow tuner development

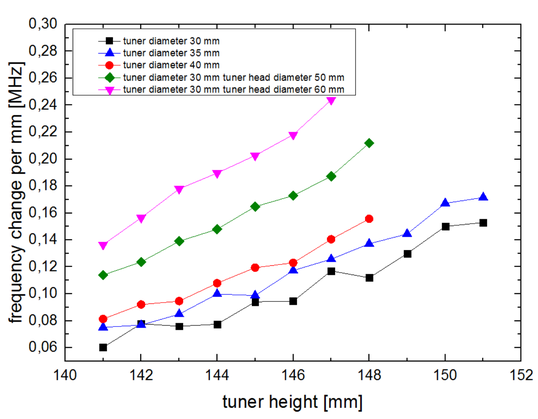


Von-Mises-Stress [GPa]

- To investigate the mechanical properties of the bellow tuner several structural mechanical simulations have been performed
- Several parameters like the number of cells, cell length and gap distance have been optimized to keep the von-Mises-Stress under 0.25 GPa for a tuner stroke of 1 mm







Buffered-chemical-polishing (BCP)

- It is estimated that the surface preparation with BCP will affect the interior of the cavity more than the cavity itself
- Several simulations concerning different BCP erosions at the stems and the cavity have been performed to investigate the resulting frequency shift