

RF measurements on the superconducting 217 MHz CH-cavity for the cw demonstrator*

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The demonstrator project is the first prototype of a new superconducting (sc) continuous wave (cw) linac at GSI for the production of Super Heavy Elements (SHE). The demonstrator consists of a sc CH-cavity embedded by two sc solenoids mounted in a horizontal cryomodule. One milestone of the project is a full performance test of the cavity with beam at the GSI High Charge Injector (HLI) which is foreseen in 2016.

Status and RF measurements

The assembly of the 217 MHz CH-cavity up to the helium vessel was finished in 2014 at Research Instruments (RI), Bergisch Gladbach, Germany (see Figure 1). Two surface preparations with BCP (50 and 25 μm) have been performed. The coupler as well as the pick up antenna have been redesigned for the first cold tests at the Institute for Applied Physics (IAP) with low rf power. After mounting the coupler and pick up to the cavity it will be high pressure rinsed and afterwards delivered to the IAP. It is expected that first cold tests of the cavity will be performed in a new vertical cryostat in April 2015. Intermediate rf measurements during the production process of the cavity have been performed at room temperature to determine the final static tuner heights and the lengths of the end caps of the cavity as well to hit the design frequency successively. Regarding a frequency shift of +430 kHz due to thermal shrinkage and pressure sensitivity the design frequency could be reached successfully as shown by Figure 2:

1. cavity without static tuners and temporarily attached end caps with oversize
2. static tuners #1, #4, #6, #7 welded into the cavity
3. left end cap welded to the cavity
4. static tuners #2, #8, #9 welded into the cavity
5. right end cap welded to the cavity
6. 50 μm BCP treatment
7. static tuners #3, #5 welded into the cavity
8. 25 μm BCP treatment

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Nevertheless, a third 25 μm BCP preparation is potentially possible without leaving the tuning range of the dynamic tuners. Furthermore, the electric field distribution on the beam axis as well as the external quality factor Q_e of preliminary couplers have been evaluated. All results seem very promising to reach the design gradient of 5 MV/m at 4 K. After successful performance tests the helium vessel will be welded to the cavity.

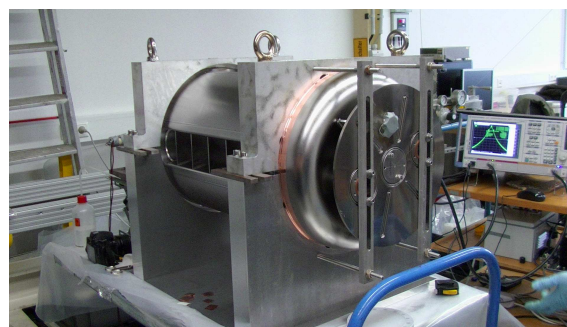


Figure 1: 217 MHz CH-cavity during intermediate rf measurements at RI.

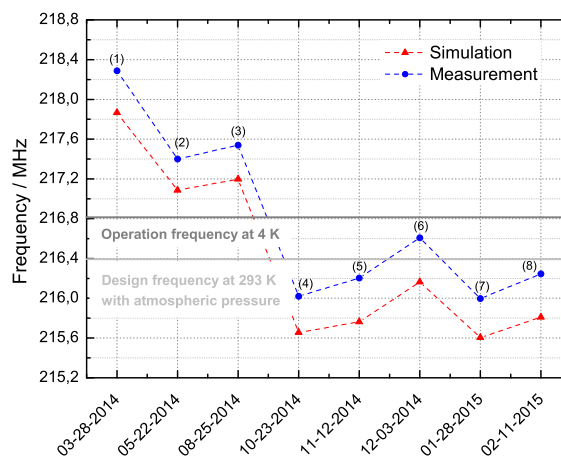


Figure 2: Behaviour of the frequency during the production process of the sc 217 MHz CH-cavity.

References

- [1] F. Dziuba et al., FIRST RF MEASUREMENTS OF THE SUPERCONDUCTING 217 MHz CH CAVITY FOR THE CW DEMONSTRATOR AT GSI, In Proc. of LINAC 2014, Geneva, Switzerland (2014)