*Work supported by GSI, BMBF Contr. No. 06FY7102
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Cold Power Tests of the sc 325 MHz CH-Cavity*

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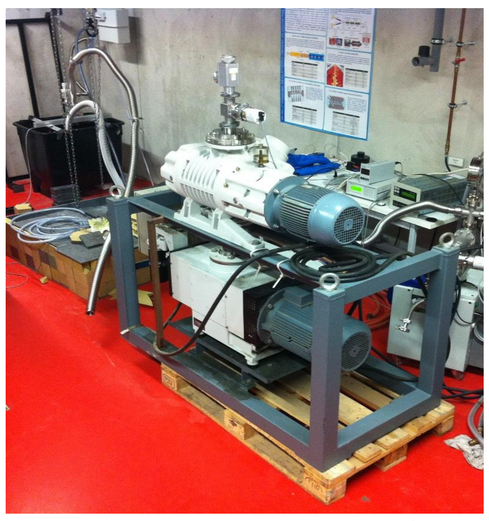
Abstract:
At the Institute for Applied Physics, Frankfurt University, a superconducting 325 MHz CH-Cavity has been designed, built and first tests have successfully been performed. The cavity is determined for a 11.4 AMeV, 10 mA ion beam at the GSI UNILAC. Consisting of 7 gaps this resonator is envisaged to deliver a gradient of 5 MV/m. Novel features of this structure are a compact design, low peak fields, improved surface processing and power coupling. Furthermore a tuner system based on bellow tuners attached inside the resonator and driven by a stepping motor and a piezo actuator will control the frequency. In this contribution measurements executed at 4 K and 2 K at the cryo lab in Frankfurt will be presented.

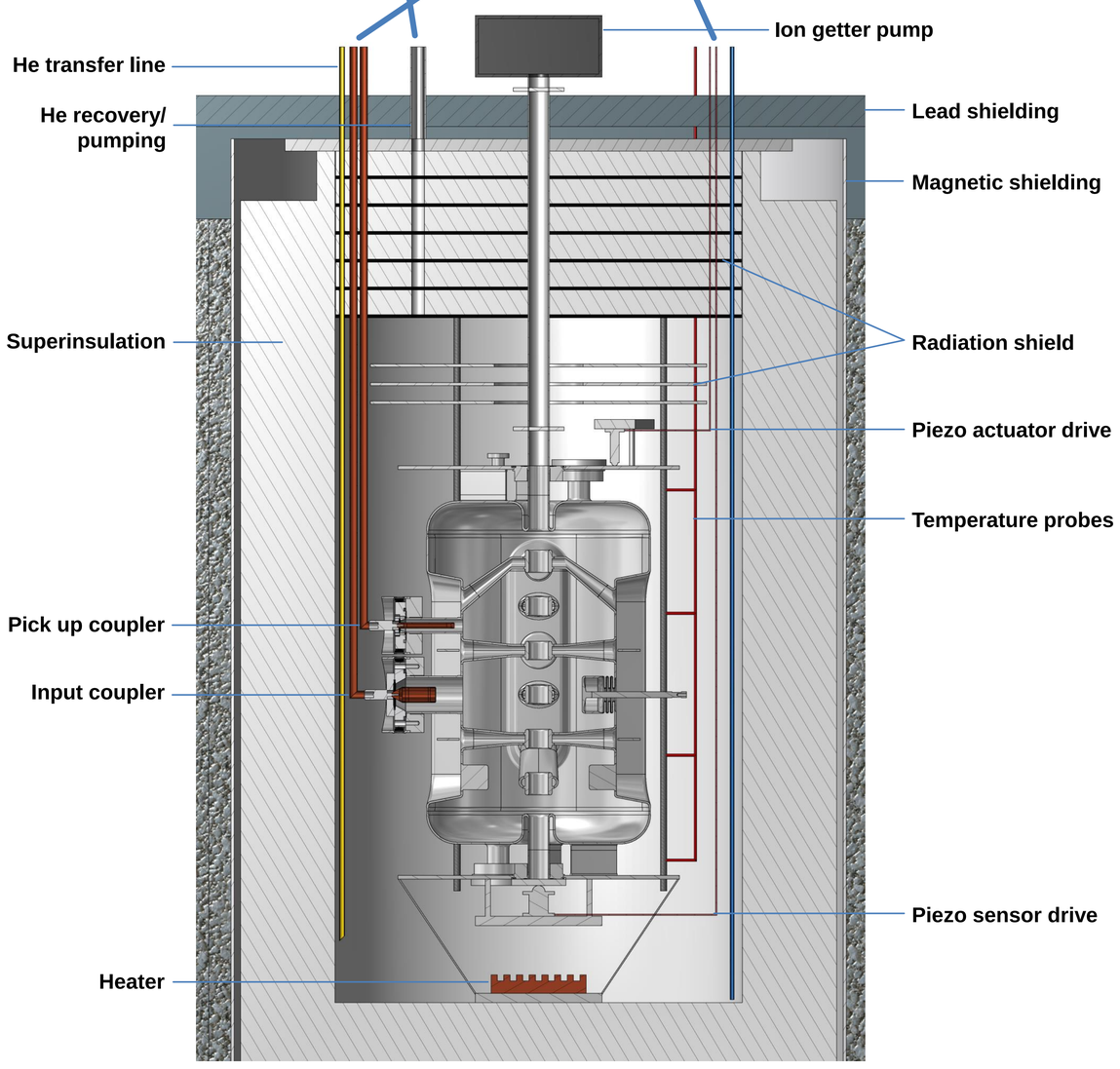
Setup and Main Parameters

In the cryo-lab of IAP a measurement setup comprising a vertical cryostat has been installed for various test purposes allowing power measurements at 4 K and 2 K, respectively. The vaporized Helium can be extracted via a port to a recovery system or pumped out by a roots pump to achieve 2 K. The forward power is delivered by a 500 W broadband amplifier. Further equipment like the control system, scopes, power meter and rf generator is arranged in three racks.



Roots pump (1000m³/h)

Racks with measurement equipment



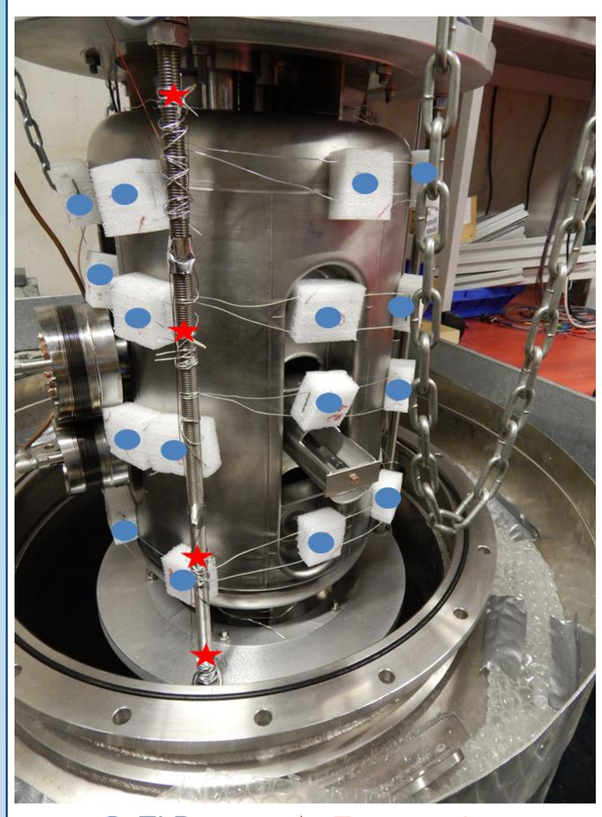
Schematic layout of the test setup.

Parameter	β	f	#cells	Eff. Length	Inner diam.	E_a	E_p/E_a	B_p/E_a	G	R/Q	R_a*R_s
Unit	-	MHz	-	mm	mm	MV/m	-	mT/(MV/m)	Ω	Ω	kΩ²
Value	0.16	325.224	7	505	347.4	5	5.1	13	66	1260	80

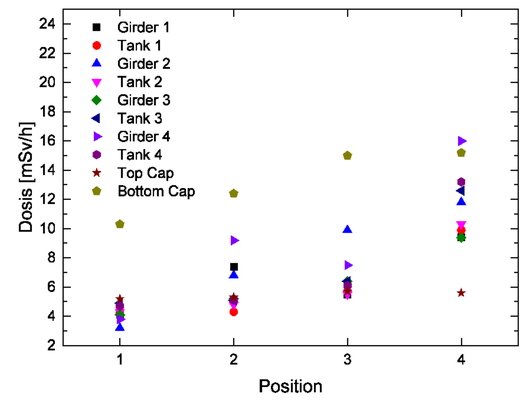
Main parameters of the cavity.

Cold Measurements

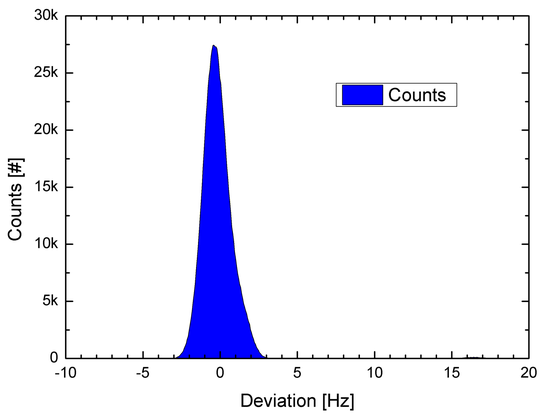
The CH-cavity has been provided with four low-temperature probes and fourty Thermo-Luminescence-Dosimeter to record field emission events. The analysis of the TLDs yielded a small potential field emitting site located at the bottom of the cavity. Furthermore a long term VCO measurement has been performed to study cavity operability with background noise from pumps, power supplies and helium bubbles.



Setup for the cold measurement.

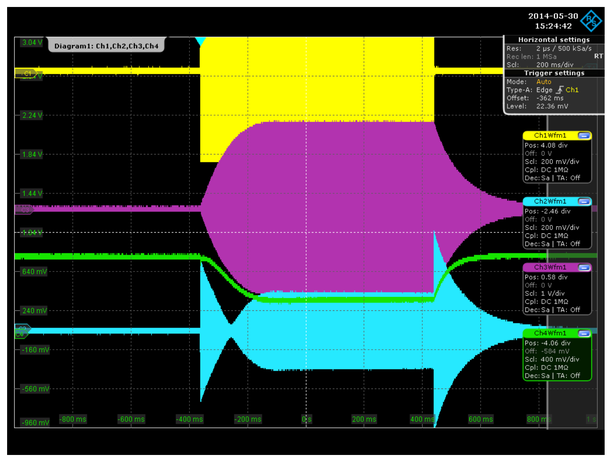


Dosis distribution among TLDs.

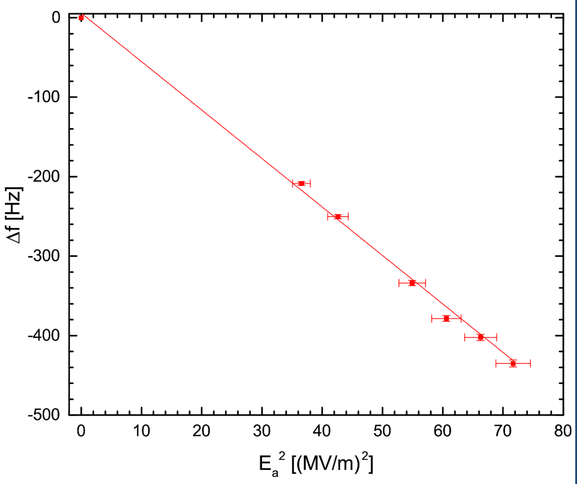


VCO long-term statistics.

LFD Measurements

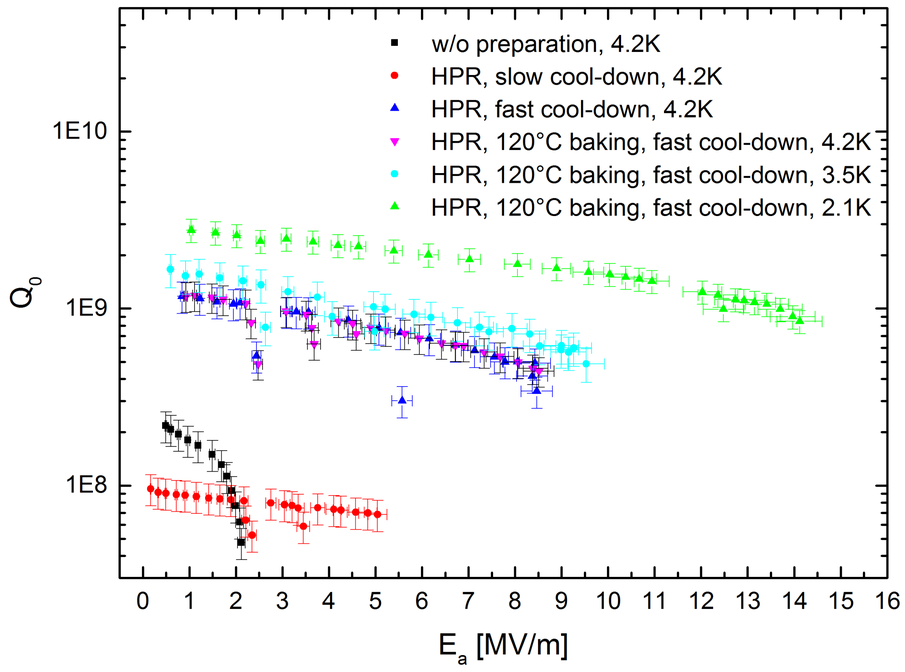


VCO response (green) at a field level of 8.5 MV/m.



LFD Analysis, K_L=-6.1 Hz/(MV/m)².

Cavity Performance



Q versus E curve.

After HPR preparation and fast cool-down the performance improved significantly to gradients up to 8.5 MV/m at 4.2 K. Lowering the temperature to 2.1 K yields a gradient of 14 MV/m with very few multipacting at low fields. Even higher field levels are limited by a supposed thermal defect leading to quench event.