Juelich Triple-Spoke cavity- test of the prototype

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Abstract

Construction of the niobium cavity prototype has been completed; the cavity has been chemically processed. Results of initial cold test are discussed.

Manufacture of 352 MHz Multigap Resonator

The triple-spoke cavity received its chemical treatment (BCP) at Saclay. Two BCP runs were made, each with the cavity in horizontal position, sending the acid in via the lower coupler port, and taking the out coming fluid from all three other openings back to the closed acid circulation system (Fig.1). Filling and emptying took about 8 minutes. Fresh acid circulated for about 70 minutes through the cavity.

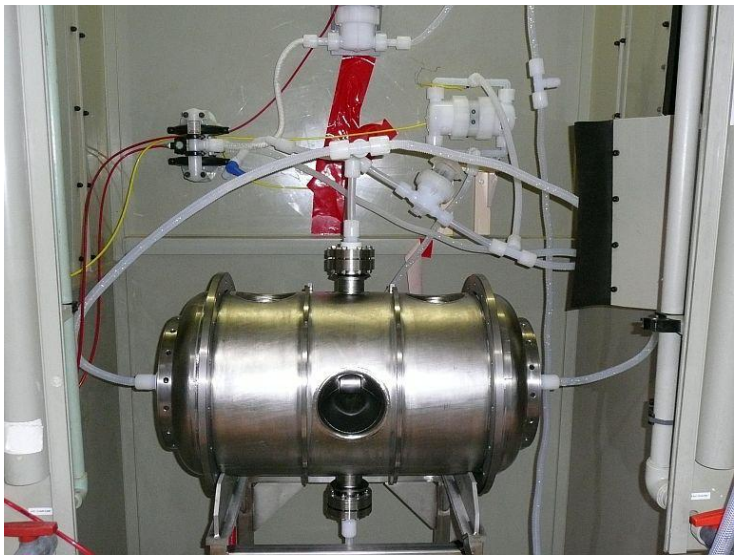

Figure 1: BCP installation at CEA-Saclay.

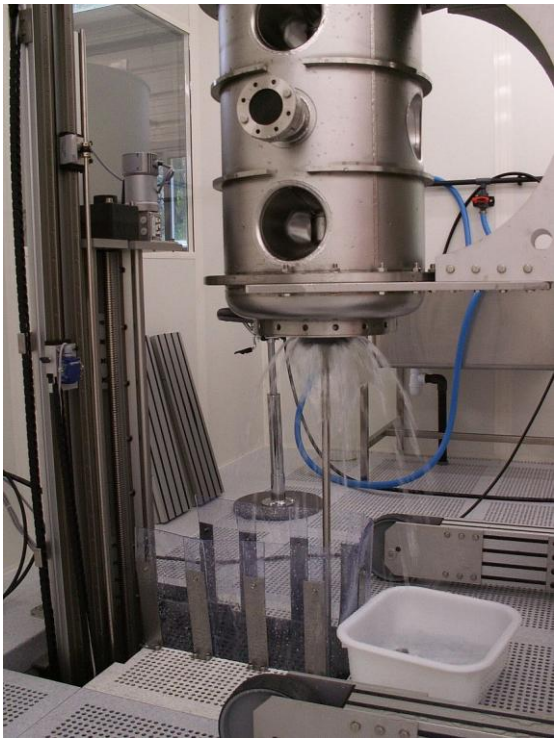

Figure 2: BCP installation at CEA-Saclay.

For the second run the flanges were detached, and the cavity was turned about the horizontal axis by 180 degrees before the flanges were re-attached again. Totally approximately 100 µm of Niobium were removed. Still, the ultra sonic measurements indicated that the removal was not homogeneous reaching in some places only 60 µm.

The cavity was subsequently high pressure rinsed at IPN-Orsay (Fig. 2). The standard nozzle designed for elliptical cavity was used. All four ports were used for rinsing; the rinsing was done in 4 positions, every time the rinsing water was pumped from the bottom. After the HPR the cavity was dried in a class 10 clean room for several hours and then all auxiliary parts such as blank flanges, input and output probe and pump out port with valve were assembled.

Measurements of the 352 MHz Multigap Resonator

Preparation of the cavity for insertion into the vertical bath cryostat included attaching thermo-elements, installing a siphon for removal of He gas from the lower end cap, installing RF lines for (critical) coupling and for the field probe, line for vacuum pump, etc (Fig.3). Cool- down revealed no problems. The first measurements have been provided by 4K. At E_{acc}=5.8 MV/m the test has been stopped by the cavity quench. There was a MP discharge at around E_{acc}=1 MV/m, but it was processed without problems. For the second measurement the upgrade of our testing facility for 2K operations has been made. The test has been stopped by a strong MP discharge at about E_{acc}=5 MV/m. Fig.4 shows the Q vs E_{acc} performance of the cavity in both tests at 4.2K and at 2K. To improve experimental results an additional cavity wall treatment is highly required.

The sensitivity of the cavity frequency to the pressure in the helium bath is measured $df/dp_{\_exp}$=-31.9 Hz/mbar with estimated $df/dp_{\_calc}$=–21.4 Hz/mbar. The Lorenz force detuning during the high power test at 4.2 and 2K was measured showing the same results K_{L_exp}=–5.5 Hz/(MV/m)^2 with K_{L_calc}=–4.1 Hz/(MV/m)^2.

Figure 3: Triple-spoke cavity at FZJ test stand.

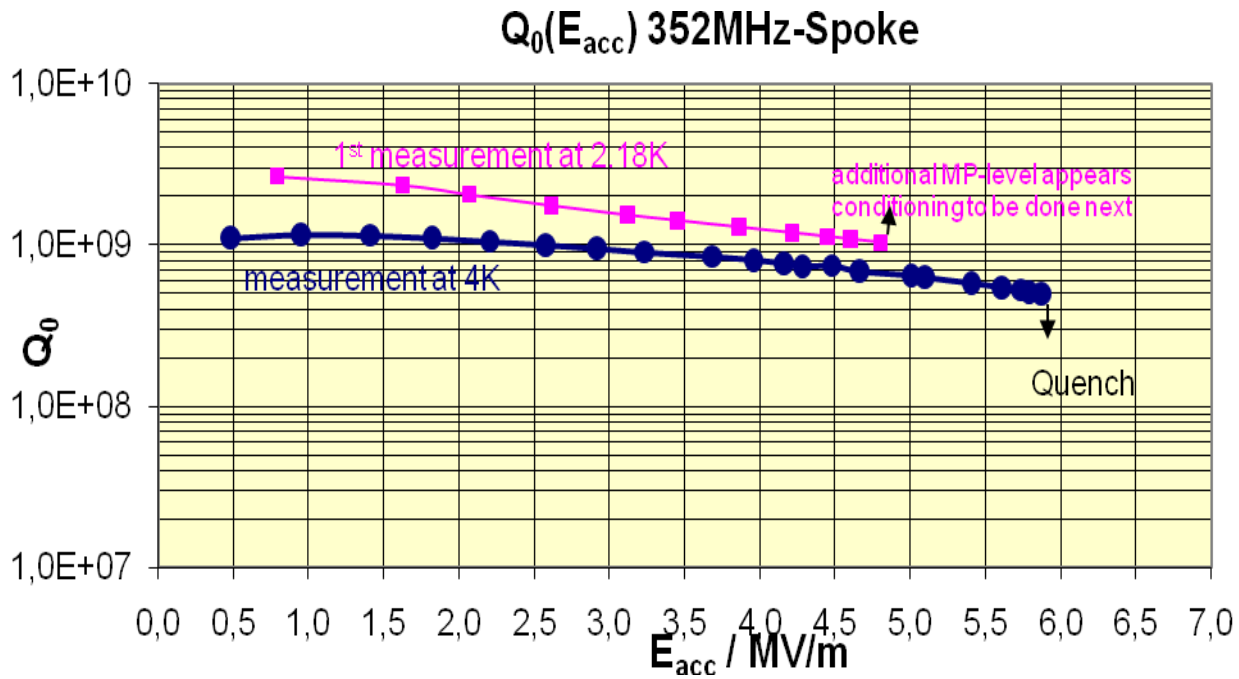

Figure 4: Triple-spoke cavity first results at FZJ.

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